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The Impact of Artificial Intelligence on Artistic Productivity in Visual Art

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Abstract

Artificial intelligence (AI), as a widely adopted general-purpose technology (GPT) , is increasingly integrated across various industries and plays an expanding role in the global economy. This paper examines the impact of AI on artistic creation from the perspective of artists. By analyzing practical cases of AI-assisted art creation and the performance of AI artworks in both primary and secondary markets, it explores the economic impact of AI on artists and further discusses how these changes affect artistic productivity. The study reveals that AI significantly reduces creative barriers, enhances production efficiency, and expands the forms of artistic expression, thereby increasing diversity and inclusiveness in art. At the same time, AI is reshaping income distribution within the art sector: artists with strong technical skills are more likely to leverage AI to increase their influence and income. Although AI has contributed to the creation of new employment opportunities, it has also brought about the real challenge of "technological unemployment." Moreover, AI artworks are accelerating the restructuring of traditional art markets by improving transaction efficiency, lowering entry barriers for young artists, and expanding distribution channels through decentralized mechanisms such as NFTs, thus boosting the overall vitality and productivity of the art market. Based on these findings, this paper recommends that artists actively develop digital skills and leverage emerging technologies, while calling on relevant institutions to enhance economic regulations to foster a fair and sustainable AI art ecosystem.

Keywords: Artificial Intelligence (AI), General-Purpose Technology (GPT), Artists, Economic Impact, Digital Skills, Artistic Productivity,

Table of Contents

1.Introduction

1.1 Background and Motivation

Since the beginning of the Industrial Revolution, human society entered a new stage. In contrast to traditional societies, technological innovation has become an essential factor of production in modern societies. A new round of technological revolution marked by artificial intelligence is currently emerging as an important driving force in economic activities of various industries. Like the steam engine in the steam era, the electric generator in the electrical era, and the computer and the Internet in the information era, Artificial intelligence (AI) is becoming an important force leading us into the age of intelligence and profoundly changing people's life. In the AI era, generative AI is rising in popularity. Due to the rapid development of deep learning, computer vision, natural language processing, and generative adversarial networks (GANs), the huge data support and efficient content generation capabilities behind generative AI have led to its widespread use in a number of industries, and it has demonstrated amazing creativity, and AI-generated content (AIGC) has become the hot topic in various fields.

1.1.1 Current Discussions on Artificial Intelligence and Art Production

AIGC refers to a new type of content generation that uses AI and algorithmic models to create, generate or assist in the production of content, it "encompasses the production of text, images, videos, 3D assets, and other media through AI algorithms, which enables automation of the content creation process. Such automation facilitated by AIGC significantly reduces the need for human labor and lowers the costs of content creation, fundamentally reshaping industries such as advertising, education, code development, and entertainment" (Foo et al., 2023) The visual arts, as one of the most important expressions of content generation, are of course strongly associated with and have become an important part of AIGC. With AI being widely used in art creation, the number of AI artworks has increased dramatically in the art market (Lawson-Tancred, 2024), technological advancements in AI are currently having a significant influence on the production of art (Cetinic et al.,2022), one prominent application thus far is its ability to serve as a medium for the creation of high-quality

visual art, fundamentally change the creative processes through which creators generate ideas and bring them into art production (Epstein and Hertzmann,2023).

However, there is also skepticism about the use of AI in art production. The discussion about the impact of AI on the field of art never stops. Meanwhile, economists have focused more on the impact of AI on artistic production and economic activity, as every innovation of technology impact the structure of the industry and brings changes to the productivity and labor market (Frank, et al.,2019; Sholler, 2022). According to Marx's (1859) production theory, any change in the relations of production or superstructure is ultimately determined by the development of productive forces, and the impact of AI on various industries ultimately belongs to the impact caused by its re-shaping of productive forces. AI is a new production force in economic activity, which can not only be used to optimize the method of production and enhance efficiency but also facilitate innovation and promote the progress of industry, and even have an impact on both upstream and downstream industries. The invention of the camera, for example, had caused a career crisis for painters, and the emergence of the film had a profound effect on the market for live performance, and AI has not only given rise to new art forms but also changed artistic productivity. Whether technological advancements such as artificial intelligence have a positive or negative impact on artistic productivity—and how they might reshape the artistic labor force—remains a subject for further research. While AI has undoubtedly impacted artistic productivity there is a lack of research on it, since economics pay more attention to the impact of AI on manufacturing, healthcare, and trading (Lu, 2021; AI Meslamami, 2023; Damioli, 2021), and research on the impact of AI on art has focused more on philosophical and sociological fields such as aesthetics, law, and subjectivity(Barale, 2021; Liu,2023; Li, 2020). Therefore, this thesis offers both theoretical and practical value in studying the impact of AI on artistic productivity from an economic perspective: on the one hand, it can fill the research gap of economics research in this area, and on the other hand, it is helpful to keep the research on artistic productivity match the context of the AI era. By studying the impact of AI on artistic productivity, we can fully take advantage of the positive effects of technology on artistic productivity, avoid the negative effects, and integrate and optimize resources.

1.1.2 The Definition of Productivity

Before examining how AI impacts artistic productivity, it is essential to first define the concept of productivity and artistic productivity.

Adam Smith (1937) defines labor as the "skill, dexterity, and judgement with which its labor is generally applied." He argues that the division of labor is a key factor in increasing productivity for three reasons: first, workers rapidly improve their dexterity through specialization; second, it reduces time losses between different tasks; and third, the invention of machines simplifies and accelerates the labor process. The concept of total factor productivity (TFP) originates from Robert Solow. Solow (1956) distinguishes TFP from the contributions of capital and labor through the production function and suggests that the growth of TFP reflects technological progress or efficiency improvements. In Solow's model, the growth rate of TFP is a key indicator of how technological advancement contributes to productivity improvement. Later, scholars such as Brynjolfsson et al. （2021) expanded on this theory, arguing that TFP growth represents the portion of economic output growth that cannot be explained by changes in capital and labor inputs, and that its growth contributes to improvements in labor productivity.

From the perspective of artistic production, the labor productivity is reflected in the skills and creativity demonstrated by artists during the creative process. By continuously refining their professional skills and engaging in innovative practices, artists enhance the quality and uniqueness of their works. The total factor productivity (TFP) can be understood as the overall improvement in the efficiency of the artistic production system beyond individual labor contributions. This includes the adoption of new technologies (such as artificial intelligence), the optimization of production processes, and the evolution of art markets and dissemination channels. Such comprehensive advancements not only facilitate the creation and circulation of artworks but also expand the scale and impact of artistic production.

1.1.3 The Definition of Artistic Productivity

Currently, there is no clear definition of artistic productivity in economics, however, some insights can be found within the field of political economy. The most influential theories in on this subject originate from the productivity theory of Marx

and Engels. As the originators of the concept of artistic productivity, Marx divided productivity into material productivity and spiritual productivity. He defined artistic productivity as the ability and motivation to engage in artistic creation and production, and it is a form of spiritual productivity that generates artistic products (Marx and Engels, 1975). Although Marx primarily focused on societal productivity rather than specifically on productivity in the arts, he argued that institutions such as religion, the family, the state, law, morality, science, and art are particular forms of production. These, he suggested, are all governed by the universal laws of production that apply to all areas of human activity (Marx, 2016). Therefore, we can extend the definition of artistic productivity by building on Marx's analysis of productivity in society. In this context, artistic productivity can be understood as a specific form of spiritual productivity, shaped by the same universal laws of production that govern other aspects of human activity, such as labor, culture, and social institutions.

Marx considered productivity to be the capacity of individuals to engage in productive activities, with real people being the essential necessary for production. In Marx's theory of productivity, there are three key components: labor, means of labor, and objects of labor (Marx, 2019). Labor refers to the sum of the physical and intellectual abilities present in the human body, which are used whenever a person produces some value. The means of labor are the material tools used in the production process, such as machinery, tools, and other resources. The objects of labor are all the things that can be worked on in the labor process, including both raw materials and natural resources. If we apply this definition to the arts, we can see that artistic productivity consists of three elements: the artists, the tools used in artistic, and the artworks produced. The productive capacity of artists is a key factor influencing artistic productivity. As a result, the quality and quantity of artworks, as well as factors like income distribution, entry barriers to the arts profession, and employment in the industry, all play a role in shaping artistic productivity.

Another definition of productivity given by Marx is that "a certain mode of production or a certain stage of industry is always linked to a certain mode of collective activity or a certain stage of society, and this mode of collective activity itself is the productivity" (Marx and Engels, 1975).

The most common collective activities in artistic production are carried out by artistic institutions, such as museums, galleries, theatres, concert halls, and art schools. These institutions specialize in organizing, planning, and promoting art activities. They bridge the gap between artists and audiences through various forms of art display, education, training, and research, while also taking on important responsibilities like art exchange, creation and appreciation, art education, and cultural preservation.

Milton C. Albrecht (1968) believes that organizations with the following elements can be defined as arts institutions:

1) Technical systems to possesses and manages tools, resources, and artworks related to the creation, exhibition, and distribution of art. facilitate and promote artistic creation, providing access to the necessary tools, knowledge, and infrastructure to support both artists and audiences.
2) The artefact and the artist are the fundamental pillars of all artistic activity, without them, the organization cannot be called an artistic institution but a social organization.
3) A complete organizational structure and an effective reward system, including agents, sponsors, personnel, events, and activities, all guided by a clear mission and culture.
4) Art criticism and feedback reflect current aesthetic trends in the art market and offer arts institutions professional standards of judgment.
5) Audiences and consumers. Whether for-profit or not-for-profit, the primary objectives of arts institutions are to create art and preserve culture, and audiences and consumers are the key target groups and the main beneficiaries of the organization's artistic efforts.
6) Arts institutions should promote broad cultural values that sustain art in society, such as using art to promote social progress, maintain stability, foster cultural development, and influence the construction of social and spiritual civilization.

It is evident that an art institution with a well-established organizational structure, operational functionality, and adequate has a very different impact on the art market compared to an independent artist. The structure of the institution, its operational mechanisms, the scale of its economic capacity, the type of the art market

in which it operates, whether it is primary market or secondary market—together influence the circulation of art and shape artistic productivity.

Economics defines productivity from a market perspective, while sociology explains artistic productivity from the viewpoints of labor, tools, and production relations. Despite their differences, both share common ground: First, they view humans as the central agents of labor, emphasizing the significant impact of labor skills and creativity on productivity; second, they acknowledge that the influence of individual workers and institutions on productivity differs; thus, it's necessary to separate research on the two. Therefore, based on the research of economists and socio-economists mentioned above, the main contributors to artistic productivity can be categorized into two primary groups: first, individuals as laborers, namely artists; and second, organizational entities that affect the circulation of art works such as galleries and auction houses.

Consequently, this thesis will examine the impact of artificial intelligence (AI) on artistic productivity by examining two distinct subjects: independent artists and art institutions. Individual artists drive the growth of artistic productivity through their skills, creativity, and labor input. Their productivity is primarily reflected in the creativity of their labor and the uniqueness of their works. while art institutions enhance artistic productivity through resource integration, scalable operations, and market promotion. Through organized operations, they enhance the scale effects and market influence of artistic production.

1.2 Problem Statements, Research Objectives and Methodology

Based on the discussion above, the research of this thesis includes the following questions:

1) Clarify the definition and characteristics of AI and artistic productivity.
2) The application of AI in visual art creation.
3) How AI impacts the productivity of artists from labor market aspect.
4) How AI impacts the productivity of artists from art market aspect.

Research Objectives：

The purpose of this thesis is to address the positive and negative effects of AI on art production and providing solutions to deal with problems that may be encountered in AI art production. This research aims can be divided to the following objectives:

1) Identify the definition of artistic productivity.
2) Identify the definition and characteristics of artificial intelligence from economic perspective.
3) Study the impacts of AI in art production via relevant literature, examining current prominent AI artists and platforms, aims to better understand how artists and art institutions adapt to the market transformations driven by technological change.
4) Analyze how AI arts are transforming art market circulation and influencing artistic productivity.

Methodology：

This study adopts a multi-method approach to explore the impact of artificial intelligence on artistic productivity:

1) Interdisciplinary Research Method: Given that the study of artistic productivity lies at the intersection of art studies, economics, and sociology, this research applies an interdisciplinary approach. It primarily draws from economic theories while incorporating relevant insights from other disciplines to construct a comprehensive analysis of artistic productivity.
2) Comparative Analysis: The research conducts a comparative analysis between art institutions and independent artists to investigate how AI influences artistic productivity at both the microeconomic and macroeconomic levels.
3) Textual Analysis: This study analyzes a wide range of literature related to artificial intelligence, the art market, and productivity. Through the lens of economic theory, it examines existing research gaps and frames the discussion accordingly.

Structure：

The structure of this thesis proceeds as follows. Section 2 is literature review.

Section 3 clarifies the definition of AI as a tool for artistic production and the definition of artistic productivity. Section 4 analyzes the application of AI in the art

production. Section 5 analyzes the impact of AI on the creation process, income, and employment of artists. Section 6 examines the impact of AI on the circulation of artworks and explores how it influences artistic productivity. Section 7 is the conclusion.

2. Literature Review

2.1 Theoretical foundation

2.1.1 Research on artificial intelligence

The study of AI can be dated back to 1950, As one of the founders of modern computer science, Turing (2009) predicted the possibility of creating machines with true intelligence and developed the famous Turing Test to determine whether a machine could "think" like a human. In 1956, John McCarthy organized the "Dartmouth Conference" at Dartmouth College in the United States, where the term artificial intelligence was first introduced and systematically discussed. This conference is considered to be the symbol of the formal emergence of Artificial Intelligence (Moor, 2006). Artificial Intelligence has been getting a lot of attention from various fields since its birth, especially economics. As an important means of production in economic activities, AI has caused profound impacts on industry structure, labor market, and technological innovation in many industries (Gupta, 2024; Webb, 2019; Rashid and Kausik, 2024). And of course, as in the case of other technologies, the impact of AI on the economy is dual, with both positive and negative aspects.

Timothy F. Bresnahan and M. Trajtenberg (1995), who consider technology to be an important means of production for economic development and distinguish between different technologies by the definitions of specific purpose technologies (SPT) and general-purpose technologies (GPT). They argue that as a General Purpose Technology (GPT) develops and diffuses across the economy, it facilitates widespread improvements in productivity，and they summarized the characteristics of a GPT for identifying a technique as a GPT. Although their theory is not specific to AI, Erik Brynjolfsson and Andrew McAfee (2014) argue the importance of AI as a general-purpose technology on the basis of this theory.

Brynjolfsson and McAfee (2014) sees AI as the "second machine age" after the industrial revolution, a technological revolution that will bring not only improvements in productivity, but also changes in the economic structure of society, employment and income distribution, leading to economic growth. Brynjolfsson and McAfee (2014) argues that low-skilled, repetitive jobs will be replaced by automation, while high-

skilled jobs will increase, and the problems of unequal income distribution and unemployment are likely to increase. But due to the lack of technological diffusion and education system, while AI has significantly increased the productive capacity of industries over the past few decades, the productivity growth has failed to be significantly reflected in the data.

Timothy F. Bresnahan and M. Trajtenberg consider technology to be an important means of production that contributes to economic development, they introduced the concepts of specific purpose technology (SPT) and general-purpose technology (GPT) to distinguish between types of technology to study the impact of different technologies on the economy. For example, the advances in general purpose technology have broad impacts on the entire society, contributing to productivity gains in multiple industries, on the contrary, the advances in specific purpose technology benefit the specific industry rapidly, but the impact is strained in very limited areas, and tend not to have far-reaching effects on the economy. Although they did not relate this theory to AI directly, but as an emerging and popular technology, AI can be classified as one of the categories and researched on the base of this theory.

2.1.2 Research on artistic productivity

The current research of artistic productivity is based on Marx's theory, he introduced the concept of artistic productivity although he did not address productivity in art industry in depth. He considered artistic productivity as the motivation and ability of art production, and a kind of spiritual productivity of art creation. He emphasized that "Religion, family, state, law, morality, science, art, etc., are only particular modes of production, and fall under its general law" (Marx, 2016).

Later, Marxist scholars such as Walter Benjamin, Pierre Macherey, and Terry Eagleton inherited and extended the Marxian theory of artistic productivity, revealing the connection between art and aesthetics, philosophy, psychology, sociology, and political economy. According to Marx's theories on productivity and relations of production and the impact of modern technology on art production, Marxist scholars have established a theoretical system of artistic productivity, but these theories mainly study the relationship between artistic productivity and ideology and relations of production, emphasize the ideological and aesthetic significance of art, and rarely

carry out in depth research in terms of economic activities. Benjamin (2018), for example, argued that technology not only transforms artistic expression, but also relations of production and productivity. Terry Eagleton (2013) argues that art production is the economic practice, like the production of other commodities, the production of art relies on certain techniques that are part of artistic productivity, and these technologies facilitate the development of art production. Bertolt Brecht (2014) emphasized the importance of technology in art production, and he argues that the level of artistic productivity can be determined directly by tools and techniques. Their research highlights that technological advancements have a significant impact on artistic productivity.

In the following period, research on artistic productivity shifted its focus to the artist as the central subject, with some economists analyzing it through the lens of labor market structures. David Throsby (2001) views artists as creative workers and argues that productivity should not be measured just by quantity, it should also consider the cultural value of the work produced. William Baumol (1993) and Richard Caves (2000) believes that the income and status inequality among different artists in the art market has a profound impact on artistic productivity. This income gap and status asymmetry mean that artistic productivity is closely related not only to the increase in labor output but also to changes in market demand and the artist's position in the cultural field. For example, top-tier artists at the forefront of the market typically have more economic incentives, while those with lower incomes may face a lack of creative motivation or be forced to take on other side jobs to supplement their income, which can affect the quantity and quality of their creative output. Their research findings suggest that artistic productivity is also closely linked to factors such as the artist's income, employment conditions, and market demand for artworks.

2.2 Prior studies

Research and discussion on AI’s impact on productivity fall into two groups: the techno-sceptics and the techno-optimists.

Sceptics base their theories on the Solow Paradox, which also known as the Productivity Paradox, was proposed by Robert Solow (1987) in his study of the impact of computers on productivity. He argues that technological progress is everywhere,

but statistics do not show that technology has significantly helped productivity growth because people have overly high expectations of computer technology, believing that it would immediately lead to a significant increase in productivity. However, the application of information technology often serves more to optimize and improve existing production processes rather than bringing about a fundamental productivity revolution. Therefore, the gap between these inflated expectations and the actual outcomes contributed to the paradox. Since then, a number of studies have supported Solow's view. For example, Cowen (2011) argues that computer and Internet technologies have not led to significant productivity breakthroughs, suggesting that the economy may be trapped in a prolonged period of 'great stagnation'. Similarly, Gordon (2014), through an analysis of long-term growth trends in the US economy, contends that recent technologies have contributed only modest improvements in productivity. Therefore, scholars such as Gordon have questioned the role of AI, arguing that expectations about its impact are overly optimistic.

In contrast, 'techno-optimists' such as Brynjolfsson et al. (2019), have strongly advocated for AI, arguing that modern technologies, including computers and the Internet, have clearly played an important role in increasing productivity and promoting economic growth, and that the potential of AI should not be overlooked. Brynjolfsson et al. (2019) argues that Solow's Paradox does not apply, suggesting instead that the delayed impact of AI on productivity is due to the 'Implementation Lag.' He explains that productivity gains from technology are not immediately realized because supporting infrastructure often limits their immediate effect. The full impact of new technologies requires complementary technologies, infrastructure, and organizational restructuring. The delay in achieving measurable impacts from new technologies can be attributed to two main factors: first, it takes time for technology to be widely adopted and reach a scale that generates significant impact; and second, additional investments are needed in complementary areas, and it takes time to discover, develop, and implement these investments. As infrastructure is completed, the full potential of the 'AI revolution' will gradually be realized.

Previous research suggests that the impact of AI on productivity can be examined from two perspectives: individuals and enterprises. The effects on individual productivity include income distribution, production costs, and

employment, while the impact on enterprises includes industrial structure and economies of scale.

From the perspective of individual producers, economists generally agree that AI affects producers at different skill levels in distinct ways. For instance, Autor et al. (2003)'s Labor Market model (ALM), which serves as a benchmark for analyzing the impact of AI and automation on employment, emphasizes that the effects of technology vary depending on workers' skill levels. AI's ability to replace simple, repetitive labor in low-skilled jobs is leading to the decline of such positions, while high-skilled jobs that rely on innovation, creativity, and technical expertise are more likely to be complemented by technology rather than replaced. Consequently, demand for these jobs is expected to rise. Moreover, AI is also likely to increase job market polarization and worsen income inequality. As a form of Skill-biased Technological Change (SBTC), which generally enhances the productivity and earnings of high-skilled workers, while low-skilled workers face employment challenges and wage reductions due to technological substitution (Acemoglu, 2002). Despite the job losses linked to automation, the ALM model also acknowledges that technological change can create new employment opportunities. Benzell (2015)'s Overlapping Generations Model examines the interrelationship between technological progress, capital accumulation, and labor markets within an intergenerational framework. With this model he argues that technology could fully replace low-skilled jobs and displace some high-skilled jobs, leading to a reduction in labor demand and a decline in wages. Acemoglu and Pascual (2018), in their Job Creation Model, argue that technological progress typically involves an automation effect, where automation replaces manual labor and eliminates certain jobs. However, it may also lead to a creation effect, where the adoption of new technologies generates new jobs, particularly in emerging industries. Moreover, the impact of technological progress is bidirectional, with different effects in the short and long term. In the short term, automation may cause job losses for low-skilled labor, but in the long term, new technologies can create entirely new jobs. Models suggest that the effect of technological innovation on employment is not only negative, as the creation effect may offset the substitution effect over time.

From an industry perspective, Autor et al. (2020) contend that AI leads to the emergence of 'Superstar Firms,' where markets become highly concentrated, and industries with increasing concentration experience faster productivity growth. However, Fligstein et al. (2022) have expressed concerns about 'star firms,' arguing that large firms may emerge as the primary drivers of technological innovation. In this case, their competitive advantage over smaller firms would be further magnified, potentially discouraging innovation among smaller firms or leading them to exit the competition, this could lead to more problems with monopoly and unfair competition. In contrast, Christensen (2015)'s theory of the Innovator's Dilemma suggests that large firms, as beneficiaries of established technologies, face challenges in dedicating resources to the development of emerging technologies. On the other hand, smaller firms are more motivated to adopt new technologies, making them more likely to benefit from these innovations.

2.3 Research gaps

Previous studies show that, while there is a significant amount of research on science, technology, and productivity, productivity research in the field of art remains primarily sociological, based on Marx's productivity theory. Additionally, there is a lack of research linking artificial intelligence with artistic productivity from an economic perspective. This study aims to fill the gaps in the current research on artificial intelligence and artistic productivity. The key points of this thesis are as follows:

This thesis aims to define artificial intelligence and artistic productivity within the context of economics. It will analyze the composition of artistic productivity in the context of the current state of the art field and explore how the concept of artistic productivity has evolved in the modern era. Additionally, it will clarify the role of artificial intelligence and explain its characteristics as a mean of production, rather than just a technological tool.

This thesis examines the impact of artificial intelligence on the productivity of artists and art production companies. It analyzes productivity trends in the art industry with AI involvement and compares them to those in the traditional art industry.

The thesis will also explore whether AI has a positive or negative impact on art productivity and suggest ways to address any negative effects.

The innovations of this thesis include studying art productivity in the context of the information age and analyzing changes in the relationship between the elements of art productivity. The thesis focuses on the technological factors that play a significant role in art production, exploring the status, value, and impact of technology on art productivity.

3. Definitions of Artificial Intelligence

The concept of Artificial Intelligence was first formally introduced in 1956 at a seminar held at Dartmouth College in the United States. Current definitions of AI are typically divided into two main categories: one from the perspective of computer science and the other from the perspective of economics. From a computer science perspective, American computer scientist and cognitive scientist John McCarthy (2020), in a paper exploring what artificial intelligence is, said "It is the science and engineering of making intelligent machines, especially intelligent computer programs. It is related to the similar task of using computers to understand human intelligence, but AI does not have to confine itself to methods that are biologically observable". The Marrian webster dictionary also gives a definition of AI from a computer science perspective "the capability of computer systems or algorithms to imitate intelligent human behavior".[1]

From the economic perspective, artificial intelligence, as a form of science and technology, will inevitably become involved in economic activities and serve as one of the means of production. Before examining the impact of AI on economic production, it is essential to first clarify its definition and characteristics as a means of production.

Bresnahan and Trajtenberg（1995）consider technical change to be the most important force driving long-term economic growth. To distinguish between different types of technologies applied in economic production, they introduced the concepts of specific-purpose technologies (SPTs) and general-purpose technologies (GPTs). SPTs are those designed for use in particular production activities, whereas GPTs have broader applicability, extending across multiple environments. General-propose technologies, as they are applied more widely, enabling the same amount of resources to produce more output. For example, GPTs can speed up production processes, reduce human errors, and distribute fixed costs over a larger scale of production, thereby significantly lowering the average cost per unit. (Bresnahan and Manuel, 1995). Given current developments, it is clear that AI is already being applied across a wide range of industries, including education, healthcare, manufacturing, and others. As such, AI

[1] https://www.merriam-webster.com [last access 13 June 2025]

is not a specific-purpose technology. Lipsey et al. (2005) has specialized in the study of historical general-purpose technologies. According to their research, only 24 technologies can be classified as GPTs. Therefore, whether AI can be considered a GPT remains to be verified based on the defining characteristics of GPTs. Bekar argues that "GPTs should be defined in terms of their micro-technological characteristics, not their macro-economic effects" (Bekar et al., 2018). Building on the theories of Timothy F. Bresnahan and M. Trajtenberg, he summarizes six characteristics of a general-purpose technology "Complementarities with a cluster of technologies that define and support it; Complementarities with a cluster of technologies that it enables; Complementarities with a cluster of technologies that typically include those that are socially, politically and economically transformative; There are no close substitutes; Have a wide array of applications; Initially crude but evolving in complexity" (Bekar et al., 2018). Despite these arguments, the criterion put forward by Bresnahan and Trajtenberg continues to be regarded as the most significant standard for determining whether a technology qualifies as a general-purpose technology (Chen, 2023). They argue that a technology qualifies as a general-purpose technology (GPT) if it meets the following three characteristics "pervasiveness, inherent potential for technical improvements, and innovational complementarities" (Bresnahan and Manuel, 1995).

When examining the impact of artificial intelligence on artistic productivity, it is essential to establish AI as a General-Purpose Technology (GPT). GPT serves as a key economic framework for analyzing productivity, offering a theoretical foundation for understanding how technological advancements fundamentally transform production systems. This framework helps explain why emerging technologies like AI can have widespread and systemic influence in the art market. Moreover, the three characteristics of GPT—pervasiveness, inherent potential for technical improvement, and innovational complementarities—are increasingly reflected in contemporary artistic practices. For example, AI is being used to enhance creative efficiency, broaden modes of artistic expression, and improve the dissemination and commercialization of artworks. Therefore, situating AI within the GPT framework offers valuable insights into the transformative role of technology in shaping artistic productivity.

According to Marx, the factors influencing productivity include the skill level of the laborer, the application of scientific and technological advancements in the production process, the social organization of production, the scale and efficiency of the means of production, and natural conditions (Marx, 2019).

The level of a worker's skill is influenced by factors such as the length of labor, work experience, and personal ability, all of which require time and practice to develop. For example, in the medieval art market, the Guild Apprenticeship (Epstein, 1995) required painters to progress through three levels: Apprentice, Journeyman, and Master. To move to the next level, they had to pass strict tests and meet the required technical standards. The apprenticeship period typically lasted seven years or longer, so it took a long time for someone to go from being an apprentice to creating art as a recognized painter. Not only in the Middle Ages, but it still requires a significant investment of time and effort to be an artist today. During this long period, artistic productivity grew very slowly, meaning that this process was not the main factor affecting changes in artistic productivity.

In contrast, the use of tools in artistic creation has had a much greater impact on productivity (Souchkov, 2005). In the early days, most art tools were directly sourced from nature, such as clay, natural pigments, stone, and wood. With the rise of industrial civilization, new tools like synthetic pigments, portable markers, and paper emerged, making artistic creation more diverse (Ward, 2008). In the information era, the development of art tools has increasingly relied on new technologies, such as artificial intelligence. Compared to traditional painting tools, The powerful neural network of AI helps artists improve creative efficiency by automating repetitive and time-consuming tasks, such as generating sketches, adjusting colors, or experimenting with different styles. This allows artists to focus more on conceptual development. Additionally, AI's rapid processing capabilities enable faster iteration and refinement, shortening the overall production process and increasing output without compromising artistic quality and inspiring more creative ideas and contribute to the growth of new art forms. Advanced production tools that can be easily learned and utilized by workers have a direct impact on their productivity.

Technology, as a crucial means of labor in modern production, also influences the development of the workforce by the complexity of its functions and its integration

with the production process. Additionally, whether production tools can be widely used to create economies of scale also plays a crucial role in productivity growth. Therefore, it is clear that the impact of tools on productivity is significant and an important factor to consider in productivity research. In the context of the arts, artificial intelligence has become a central focus in the study of artistic productivity.

3.1 Pervasiveness

Pervasiveness refers to the idea that the technology can be used as an input across various sectors, in the case of AI, it needs to be tested to see if it can be applied widely in different industries (horizontalization) and bring significant impact on them (specialization) (Zhang, 2024).

The horizontalization of AI is demonstrated by its widespread adoption across diverse sectors—healthcare, finance, education, and the arts, this broad uptake has driven marked increases in AI's market penetration and share. The global artificial intelligence market was valued at USD 196.63 billion in 2023 and is projected to grow at a compound annual growth rate (CAGR) of 36.6% from 2024 to 2030, ongoing research and innovation led by tech giants are driving the adoption of AI across various industry, including advertising, automotive, healthcare, retail, finance, agriculture, law, and manufacturing (see Figure 1). For instance, according to the report from the Business Research Company (2025),[2] the AI in transportation market has seen significant growth in recent years, with expectations for it to increase from $3.78 billion in 2024 to $4.43 billion in 2025, reflecting a compound annual growth rate (CAGR) of 17.4%. According to PwC's October 2024 Pulse Survey (2025),[3] 49% of technology leaders from Industrial products (28%), consumer markets (21%), financial services (15%), technology, media, and telecoms (20%), health sector (4%), energy and utilities (8%), and other industries reported that AI was 'fully integrated' into their companies' core business strategy, while a third indicated that AI was fully integrated into products and services. In 2023, according to the data from Grand view

[2] https://www.thebusinessresearchcompany.com/report/ai-in-transportation-global-market-report [last access 13 June 2025]
[3] https://www.pwc.com/us/en/tech-effect/ai-analytics/ai-predictions.html [last access 13 June 2025]

research (2024),[4] the UK AI market accounted for 24.8% of total European revenues, the rapid digitization of sectors such as banking, insurance, healthcare, and business services has served as a major catalyst for the accelerated growth of AI in the UK. China's AI market is expected to grow at a compound annual growth rate (CAGR) of 43.5% from 2024 to 2030, driven by the increasing application of AI across various industries in the country.

These figures show that AI is widely used across various industries and is driving rapid change, creating significant market potential in every field, reflecting its broad applicability as a general-purpose technology.

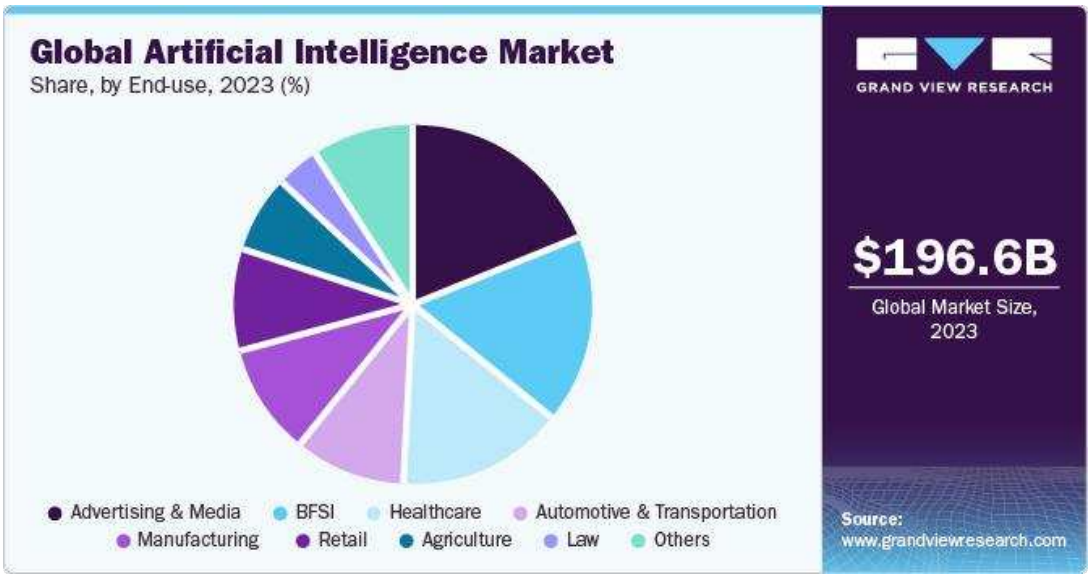


Figure 1. Global AI Market share 2023.
Source: https://www.grandviewresearch.com/industry-analysis/artificial-intelligence-ai-market

In terms of the adoption of Artificial Intelligence in specialization, according to Faist (2024),[5] more than 75% of recommendation decisions for global video streaming services (e.g. Netflix, YouTube, etc.) are driven by AI algorithms from 2023. The Asia-Pacific artificial intelligence market accounted for 25.6% of global revenue by 2023, educational institutions in the region are increasingly adopting AI to enhance educational outcomes through personalized learning experiences, intelligent tutoring

[4] https://www.grandviewresearch.com/industry-analysis/artificial-intelligence-ai-market [last access 13 June 2025]
[5] https://www.faistgroup.com/news/global-ai-market-2030/ [last access 13 June 2025]

systems, and data analytics. The AI market in the Middle East and Africa (MEA) region is expected to reach $166.33 billion by 2030, the region has focused on advancing Arabic language processing in AI technologies, including Natural Language Processing (NLP) and Speech Recognition, to accurately interpret and generate Arabic text and speech.

The market share and influence of artificial intelligence in the art market are also increasing. According to a Market.us report, the global AI-in-art market is expected to grow from USD 3.2 billion in 2023 to about USD 40.4 billion by 2033, a 28.9 percent CAGR between 2024 and 2033. This growth is driven largely by AI's role in sparking new creative methods and boosting curation and recommendations. For example, by analyzing large datasets—like sales records, artist profiles, and consumer tastes—AI can suggest artworks that match a collector's interests and help galleries and auction houses improve their collections and reach more people. For new artists, AI offers great chances: they can use AI tools to try out different styles, get noticed, and connect with bigger audiences through online platforms and social media. AI-powered marketplaces also make it easier for anyone to sell their work, lowering entry barriers and creating a more open art community. The high-priced sales of NFT artworks also signify the growing market share of artificial intelligence. The most expensive NFT of 2024 was Beeple's "Everyday," which sold for an astonishing $69 million at Christie's in March. This record-breaking sale highlights the growing significance and value of digital art as NFTs in art market.

3.2 Inherent potential for technical improvements

Inherent potential for technical improvements means that the technology's performance improves over time, this improvement can be multi-dimensional, including the rapid enhancement of task processing, advancements in multimodal capabilities, and lower costs of AI models (Chen, 2024).

The improvement in AI processing speed largely depends on the optimization of model parameters such as memory and intelligence, which straightforwardly increase the successfulness of AI in an arbitrary world (Dobrev, 2022), and the volume of training data. Parameters refer to the internal variables or weights that the model learns during the training process, these parameters help the model make predictions

or decisions based on input data. Take the development of the GPT series as an example: When GPT-1 was introduced in 2018, it had only 110 million parameters and 5GB of pre-training data. By the time GPT-2 was launched in February 2019, the parameters had increased to 1.5 billion, with the pre-training data growing to 40GB. By 2020, GPT-3 was introduced with a massive 175 billion parameters and a significantly larger pre-training dataset. To demonstrate the increasing number of parameters and the expanding training data of GPT models, OpenAI conducted a series of tests in which both GPT-3.5 and GPT-4 took more than 34 human-prepared exams, covering subjects such as chemistry, biology, mathematics, arts, economics, and literature. These models were not specifically trained for the exams. The results revealed that GPT-4 significantly outperformed GPT-3.5. According to GPT-4 Technical Report (2023),[6] GPT-4 is more reliable, creative, and better able to handle more complex or subtle instructions compared to GPT-3.5.

The multimodal capabilities of AI provide a technological extension for artists, enabling them to achieve richer and more diverse forms of artistic expression through AI. Today, we have various AI models for text-to-image generation, text-to-video, and text-to-music creation. What they all share in common is that they are trained on big datasets collected from the internet, encompassing a wide range of social artifacts: images of people, animal portraits, digitized books and articles, film clips, music and audio files, and more. Trained in such diverse mediums, multimodal generative Al processes all that complex information and transforms it into datasets as new sources of artistic creation (Suryajaya, 2024). For example, in 2021, OpenAI embarked on a multimodal exploration and launched DALL-E, a tool that generates images from text. In April 2022, DALL-E 2 was introduced, delivering even better results by training on millions of stock images, taking image generation to the next level. Next came Midjourney, widely recognized in the visual arts sector for its generative AI, was developed by David Holz on July 12, 2022. It is known for its speed in image generation and its ability to process multiple prompts simultaneously. A key feature of all plans is the allowance for commercial usage of the AI-generated images (Roose, 2022). The famous AI artwork ‘Théâtre D’opéra Spatial’ was created using the Midjourney platform and won first prize at the Colorado Emerging Digital Artist

[6] https://openai.com/index/gpt-4-research/ [last access 13 June 2025]

Competition. Later in August, Stability AI launched the Stable Diffusion, which generates high-quality images. In October 2022, companies like Google, Meta, and NVIDIA built upon the foundation of text-to-image models, leading to the development of tools such as Dream Fusion and Imagen Video. This marked the beginning of a new phase of technological advancements in text-to-video and text-to-3D generation.

The cost of using AI models has decreased (Acemoglu, 2025). Regarding the transformative impact of AI on industry, NVIDIA CEO Jen-Hsun Huang emphasized that accelerated computing can lead to significant cost and energy savings. He noted that as the speed of computing increases, the associated costs decrease, with a 100-fold increase in speed potentially resulting in savings of 96 to 98 percent (Zheng, 2024). Therefore, as the parameters and training data improve, the cost of using AI, which relies on computing power, will naturally decrease. From the perspective of artistic creation, many powerful tools have become publicly accessible or offer low-cost subscription services. This allows independent artists to complete the entire creative process without relying on large production teams. It also greatly reduces the financial burden of trial and error, offering more flexibility and possibilities for creative exploration. These trends indicate that AI aligns with the ‘inherent potential for technical improvements’ of general-purpose technology.

3.3 Innovational complementarities

Innovational complementarities means that the technology can stimulate related innovations across different sectors and driving development in those areas. The innovational complementarities of artificial intelligence are reflected in its synergistic interactions with other productivity factors, which drive the improvement of artistic production efficiency. This enhancement is not primarily focused on the "increase in output quantity" as in traditional manufacturing industries but rather emphasizes improving creative efficiency and market value.

From the perspective of work efficiency, AI complements artists and functions as a “co-creation tool” in the creative process. It facilitates the exploration of new creative possibilities, enhancing both the quantity and variety of artistic outputs (Karras et al., 2017). Additionally, AI significantly improves creative efficiency by

minimizing repetitive tasks and speeding up the creative workflow, quickly handling tasks that would normally take artists a significant amount of time. This allows artists to focus more on core creative activities, allowing them to focus more on creative tasks (O'Toole and Horvát, 2024). For example, tools like Midjourney, DALL·E, and Runway enable artists to generate sketches and adjust colors in much less time than traditional methods would require, generating high-quality artworks based on textual descriptions or style emulation (Oksanen et al., 2023), the integration of artificial intelligence and virtual reality enabled artists to create interactive art installations that engage with the audience.

From the perspective of market value, AI complements digital art platforms. Non-fungible tokens (NFTs), driven by AI, offer a means of "certifying" digital art and bring tangible economic advantages (Włodarczyk, 2024). For example, NFTs enhance the liquidity of artworks, facilitating their circulation, and promoting greater transparency in art market transactions. For artists, NFTs facilitate enhanced promotion and the opportunity for passive income (Włodarczyk, 2024). When artists mint their digital creations as NFTs, they can promote them while retaining ownership rights, which are protected by blockchain records. After the initial sale, creators can continue to earn royalties from any future re-sales.[7]

Additionally, the growth of AI art also drives the advancement of AI technology itself. Crowd-sourced Efforts effectively demonstrate this feature of AI: AI models are developed through the participation and contributions of a wide range of users. Typically, Crowd-sourced Efforts are usually realized through online platforms or communities, engaging people from different fields, backgrounds and skills. People collaborate to gather and organize large volumes of art-related data, such as images, audio, and video. These data can provide more diversified and rich creative materials for the improvement of AI, helping AI models understand the characteristics, styles, and themes of artworks, and ultimately improving the quality and diversity of AI-generated art.

From the points above, it can be concluded that AI shows the key characteristics of a general-purpose technology, including pervasiveness, inherent potential for technical improvements, and innovational complementarities.

[7] https://www.knownorigin.io [last access 13 June 2025]

Therefore, this thesis will explore the impact of AI on art production, grounded in the theoretical framework of general-purpose technologies in economic activities.

4. Application of Artificial Intelligence in visual Art

Artificial intelligence, with its powerful capabilities, has significantly promoted the development of artistic production, many popular commercial "generative AI art" products have entered the market.[8] Although artificial intelligence has become a popular topic in recent years, AI-generated art has actually emerged much earlier. For example, Harold Cohen's 1973 presentation at the Venice Biennale, where he showcased a painting created with his computer program AARON, is often considered the official beginning of art created through artificial intelligence (Mazzone and Ahmed, 2019). In 2010, Margaret A. Boden applied the concept of the Turing Test to AI-generated artworks. The Turing Test, originally proposed by British mathematician Alan Turing in 1950, is a method for evaluating whether a machine possesses intelligence. Its core idea is that if a machine can engage in text-based communication with a human in such a way that the human cannot distinguish whether they are interacting with a machine or another human, then the machine is considered to have human-like intelligence (Turing, 1950). The test typically involves an interrogator engaging in anonymous conversations with both a human and a machine, if the interrogator cannot accurately identify which is the machine, the machine is said to have passed the test. Boden used this concept to examine whether humans can distinguish between artworks created by artificial intelligence and those created by human artists. She demonstrated, through a Turing Test for artistic creation, that computer-generated art had already 'behaviorally' passed the test, sometimes even at a world-class level (Boden, 2010). In the case of non-interactive examples, such as AARON and Emmy, the test was passed in a particularly strong form. On 25 October 2018, *Portrait of Edmond Belamy*, an AI-generated painting, was sold for $432,500 at Christie's. As the first AI-created artwork to be sold at a major auction, this sale marked a significant milestone in the art world, opening new opportunities for the visual arts and demonstrating the economic value and potential of AI-generated art (Doherty, Shauna, 2019). In 2021 the AI artist "Botto" was born and has been developing in the art market at a very fast pace. "Botto," an AI-powered artist, earned over €1 million from the auction of its first four NFT artworks. By analyzing millions

[8] https://asia.nikkei.com/Spotlight/Datawatch/Generative-AI-mania-brings-billions-of-dollars-to-developers [last access 13 June 2025]

of existing artworks through algorithms, Botto generates its own original creations. It describes itself as “a generative algorithm whose sole destiny is to create.” His paintings now appearing in art exhibitions and auctions all over the world (Wiratno, 2024).

As the development of computer technology, the role of AI in visual arts has gained significant attention, many artists around the world are actively exploring new AI-driven creation, and the concept of AI-generative art, which refers to the use of a system with a certain level of autonomy as a key element in artistic creation, has been widely studied both theoretically and practically over the past several decades (Boden, and Ernest, 2009).

To study the applications of AI across various industries, Ajay et al. (2023) introduce the concepts of ‘Single-point solution’ and ‘System solution’ in their research. They argue that the integration of AI with the art industry occurs in two ways: one is the use of AI as a Single-point solution, in which AI is used to solve a specific problem in art production but keeps the overall workflow unchanged. In this case, the integration of artificial intelligence with artistic creation remains superficial and does not significantly influence the overall process of artistic production. In this case, the integration of AI with art creation remains superficial and does not significantly impact the broader process of art production. The other approach is to apply AI as a system solution to art production, where AI transforms the entire production process. This leads to a deeper integration of AI with art creation, resulting in a significant impact on art productivity. This theory is of great significance for studying the application of AI across art industries. Therefore, this chapter builds on their framework to examine how AI is utilized by artists and art institutions, and how it subsequently influences the art market.

4.1 Single-point solution

Generative AI has the ability to create high-quality artistic works across various fields, including visual arts, concept design, music, fiction, literature, video, and animation (McCall, 2024). These technologies are projected to fundamentally transform the creative process, significantly influencing how creators conceive, develop, and realize their ideas (Epstein et al., 2023). Patricia Townsend (2014)

proposed that the artistic process can be divided into three stages, which are “genesis”, “development”, and “separation”. The “genesis” stage includes the initial conception, incubation, and emergence of an idea for a new work (or a general sense of direction when the notion of an idea is too specific). The “development” stage refers to the period during which the artist interacts with their chosen medium to produce the artwork, in this term, we consider the chosen medium as artificial intelligence. The final stage, “separation”, involves presenting the completed work to the public, most commonly through an exhibition. In the single-point solution, the present of AI can be seen in all these three stages to optimize the artistic production:

4.1.1 Genesis: Algorithms Provide New Perspectives for Artistic Creation

In all the technologies we use today, whether it's photography, film, or software algorithms, the tools and algorithms are basic tools, just like brushes and paint. The same can be said for the new AI-based algorithms that are emerging (Hertzmann, 2018). From Ancient Greek art to contemporary art, the tools and methods of creation have changed significantly, every technological change leads to the emergence of new art forms and new modes of artistic production (Shiner, 2001). For example, the woodcutting originated in northern Europe around the 1400s, driven by advancements in papermaking technology, and between the 14th and 15th centuries, the woodcut technique evolved because of the improvements in carving method (Stewart, 1980). This innovation gave rise to printmaking—both woodcuts and engravings—as a new art form that, unlike hand-drawn manuscripts or paintings, could be mass-produced and widely distributed. By the late 19th century, advancements in film sensitivity and the growing portability of cameras made photography more widely accessible. With user-friendly cameras and faster films, it became possible to photograph almost anything (Sontag, 2021). The emergence of photography changed the course of visual art, for the first time, a mechanical process could capture images with incredible detail and accuracy, challenging traditional notions of realism in painting. The rise of photography led to changes in the way artists viewed reality and representation, and enabling anyone with a camera to create and share art, it also influenced the development of new forms of artistic expression (Hutson et al., 2023). Starting in the late 20th century, the rise of digital technologies has led to the emergence of digital

art, interactive installations, virtual reality (VR), and augmented reality (AR) as new art forms, artists can now use software, digital tools, and virtual platforms to create works that would not have been possible in the pre-digital era (YUHAN et al., 2024).

In the digital age, the use of AI and machine learning in art creation has led to the exploration of algorithmic art, artificial intelligence has become integrated into every aspect of artistic creation (Nairn and Justin, 2023). What sets AI apart from others is its unique ability of "intelligence" and "creativity." Unlike traditional tools that simply assist, AI actively generates surprising images and ideas, it not only aids artists but also sparks innovative inspiration and new forms of expression in their work. From training AI models on datasets, setting parameters, to generating outputs, this process often leads to surprising and original results.[9] Artists such as Soufiane Idrissi and Mario Klingemann accept and welcome the unpredictability of machine-generated outcomes, they explore the potential of AI in providing creative ideas.

For example, in the painting named *Painting with Artificial Intelligence* (see Figure 2), Moroccan artist Soufiane Idrissi used AI algorithms to generate tens of thousands of color combinations. These color patterns served as a generative source of inspiration, expanding the range of visual possibilities and informing his creative process. He develops an algorithm where every color and form are transcribed as a line of computer code. In this process, a khaki green color is translated into an online web program and linked to another line of code that defines its form. By making small changes to the color formula—such as altering just one digit in the code—the color shifts, not into a lighter or darker shade of the original, but into a completely different beige-brown color, while retaining a digital connection to the initial color. These digitally generated colors were transferred onto the canvas to create the artwork. Because all the colors share a common computational root and follow a precise process, the final image appears exceptionally harmonious and balanced. [10]

[9] https://visualalchemist.in/2024/09/25/the-role-of-the-creator-in-generative-art-code-as-medium-vs-ai-as-artist/ [last access 13 June 2025]

[10] https://www.sothebys.com/en/buy/auction/2021/contemporary-curated-5/painting-with-artificial-intelligence [last access 13 June 2025]

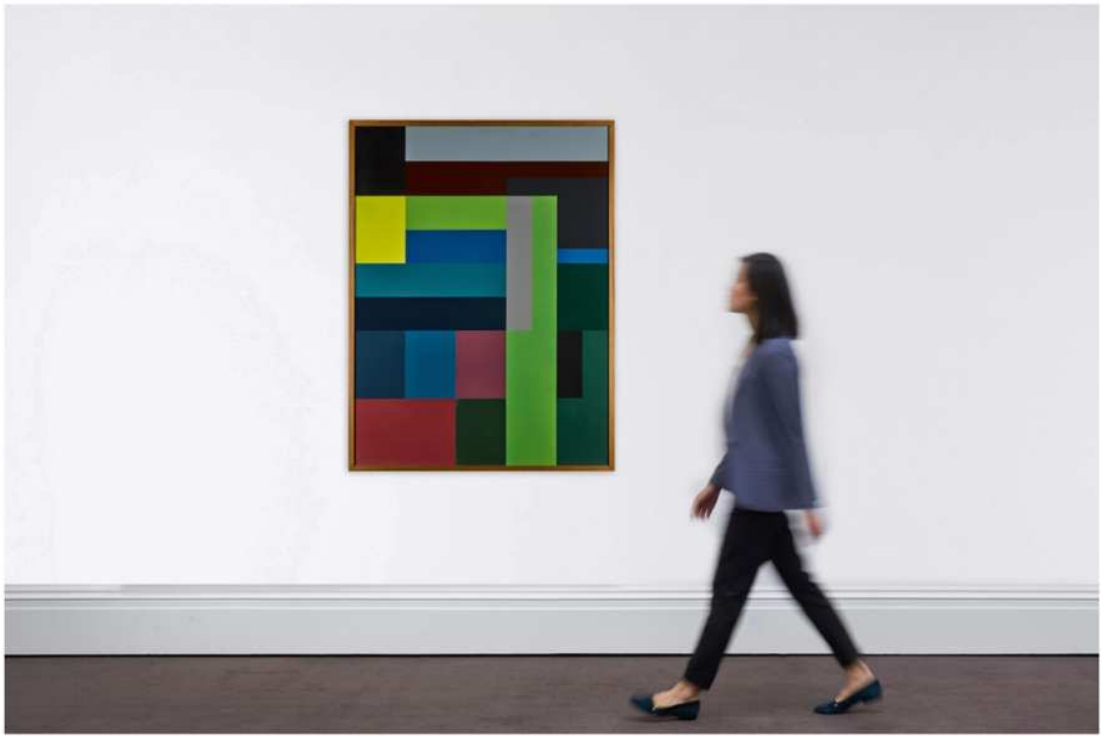


Figure 2. Painting with Artificial Intelligence, by Soufiane Idrissi, 2007. Source: https://www.sothebys.com/en/buy/auction/2021/contemporary-curated-5/painting-with-artificial-intelligence

Roope Rainisto is a photographer and artist, he uses artificial intelligence to replace the camera, generating images that achieve effects not possible with traditional photography. Best known for his *Life in West America* (see Figure 3), which is a "post-photography" project. This series explores a nostalgically distorted vision of the American West. Drawing inspiration from the early days of American color photography, it incorporates elements such as Cadillacs, diners, and denim-clad characters reminiscent of the 1960s—evoking the feeling of faded memories or scenes from an alternate history. In *Life In West America*, Roope Rainisto explores the role of AI as a creative partner in the earliest stages of the artistic process. Each image in the collection was generated using models he trained specifically for this project. To create the final set of 500 images, he began by generating around 35,000 drafts, followed by an additional 15,000 inpainting variations to enhance specific visual elements. Diffusion-based generative models, as used here, embody a kind of *shoshin*—a beginner's mind open to unexpected outcomes and new aesthetic possibilities. This

method highlights AI's potential to expand artistic imagination beyond conventional boundaries.[11]

Figure 3. Life in West America, by Roope Rainisto, 2023.

Source: https://lifeinwestamerica.com

Artificial intelligence, as an artistic tool, not only supports artists in generating new ideas and creative directions but also inspires creators without formal art training to engage in artistic practices. Moreover, it offers art enthusiasts accessible means to explore and develop their own creative expressions, making inspiration more widely attainable. (Hertzmann, 2018; Bellaiche et al., 2023). For amateur enthusiasts who wish to create artworks, AI has made the process of artistic creation more accessible and easier, offering a range of creative tools that let them create art with just a basic sketch or a short text description. In a study of amateurs creating artwork with AI, Zhang (2024) reported that the sample included 12 males and 5 females aged between 20 and 45. All participants described their drawing skills as non-expert, non-

[11] https://lifeinwestamerica.com[last access 13 June 2025]

professional, or unskilled. The results of the study show that, regardless of age or background, amateurs were able to learn how to use AI drawing tools in less than 10 months (see Table 1). AI painting offers an engaging and entertaining way for laypeople to explore and interact with information, while some challenges require further investigation and resolution, the potential of generative AI in art creation is clear.

Participants ID	Gender	Age	Background	Usage Duration
P1	Male	23	Graphic design	6 months
P2	Male	N.A.	Finance	1 month
P3	Female	21	Architecture	8 months
P4	Male	32	Accounting	3 months
P5	Male	35	Trade	1 week
P6	Male	26	NGO	5 months
P7	Female	43	IT	2 weeks
P8	Female	20	Medicine	2 weeks
P9	Male	24	Electronics	7 months
P10	Female	20	Unemployed	4 months
P11	Male	30	Manufacturing	1 month
P12	Male	45	Optics	6 months
P13	Male	22	Information system	3 months
P14	Female	20	Education	4 months
P15	Male	34	IT	6 months
P16	Male	25	IT	9 months
P17	Male	22	Geography	5 months

Table 1. Time spent by amateurs using AI tools to create artworks, illustrating the efficiency of AI as a creative tool.
Source: Zhang, Xiaoyu, et al (2024)

4.1.2 Development: Enrichment of artistic expression

Traditional visual arts, such as painting and sculpture, are mainly static forms of expression, with the advancement of AI, “dynamic art” has started to emerge in art exhibitions (Lee, 2022). For example, at the 2024 Venice Art Biennale, Memo Akten’s installation *Boundaries* (2024) was exhibited at the Chiesa di Santa Maria della Visitazione (see Figure 4), captivating audiences with its immersive blend of technology, art, and philosophy. Akten employs cutting-edge technologies, including machine learning algorithms, motion capture, and real-time data processing, to develop his installations. In the digital animation video Boundaries (2024), Akten used AI to recreate the movements of human dancers. The AI-processed visuals are strikingly imaginative, characterized by vibrant colors and dynamic motion. Through

this work, he explores a range of interconnected themes, including the relationship between humans and the environment, the body and the mind, the material and the immaterial, as well as the boundaries between humans and artificial intelligence.

Figure 4. Boundaries, by Memo Akten, 2024.
Source: https://www.memo.tv/works/boundaries-2024/

The role of AI in art creation is not just passively receiving information and outputting results, it is also able to interact with the artist and assist the artist in the production of the artwork. This interactive collaboration between AI and the artist not only enhances the production of the artwork but also transforms the process itself into a significant part of the artwork's artistic value. For example, some artists use Human-Computer Interaction (HCI) (Sinha et al., 2010) in their art creations, so that the machine interacts with the artist according to the instructions and completes the artwork together. Human-computer interaction transforms artmaking into a collaborative and co-creative process. For example, Sougwen Chung (Fang et al., 2023) designed a robot named D.O.U.G. (Drawing Operations Unit: Generation 2) in 2017 (see Figure 5), this robot is drive by neural network, she training the neural network by repetition of her own drawing style, and programming it to emulate her motion in real time by use of a digital sight application, as a result, the robot can sense the artist's movements while drawing and actively collaborate in the creative process, thereby achieving true co-creation between the machine and the artist.

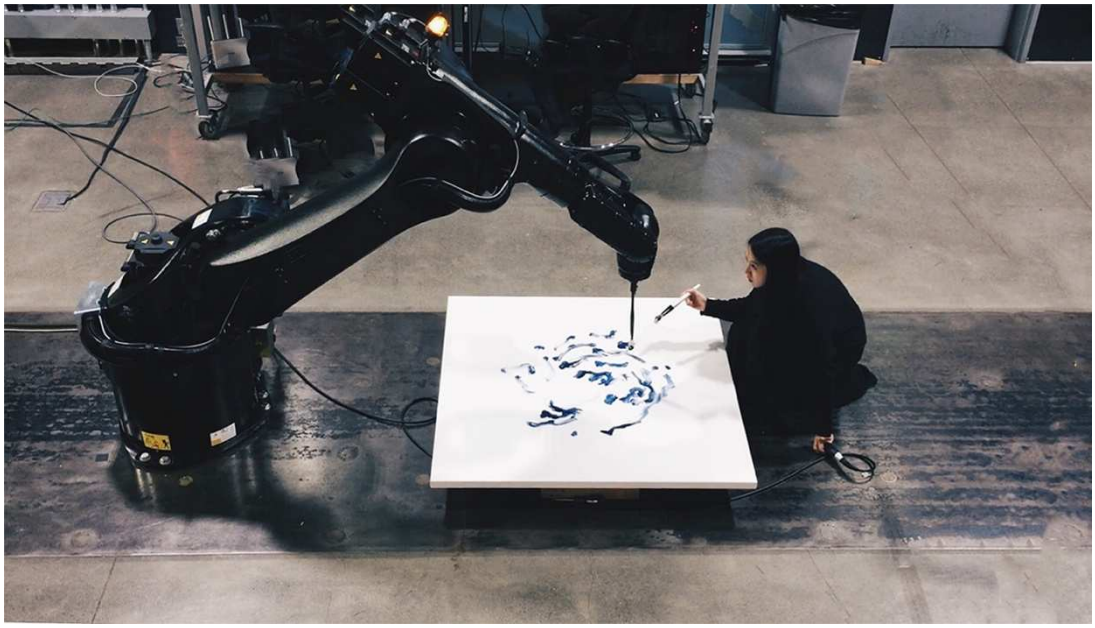


Figure 5. Drawing Operations, by Sougwen Chung, 2017.
Source: https://sougwen.com/projects

4.1.3 Separation: AI promotes the democratization of art

The concept of the democratization of art first emerged during the 1789 French Revolution (Looseley, 2004). In the traditional art world, galleries and museums have long been the primary institution for artists to showcase their work. However, these institutions are often dominated by social elites, they have traditionally been seen as strongholds of high culture—featuring complex and elitist art that reflects a specific suite of values (Booth, 2014), making them socially exclusionary and creating a divide between the privileged few and the popular social classes (Bennett, 2013). Even though the art world had entered the Web 3.0 era, the technical barriers of art excluded many ordinary people, instead, professionals, technologists, and financial speculators dominated the aesthetics and art market (Wang et al., 2024). Generative AI, however, breaks down these barriers and privileges and has made it possible for artists and art enthusiasts from all over the world to connect, collaborate, and showcase their work without relying on traditional gatekeepers. This increased accessibility has resulted in a more diverse and inclusive art scene, showcasing a wider range of voices and perspectives, bringing about the “decentralization” of art (Adeloye, 2024).

Online art galleries reduce inequalities in the art market by democratising access of artists to the art world (Samdanis, 2016), one way AI promotes the democratization of art is through its integration with the Metaverse and creat the online art gallerties in the Metaverse (see Figure 6). The Metaverse is a large-scale, persistent, and interactive real-time platform composed of interconnected virtual worlds. It enables people to socialize, work, trade, play, and create within a fully digital environment (Pattam, 2022). By seamlessly merging physical reality with virtual environments, the Metaverse is poised to reshape the future. Its potential to revolutionize diverse aspects of human life—from entertainment to commerce—highlights its growing significance.

At the core of this transformation is AI, which accelerates the evolution of the Metaverse by enriching it with increasingly immersive and innovative experiences. The Metaverse allows users worldwide to create virtual spaces where they can showcase and trade artwork, AI gives the blockchain the ability to build an metaverse where digital objects interact and evolve with each other (Jeon et al., 2022), users can generate personalized pieces and display them in digital exhibitions. For example, artists in the Metaverse can use generative AI to create virtual art galleries filled with AI-generated masterpieces, showcasing diverse artistic styles and themes (Chamola, 2024). Additionally, users can explore galleries from artists around the world and directly communicate with them.

In addition to help users create art, AI enhances the Metaverse experience by making art interactions more immersive and realistic (Mariappan et al., 2024). Digital avatars are one more way in which AI collaborate with the Metaverse, which are a graphical representation or embodiment of an individual or entity in the digital realm (Ramadan, 2025). AI empowers digital avatars in the metaverse with intelligent analysis, intelligent judgement and interactive capabilities to provide personalized services to the audience (Pattam, 2022), AI-powered chatbots and virtual assistants has enabled institutions to provide personalized tours answer visitor inquiries, talking with visitors, explaining the artwork, recommending artworks and art exhibitions, at the same time, gather valuable data on visitor preferences (Costin and Eslava, 2022). This innovative way of social interaction not only strengthens the connection between artists and audiences but also helps creating new possibilities for self-expression and exploration, thus promotes the democratization of art (Hutson,2024).

Figure 6. Metaverse Art Gallery, by Ben, 2023.

Source: https://metaverse08.com/what-is-a-metaverse-art-gallery/

Another way AI is contributing to the democratization of art is by creating the machine artist driven by algorithms. The democratization of the interaction between humans and machines is a key and unprecedented factor that characterized the post digital artistic field (Fernández-Castrillo, 2023).

For example, Botto[12] is a decentralized artificial intelligence art project created in 2021. As a machine artists trained by AI, it can autonomously create art works of cultural impact and financial reward without direct human intervention. Botto is governed by a community (see Figure 7), members of the community play a role in its training process to impact the theme, style, and imagery of each creation, to date, over fifteen thousand people have contributed to Botto's development. Every week, Botto creates around 4,000 images based on randomly generated prompts, which are then filtered through a computational "aesthetic system" to select 350 images for community voting. In this process, no manually set keywords or real-world images are used, and the image selection is entirely controlled by the system. Community members can vote on the image pairs presented by the system and enhance their voting power by staking their $BOTTO tokens. The final winning piece of the week is selected based on these votes. Members typically discuss and campaign for specific pieces on Discord or Twitter, especially during the final 24 hours of the voting period. The winning image is minted as an NFT and auctioned in ETH on the SuperRare

[12] https://botto.com [last access 13 June 2025]

platform. The proceeds are partially distributed to voters according to the community governance mechanism, incentivizing them to select works with high market potential, while also covering server costs and other community-approved operational expenses.

More importantly, Botto is not a closed system but a continually evolving "decentralized autonomous artist." Community members are involved not only in voting for images but also in designing economic mechanisms, making decisions on artistic collaborations, managing budgets, and more. Future developments include incorporating emerging generative models to foster competition within the system, creating more sophisticated reward structures that tie financial incentives to community contributions, and promoting cross-disciplinary collaborations with human artists (Klingemann et al., 2022).

Botto's creative process is driven not only by AI but also by collective, decentralized participation in art creation and governance. It breaks away from traditional, elite-controlled art models, making the production, distribution, and valuation of art more democratic and decentralized, with a transparent and open art economy powered by blockchain technology.

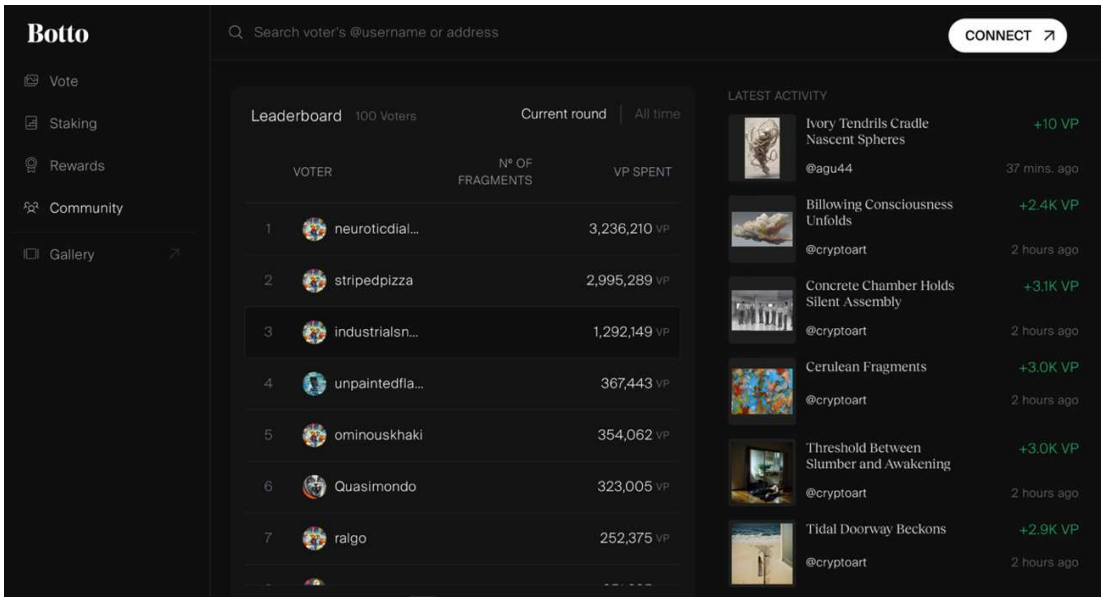


Figure 7. Screenshot of Botto's vote page.

Source: https://botto.com/app/vote

4.2 System solution

Information technologies are now everywhere in our daily lives. They help grow the digital economy and accelerate the production, distribution, and consumption of goods and services. These new technologies have touched every area, including the art world, and new business models reinforce or complement the established art ecosystem. Art institutions are using new media for display, promotion, and conservation of their collections, aiming to create a unique and engaging experience for their visitors. At the same time, artists are using social media as cultural branding intensifies in the digital age, and their experiments with new media are creating new art forms that push the boundaries of contemporary art and museum collections. Technologies, business, and culture come together to help promote art and offer more meaningful and engaging experiences for both buyers and audiences (Samdanis, 2016). Thus, artificial intelligence as a systemic solution in art production is reflected in the fact that it influences the ecosystem of the art market.

4.2.1 AI has changed the supply and consumption patterns of arts.

Since the 1960s, collaborations among scientists, artists, and inventors have grown steadily, leading to the increasing integration of science, art, and technology. During this time, electronic devices began to be used as tools for artistic creation. The experience of engaging with art and culture is inherently diverse, it can be individual or collective, physical or virtual, active or passive, public or private, on-site or in private places, open-air or indoor. With the spread of digital art, there is a remarkable increase in the market presence of art (Özdemir, 2022). AI art provides people new ways to interact with art. Instead of just looking at it, they can interact with it, and sometimes their reactions even become part of the artwork. The integration of AI into the visual arts has not only reshaped the process of art creation and introduced fresh perspectives, but is also changing the way people experience and consume of art.

On October 24, 2024, in New York, Sotheby's held the exhibition and sale titled "Exorbitant Stage: Botto, a Decentralized AI Artist", the event concluded with a total of $351,600 in sales across six lots.[13] The auction brought attention to how AI has

[13] https://www.sothebys.com/en/buy/auction/2024/exorbitant-stage-botto-a-decentralized-ai-artist [last access 13 June 2025]

expanded the supply and consumption of artworks beyond physical objects, with AI-generated and digital artworks capturing a growing share of the art market. This is a significant signal that how AI offers a fundamental solution to the labor-intensive nature of artistic creation for some businesses. As a result, capital is increasingly replacing labor as the primary input in producing original artworks (Lee, 2022). The emergence of AI brought art productions into the era of semi-automation or even full automation, enabled the production of art more efficiently and at a lower cost, meeting growing market demands, and creating more diverse supply and consumption patterns (Adeloye et al., 2024).

This transformation is driven by greater personalization, enhanced interactivity, and the expansion of digital platforms, making content more accessible to a broader audience. The technology-driven art consumption patterns primarily consist of three main types: immersive experiences, digital derivatives, and technology cultural tourism (Wang, 2023).

1) Immersive experiences

In the past decades, artists and the GLAMs (Galleries, Libraries, Archives and Museums) have traditionally been the main channels for showcasing art to a wide audience. Now they are increasingly embracing Information and Communication Technologies (ICT) to discover innovative and impactful ways to engage people with art exhibitions and mainly invested in the shift from physical to digital experiences (Maciuk et al., 2022). now users can enjoy art works from virtually visit a physical or a Virtual Reality (VR) exhibition or use Augmented Reality (AR) and Mixed Reality (MR) (Sylaiou et al., 2024).

The combination of AI and VR has given rise to a new artistic experience called Intelligent Virtual Environments (Luck and Ruth, 2000). By integrating applied artificial intelligence, these environments extend the display of artworks beyond the physical boundaries of galleries and museums, creating a more open space for artistic sharing and exchange. This interactive feature enriches the virtual exhibition experience, promoting a deeper connection and engagement with the art. This emerging trend is well demonstrated by DRIFT STUDIO, a team of artists and technologists who use AI and immersive technology to create unique artistic experiences.

DRIFT STUDIO was founded by Dutch artists Lonneke Gordijn and Ralph Nauta. Together with a multidisciplinary team of 65 members, they focus on creating immersive installations using technologies such as artificial intelligence. In 2017, they created their first augmented reality artwork, Concrete Storm, for Microsoft HoloLens, which was exhibited at The Armory Show in New York. Within a limited booth space, they installed three concrete pillars. When visitors wore the HoloLens, they could hear a storm and see the pillars—appearing four times taller than in reality—swaying in the wind. This allowed them to experience a scene that would be impossible in real life. The combination of AI and augmented reality technology made these "impossible" experiences possible (see Figure 8).

Figure 8. Concrete Storm, by DRIFT, 2017.
Source: https://studiodrift.com/work/concrete-storm/

The most influential way AI has been applied in virtual reality is to recreate a physical gallery environment through virtual reality (VR) and augmented reality (AR), enabling visitors to explore exhibition spaces and interact with artworks in a more immersive way. These AI-driven innovations enhance the virtual exhibition experience, bridging the gap between the digital and physical worlds of art. Several organizations

are leading this development, such as V21 Artspace, GalleriesNow, and ANNKA KULTYS gallery, all of which utilize AI and multimedia technologies to create more accessible and engaging virtual art experiences.

V21 Artspace[14], founded in 2017 by Joe Clark and Claire Cutts, focuses on enhancing accessibility, audience engagement, and archival practices within the arts and culture sector. The organization employs two main formats: 3D Virtual Tours for showcasing and preserving real-time exhibitions, and bespoke CGI Virtual Exhibitions & Galleries for situations where physical spaces are not available. V21 Artspace has collaborated with a wide range of arts organizations both in the UK and internationally, providing virtual galleries for global exhibitions. Their platform attracts viewers worldwide and offers access to hundreds of interactive 3D exhibitions.

V21's goal is to collaborate with arts organizations to develop digital solutions that complement physical exhibitions, ensuring art remains accessible regardless of location or physical ability, using immersive technology to remove physical and financial barriers and increase audience engagement, and encouraging inclusivity in the art and culture community (see Figure 9).

Figure 9. Screenshot of V21 Artspace Virtual Exhibition page.

Source: https://v21artspace.com

Annka Kultys is a Polish Swiss art dealer, in 2015 she founded her eponymous gallery in London, a contemporary and digital art gallery, with the clear goal of

[14] https://v21artspace.com [last access 13 June 2025]

supporting digital and new media artists using emerging technologies. ANNKA KULTYS gallery[15] is a hybrid art space that combines physical and digital experiences. It has quickly become a key gallery for emerging artists, especially millennials, who use technology—and more recently, blockchain—in both traditional and digital art. By showcasing these artists and supporting the "phygital" approach, Kultys aims to influence the discussion on modern art and technology while expanding what is possible in both real and virtual gallery spaces (see Figure 10).

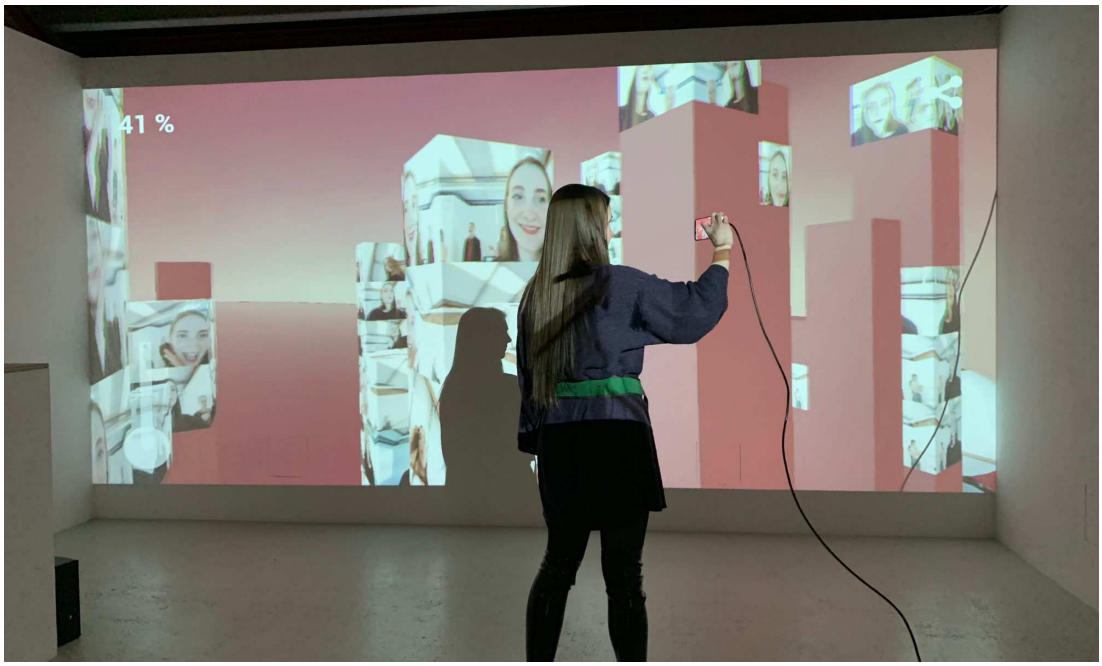


Figure 10. Non-Places , by Marc Lee, 2019.
Source: https://www.annkakultys.com/organ-thing-6-may-2019/#more-27246

In 2022, Kultys realized that separate physical and digital exhibition projects were limiting her options, so she collaborated with the professional developers of GalleriesNow [16] to create a “digital” gallery (see Figure 11) accessible through virtual reality (VR). As the company’s co-founder, Tristram Fetherstonhaugh, puts it, by visiting this digital gallery, “instead of scrolling the space, you’ll be strolling the space”. The physical gallery is located in a remote corner of East London in an old warehouse, while the virtual gallery is a much larger complex. Exhibitions take place in a central pavilion located within a wider network of gallery spaces, and the real-life

[15] https://www.annkakultys.com [last access 13 June 2025]
[16] https://www.galleriesnow.net [last access 13 June 2025]

physical gallery features a corrugated industrial roof, while the outdoor VR version of the exhibition hall allows visitors to gaze up at an ever-blue sky.

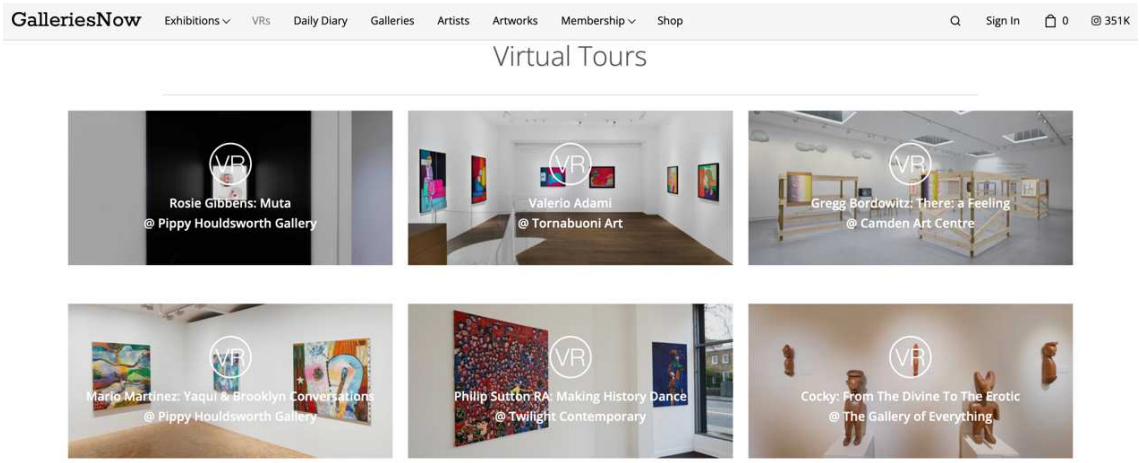


Figure 11. Screenshot of of GalleriesNow Virtual Exhibition page.
Source: https://www.galleriesnow.net/vr-exhibitions/

Kultys has observed that audiences are extremely enthusiastic about the experience, and she predicts a future where VR becomes more widely accessible, allowing people to effortlessly explore a rich archive of past exhibitions with just a simple click of a button on their handheld controller (Jo Lawson, 2024). With AI enhancing the potential of virtual reality, audiences can be fully immersed in a virtual artistic space. This not only enriches the exhibition's artistic experience but also deepens users' understanding of artists and their works, ultimately encouraging art consumption (Wu, 2022).

Currently, GalleriesNow, an art exhibition platform that collaborates with over 200 physical galleries, runs a VR program in cities like London, Paris, New York, Berlin, Milan, Hong Kong, Seoul, and Los Angeles. With a dedicated team of specialist photographers, the VR experience allows art enthusiasts to explore the exhibition and understand its layout, curation, and arrangement—all without leaving home.

2) Digital derivatives

Non-Fungible Tokens (NFTs) are tradeable rights that can be used to acquire ownership of digital assets, such as music, videos, and images (Dowling, 2022). Although the digital files themselves can be infinitely reproduced and copied, the

NFTs that represent these files are carefully tracked on their underlying blockchains. These blockchains provide buyers with a verifiable and secure proof of ownership for the NFTs they purchase. It is this blockchain-verified proof of ownership, rather than the digital file itself, that has become the valuable commodity for which enthusiasts and collectors are willing to pay (Mani, 2021). One key use of NFTs is as art objects — what Franceschet et al. call "crypto art" or "rare digital art" (Franceschet et al., 2021). These are limited-edition collectible artworks that are specifically created to be tokenized and registered on a blockchain for sale. Typically, such digital artworks are auctioned on online platforms or displayed in NFT galleries. "Crypto art" does not neatly align with traditional definitions of art objects, since many of these works are generated using artificial intelligence (AI) algorithms. NFTs provide a new way for AI artists to monetize their creations and establish their value in the art market. By minting NFTs that represent unique digital artworks created or modified by AI, artists can prove ownership, authenticity, and provenance for their works in a way that was not previously possible (Cooke, 2024).

The emergence of the Al generated Non-fungible token (NFT) art is a paradigm of the shift in the global art market that combines the genius of artificial intelligence and blockchain technology. Although the initial surge of interest in NFTs was driven not by the art world but by enthusiastic financial investors, advancements in artificial intelligence and blockchain technology have paved the way for NFTs and virtual digital collectibles to enter the art market, redefining the way digital art is traded and collected and the economic dynamics of the whole art industry (Terekhova, 2025). The surge in AI-generated art sales initially aligned with the NFT boom of 2021–2022. In fact, auction sales in this category reached a new high in 2023.[17] As shown in the two bar charts (see Figure 12 and 13) from the Art and AI Report 2024, AI-generated artworks have seen a significant increase in both value and quantity at auctions since 2021, reaching a peak in 2023.

[17] https://www.hiscoxgroup.com/news/blog/hiscoxs-art-and-ai-report-2024 [last access 13 June 2025]

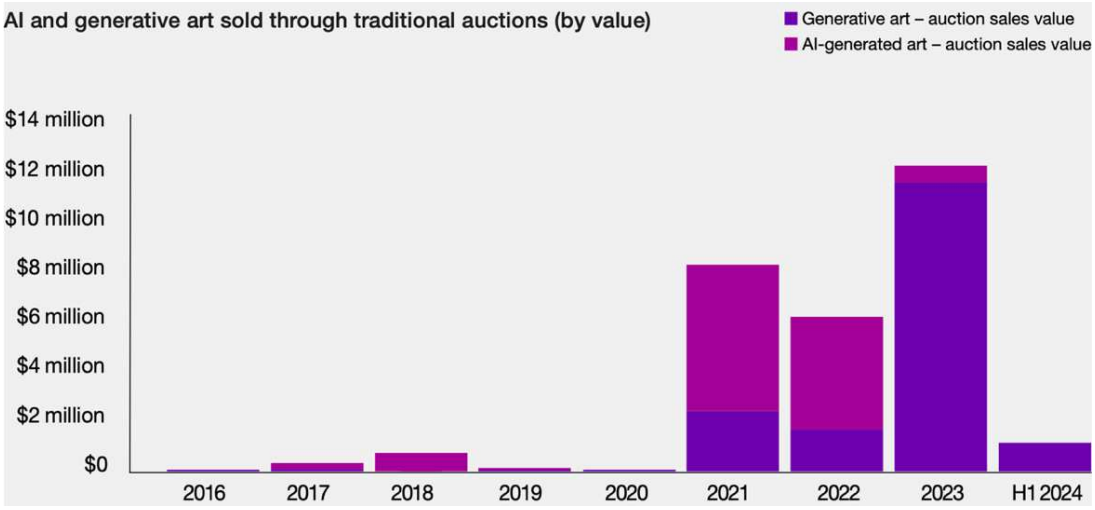


Figure 12. Al and generative art sold through traditional auctions (by value). Source: https://www.hiscoxgroup.com/sites/group/files/documents/2024-11/Art%20and%20AI%20report%202024%20-%20Phase%202.pdf

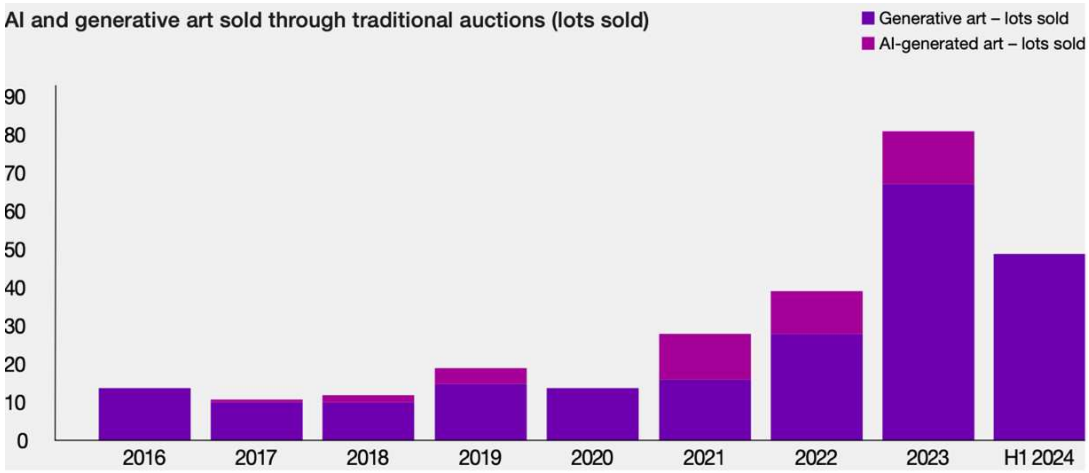


Figure 13. Al and generative art sold through traditional auctions (lots sold). Source: https://www.hiscoxgroup.com/sites/group/files/documents/2024-11/Art%20and%20AI%20report%202024%20-%20Phase%202.pdf

As people's interest in AI-generated artworks increases, a new wave of creativity and innovation is sweeping across the NFT market, incorporating AI into NFT creation and functionality. This new generation of NFTs can change and evolve, giving collectors digital art that's always shifting. Some NFTs respond to real-world factors like the time of day, the weather, or current events, creating dynamic and interactive experiences. The blend of AI-generated art and NFTs is pushing the boundaries of

creativity and ownership in the art and collectibles market, expanding possibilities in digital art and ownership.

According to the Hiscox Online Art Trade Report 2023,[18] 20% art buyers have purchased an NFT, while 12% expressed interest in acquiring one within the next 12 months. Investment potential remains the primary driver for NFT purchases, with 66% of buyers citing it as their main motivation. However, interest in NFTs for their social impact and patronage has grown significantly, rising from 39% in 2022 to 54% in 2023. Additionally, more buyers are valuing the sense of community that NFTs provide—44% now consider networking and belonging to a like-minded group a key reason for purchasing, up from 38% the previous year.

As the trading of digital artworks continues to rise and the number of digital art collectors expands, major physical galleries and auction houses have introduced specialized platforms for digital art transactions. On March 11, 2021, Christie's made history by selling Beeple's Everydays: The First 5000 Days (see Figure 14) for $69 million. As the first major auction house to introduce non-fungible tokens (NFTs) to the global auction stage, Christie's witnessed a surge of enthusiastic interest from collectors and artists alike. In response, the auction house launched Christie’s 3.0 in September 2022, a newly developed platform that will allow for fully on-chain NFT sales, demonstrating the auction house's commitment to both artists and collectors in the Web3 space.[19] Christie's 3.0 facilitates end-to-end auctions on the Ethereum blockchain. All transactions, including post-sale processes, are automatically recorded on the blockchain, ensuring transparency and security. In addition to offering the highest level of curation in the NFT art market, this groundbreaking platform also incorporates essential compliance and taxation tools, addressing key market demands and making it a pioneering step in the industry. Within the first year of the platform's establishment, Christie's 3.0 held six auctions, showcasing 100 works from over 70 artists. The top-performing lot of this year on Christie's 3.0 was Deekay's Self-Discovery (see Figure 15), which sold for 48.4 ETH ($91,868.52).[20]

[18] https://www.hiscox.co.uk/online-art-trade-report [last access 13 June 2025]
[19] https://nft.christies.com/auctions [last access 13 June 2025]
[20] https://press.christies.com/365-days-of-christies-30 [last access 13 June 2025]

Figure 14. Everydays: The First 5000 Days, by Beeple, 2017.

Source: https://onlineonly.christies.com/s/beeple-first-5000-days/beeple-b-1981-1/112924/

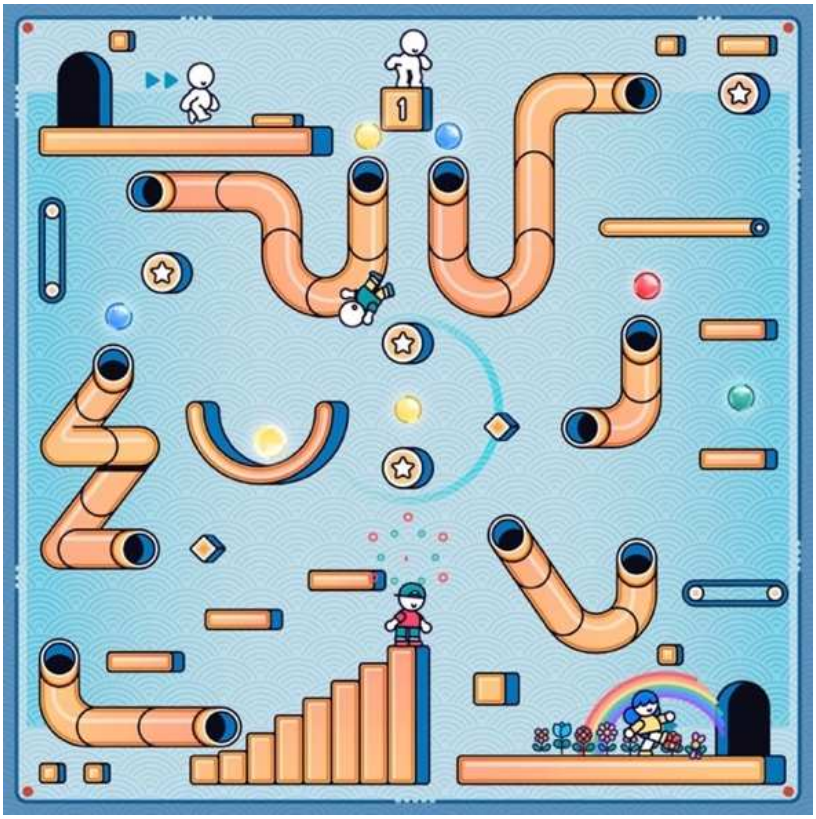
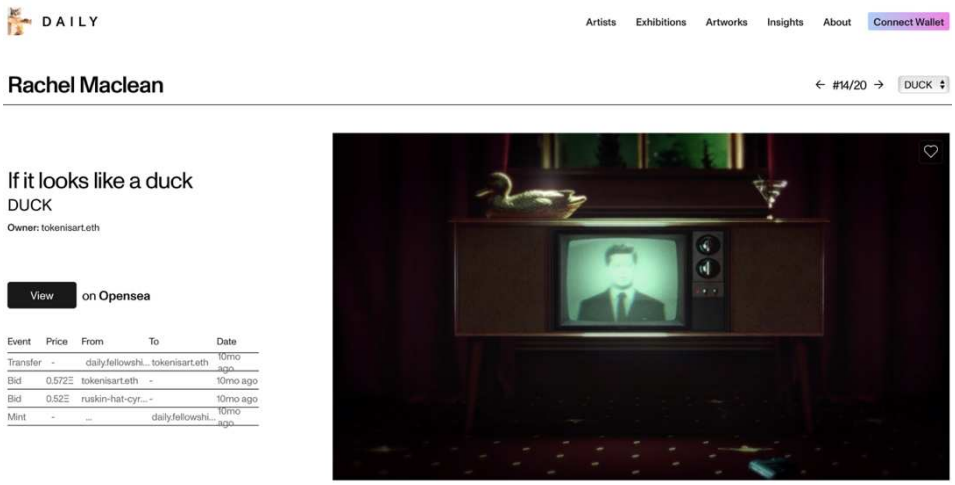


Figure 15. Self-Discovery, by Deekay, 2023

Source: https://deekaykwon.com/self-discovery

In addition to auction houses, some galleries and organizations have also established their own NFT platforms dedicated to AI art, such as Daily.xyz and K011's 0KAI.

Daily.xyz[21] is an innovative NFT art platform launched by the crypto art collective Fellowship. It focuses on showcasing and documenting the evolution of generative AI art through a daily minting project. Each day, carefully selected AI-generated artworks are minted as NFTs on the Ethereum blockchain, creating a continuous and curated record of AI art development. Unlike traditional art, AI-generated art is continuously produced, and in the context of AI and blockchain, the transformation of digital art happens not yearly, not monthly, but daily. In step with the fast-paced development of AI art, the highlight of Daily.xyz lies in the immediacy of the artworks it showcases. Daily.xyz isn't just a showcase, but also a marketplace. Every week, the platform hosts a series of 24-hour auctions featuring a curated selection of AI artists. Collectors can select NFTs they are interested in on the platform, view the ownership history, highest bids, price trends, and detailed transaction records on Opensea (see Figure 16). Therefore, NFTs traded on Daily.xyz ensure a high level of transparency and credibility. Since its establishment, the platform has seen



participation from 150 artists and 5,000 collectors, with total primary sales exceeding $15 million.[22]

Figure 16. Screenshot of of Daily.xyz artwork page.

Source: https://daily.xyz/artworks?artworks-featured-v2%5Bquery%5D=DUCK

[21] https://daily.xyz/about-us [last access 13 June 2025]
[22] https://daily.xyz/exhibition/daily-program-season-2 [last access 13 June 2025]

The highlight of 0KAI lies in the real-time generation of NFT artworks, where the creation and trading of the artwork happen simultaneously. The final outcome of the artwork is also random, making each transaction feel like a collaborative performance between humans and machines, which attracts a large number of collectors to watch and purchase. KVG's new digital extension K011 [23] is a professional art and technology studio focused on Web 3.0 art curation and trading. As the name suggests, 'K' stands for 'Kuration' (German), while '011'represents the binary code for '.3', and 0KAI the first on-chain AI art technology that safeguards the privacy of the artist's input, revolutionizing and transforming the way of creating and collecting AI art, introduced by K011. 0KAI offers a unique platform that enables prompt encryption and real-time artwork generation, with each encrypted prompt being saved on-chain in its hash, ensuring permanent storage. Each artwork is created in real-time, with no pre-minted pieces, and is stored on Arweave after minting. 0KAI supports long-form AI art while providing complete transparency and security for both artists and collectors. With its one-of-a-kind features, 0KAI presents a new and innovative approach to collecting on-chain art. It also allows collectors to participate in the generative process of the artworks and collect AI artwork in real-time, which adds an element of excitement and unpredictability, making the experience even more engaging for them.[24] On April 18, 2024, 0KAI launched its first project, *Algoritmo Divino* (see Figure 17), by one of the most prominent AI artists Ganbrood. This project was available through the Dutch auction and featured 333 unique, live-generated iterations. This is the first time that collectors are allowed to participate in the generative process of the artworks and collect AI artwork in real-time, which adds an element of excitement and unpredictability, making the experience even more engaging for them.

[24] https://www.k011.com [last access 13 June 2025]

Figure 17. Algoritmo Divino: Paradiso, by Ganbrood, 2025.
Source: https://www.katevassgalerie.com/blog/0kai

For traditional art market entities, these online platforms' direct collaboration with primary market artists appears more aggressive. Beer and Burrows (2010) argue that new participatory web cultures, characterised by user-generated content, rating, reviewing, and collaboration, break traditional boundaries between producers and consumers. traditional art markets are competing with a more open, decentralized market (Khademorezaian et al., 2024). Art market economist Magnus Resch said, "The NFT craze has revealed a completely new group of buyers who are interested in purchasing art if we make the process seamless, offer price transparency, and provide a comprehensive overview of the data."

3) Cultural and Tourism Industry

The impact of artificial intelligence on the field of art is no longer limited to galleries and museums, spaces for showcasing, interacting with, and consuming tech-based art are gradually expanding into our daily life. The development of artificial intelligence is continuing to grow rapidly, and as a result, there is a significant push to integrate these technologies into the modern cities. This process, which can be referred to as the rise of urban AI (Luusua and Ylipulli, 2020), the simultaneous rise of

urbanization and digitalization has driven the swift spread of urban AI, embedding it deeply into every corner of the city, becoming an essential part of urban culture (Luusua et al., 2023). This integration of AI into urban environments is particularly evident in public art installations, the following examples illustrate how AI art installations are reshaping public urban spaces.

In 2018, a public outdoor art installation *Self and Other* (see Figure 18) appeared in the Albert Embankment, an arts and culture district on the south bank of the Thames in London. It was the first outdoor installation in the UK created through a collaboration between Random International and Futurecity. Established in 2005, Random International is a post-digital art collective that explores how technological advancements affect the human experience. Futurecity is an agency dedicated to creating cultural spaces within cities, integrate art into public spaces, offering contemporary narratives for towns, cities, and urban centers.[25]

The installation, equipped with custom motion-tracking software, cameras, and with the help of artificial intelligence, transforms the viewer's reflection into points of light projected through evenly spaced glass panels. Depending on the angle of view, the image can range from a literal representation to a more abstract form. As the observer moves, their illuminated reflection shifts in real time, creating an interactive and dynamic visual experience. Mark Davy, founder of Futurecity noted that The Thames is fast becoming a 'cultural ribbon', with major artworks along its length. Random International's new permanent kinetic artwork will become an important cultural stopping point on that journey.

[25] https://www.random-international.com/self-and-other-for-the-albert-embankment [last access 13 June 2025]

Figure 18. Self and Other, by Random International, 2018.
Source: https://www.random-international.com/self-and-other-for-the-albert-embankment

Drones have emerged as a powerful medium in contemporary public art, offering not only striking visual spectacles but also profound cultural resonance within urban spaces. As installations in the sky, they serve as a bridge between environment, community, technology, and artistic expression. *Franchise Freedom*, an AI-driven installation by Dutch art collective Studio Drift, exemplifies this intersection (see Figure 19). Composed of hundreds of illuminated drones, the work uses an algorithm to simulate the flight patterns of starlings—capturing the tension between freedom and structure, and inviting reflection on the parallels within human society.

The algorithm was choreographed by Studio Drift's founders, Lonneke Gordijn and Ralph Nauta, to evoke emotional impact, yet the inherent unpredictability of AI behavior ensures that no two performances are exactly alike. This unpredictability imbues each presentation with a sense of organic movement, making the swarm feel alive and responsive. Since its debut at Art Basel Miami Beach in 2017, Franchise Freedom has lit up the skies of cities including Amsterdam, New York, Barcelona, and Capri. More than a visual spectacle, the work reimagines public space as a site of

dialogue between humanity, nature, and machine intelligence (Didero, 2018).

Figure 19. Franchise Freedom, by Studio Drift, 2017.
Source: https://studiodrift.com/work/franchise-freedom/

4.2.2 Artificial intelligence has expanded the boundaries of the art market

The traditional art market is marked by several structural limitations that hinder its efficiency and inclusivity. Compared to the limitations of the traditional art market, AI-generated art has significantly expanded its boundaries and possibilities (Adam, 2014).

First of all, AI is lowering the costs associated with intermediaries (Zhu, 2022). In the traditional art market, transaction costs are hardly negligible, as buying and selling typically involve numerous intermediaries such as auction houses, galleries, and dealers, each taking a commission. For example, at major auction houses like Sotheby's or Christie's, both buyers and sellers often pay around 20% of the final sale price in fees (Smith, 2002). This does not even include additional costs such as shipping, insurance, storage, and authentication, all of which make the entry barriers to art transactions very high and further reduce the attractiveness of art as a financial

asset class. In contrast, AI-driven art platforms—especially blockchain-based NFT marketplaces—have drastically reduced these transaction costs, typically charging only a small platform fee. For instance, on OpenSea, the world's largest NFT platform, each transaction incurs only a 2.5% fee, and artists and buyers can connect directly without intermediaries or gallery involvement. The Foundation platform, focused on digital art, charges a 5% fee, with the remainder of the proceeds going entirely to the artist, while also providing a revenue-sharing mechanism across both primary and secondary markets. Another platform, Rarible, allows users to freely create and trade NFTs, with a similar 2.5% fee. Even the high-end digital art platform SuperRare, despite charging a 15% fee, still offers a clear cost advantage compared to traditional galleries, which typically take a 20%–50% share of the artist's sales. Furthermore, Blur, a platform targeting professional traders, pushes transaction costs even lower, with fees as low as 0–1% and a token-incentive system that further compresses the overall cost structure. These platforms not only lower the entry barriers but also redefine the speed and efficiency of art circulation in the digital age.

Secondly, a key feature of AI-generated art is the faster circulation of artworks (Wang et al., 2024). If we view the art market as a financial market, its lack of liquidity becomes immediately apparent. The process of liquidating a piece of physical artwork is often long and complicated (Honnaya, 2022). For instance, if a collector urgently needs cash and wants to sell a work, they might have to wait several months for an auction event suitable for that specific piece. Even for well-known artists, selling in the traditional market often requires waiting for the right auction window or finding a specific buyer, with the liquidation cycle potentially stretching over months or even years. For most lesser-known artists, an active secondary market may not exist at all, and once a piece is sold, it is effectively locked away in private collections. Furthermore, unlike financial assets, artworks are largely indivisible—you cannot easily sell or purchase a fraction of a painting. This makes liquidity even more limited. In contrast, the AI art and digital art markets benefit from blockchain technology, which enables fractional ownership, whereby multiple purchasers become joint owners and share the rights and associated costs (Is, 2020). As a result, an AI-generated digital artwork can be divided into many shares and sold in portions, greatly enhancing market liquidity and improving accessibility for small-scale investors.

Thirdly, artificial intelligence has made the art market more accessible to a wider range of people (Wang et al., 2024). One defining characteristic of the traditional art market is its lack of transparency. In conventional settings, prices, provenance, artwork quality, and the identities of buyers and sellers are often obscured by multiple layers of intermediaries. Many major transactions are conducted privately, with prices undisclosed and contracts kept confidential. In contrast, artificial intelligence has optimized the trading environment of the art market, making art transactions more secure and efficient. AI art platforms and NFT marketplaces introduce smart contracts, on-chain records, and traceable transaction histories, significantly improving market transparency. Users can readily access ownership records and the full pricing history of artworks at any time, reducing the risks associated with information asymmetry and making the market more open and trustworthy. According to the *Hiscox Online Art Trade Report 2023*,[26] 90% of new art buyers and 89% of young art buyers stated that the ability to accurately track an artwork's history and provenance would increase their confidence in purchasing art online. Technologies such as blockchain, NFTs, and digital twins are beginning to address these concerns.AI-generated artworks are often transformed into digital assets and authenticated or traded on digital art platforms supported by blockchain technology. At its core, blockchain is a shared database in which stored data or information is verifiable, transparent, valid, and tamper-proof. Once recorded on the blockchain, an artwork is issued a unique digital certificate. This certificate serves as proof of copyright ownership for the artist and as proof of ownership for the collector after purchase. Digital art trading platforms have made the art market more open and transparent, allowing buyers to communicate and transact directly with artists, thereby reducing the risks caused by information asymmetry and lowering the costs associated with intermediaries (Zhu, 2022).

[26] https://www.hiscox.co.uk/online-art-trade-report [last access 13 June 2025]

5. The Impact of AI on Artists' productivity

Compared to other professions, the artistic labor market has several distinctive features. For instance, only a few artists are engaged in full-time creative work or have the opportunity to do so. Income distribution is highly unequal—while most artists earn very low wages, a small number of "star" artists capture a disproportionate share of industry rents (Throsby, 2001). However, the rise of artificial intelligence has begun to alter these fundamental features of the artistic labor force.

"AI will bring a transformation as far reaching as the industrial revolution, the coming of electricity, or the birth of the internet," said British Prime Minister Rishi Sunak ahead of the UK Government's global AI summit in autumn 2023.[27] For artists in particular, artificial intelligence (AI) has significantly transformed the creative landscape and labor market. Rather than focusing on the philosophical debate of whether machines are capable of "creating art", a more pressing and tangible concern lies in how AI technologies are influencing the productivity of artists in practical terms. From the perspective of artistic creation, artificial intelligence not only provides inspiration for artists but also offers technical support during the creative process, significantly reducing the time required to complete a work. From an economic perspective, generative AI technologies—such as ChatGPT, Stable Diffusion, DALL·E, and Midjourney—that can create text, images, and videos much faster and often at lower cost than human labor, have demonstrated the transformative potential of AI for both society and the economy. When artificial intelligence, as a new means of production, intersects with artists as the primary productive force, it inevitably reshapes artistic productivity and the dynamics of creative work.

In 2023, a flash mob began on Twitter and other platforms, where artists voiced their protest against the rapid development of neural networks that threatened to replace their profession. However, not all artists chose to "fight the enemy", some instead embraced these tools and adapted them to serve their own creative goals. As a suite of tools used by human creators, generative AI is positioned to disrupt many sectors of the creative industry and beyond. While it may pose short-term threats to existing jobs and labor models, it also holds the potential to enable new forms of

[27] https://www.gov.uk/government/news/uk-to-host-first-global-summit-on-artificial-intelligence [last access 13 June 2025]

creative work and reshape the broader media ecosystem (Epstein, Ziv, et al., 2023). Therefore, how to use artificial intelligence to enhance artistic productivity rather than undermine the creative enthusiasm of artists has become a crucial issue in the art labor market.

5.1 Influences on Artistic Creativity and Efficiency

Bresnahan and Trajtenberg (1995) suggested that one of three characteristics of General propose technologies (GPTs) was the technology's ability to generate innovation. Any GPT will affect all sorts of production processes, including those for invention and innovation. Some GPTs will be biased towards helping to produce existing products, others towards inventing and implementing new ones (Jovanovic and Rousseau, 2005). As one of the most prominent General Purpose Technologies, artificial intelligence has a dual impact on the process of artistic creation. It not only transforms the creative process but also provides artists with sources of inspiration, thereby enhancing the efficiency of artistic production by automating repetitive and procedural tasks, integrating fragmented information, and offering varied sources of inspiration. This allows artists to access more references in less time, enhancing both the speed and quality of their creative output. The application of artificial intelligence in art creation helps to enrich the means of artistic production and improve the quality of the artistic production process (Gong, 2021).

5.1.1 AI reshapes the division of labor

Technological progress influences the economy in two main ways. On the one hand, new production tools enable capital to partially substitute for labor. On the other hand, technological advancements help workers complete the same tasks in less time, thereby improving labor productivity (Peng, 2024). The Harvard Business School conducted a study on how artificial intelligence affects productivity. A total of 758 consultants participated in the experiment. After first completing a comparable task to establish a performance benchmark, participants were randomly placed into one of three groups: no AI access, GPT-4 AI access, or GPT-4 AI access with a prompt engineering overview. The results showed that for each one of a set of 18 realistic consulting tasks within the frontier of AI capabilities, consultants using AI were

significantly more productive and produced significantly higher quality results—task speed increased by over 25%, human-rated performance improved by more than 40%, and the overall task completion rate rose by over 12% (Dell'Acqua et al., 2023).

There are two main approaches to the division of labor between humans and artificial intelligence.

The first is known as Centaur behavior (Dell'Acqua et al., 2023). The concept of “Centaur behavior” originates from the mythical creature that is half-human and half-horse. It was first introduced by chess grandmaster Garry Kasparov to describe the collaborative mode between humans and artificial intelligence in chess. This model reflects a close and strategic division of labor, where both human and machine contribute based on their respective strengths. In the field of artistic creation, a similar "centaur-like" collaboration has emerged between artists and AI. Artists adaptively switch between human and AI-led processes depending on the nature of the task and the level of creativity required—delegating highly efficient, programmable elements to AI, while reserving the more intuitive and aesthetically demanding aspects for human input. Through this form of cooperation, artists can make better use of technological tools to expand the boundaries of their work, while retaining core control over artistic expression.

The second approach is Cyborg behavior (Clynes and Kline, 1960), named after hybrid human-machine beings from science fiction, this approach emphasizes deep integration between humans and AI. Cyborg users don’t simply assign tasks to AI—they work closely together at the edge of what both can do. This collaboration may involve alternating responsibilities within a single task, such as starting a sentence for the AI to finish or working side-by-side with AI to complete it. For example, the artist may first provide a conceptual sketch or description, then allow the AI to generate an initial draft, which the artist further modifies and refines. This back-and-forth, real-time interaction transforms the creative process into more than just a simple division of labor—it becomes a symbiotic system between human and machine.

With the development of artificial intelligence, its role is gradually shifting from Centaur behavior to Cyborg behavior. Dual-process theory (Kahneman, 2011). proposes that there exist two forms of reasoning or thinking: System 1, which is characterized as fast, effortless, automatic, non-conscious, and driven by affective and

intuitive cognition; and System 2, which is defined as slow, effortful, controlled, conscious, and based on reflective and analytical cognition. According to this framework, expert human intuition and judgment are generally associated with the functioning of System 1, whereas computer-based processing and computation are more appropriately linked to the characteristics of System 2 (Kahneman, 2011). The involvement of artificial intelligence has, to a certain extent, reshaped the functioning of these two cognitive systems. On one hand, AI provides a wide range of options and possibilities in the early stages of creation through functions such as image generation, style transfer, and conceptual association. This enhances the intuitive stimulation associated with System 1, enabling artists to generate inspiration more efficiently. On the other hand, AI supports technical tasks like image editing, color matching, and structural analysis, which are typically linked to System 2's deliberate and analytical thinking. By taking over these more routine and time-consuming tasks, AI reduces the mental burden on the artist and allows them to focus more on creative decision-making and personal expression. Therefore, from the perspective of dual-process theory, artificial intelligence not only improves the technical efficiency of the artistic process but also helps optimize the way artists think and work—bridging intuition and logic and streamlining the path from concept to execution.

The impact of artificial intelligence on artistic productivity is reflected not only in its transformation of the relationship between artists and their creative tools, but also in its reshaping of the traditional workflow of art creation.

The traditional process of artistic creation involves obtaining inspiration, selecting appropriate tools, choosing techniques that match those tools, and ultimately completing the artwork. This entire process is carried out solely by humans and relies heavily on the artist’s experience and intuition, resulting in relatively low efficiency. The introduction of artificial intelligence has, to a certain extent, refined the division of labor within the creative process (Nassar, 2022). AI can assist artists by handling nearly half of the workflow such as modeling, manipulation, and final output, allowing artists to focus primarily on conceptual development (see Figure 20).

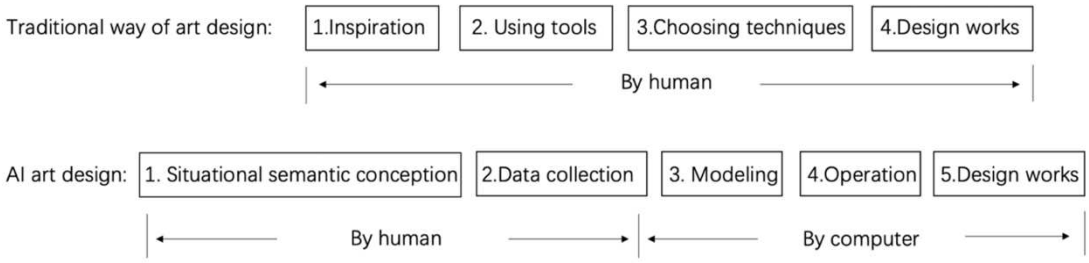


Figure 20. Workflow of Artistic Creation.
Source: Nassar (2022)

In traditional art, take image creation as an example, the artist usually gets inspiration from personal experience, draws a sketch, and revises it many times before finishing the final piece, this process may take several hours or even longer. In contrast, with the help of AI tools such as Midjourney and DALL·E, the artist only needs to input keywords or upload a concept image, through text-to-image or image-to-image generation technologies, a large number of images can be produced in a short time, the artist just needs to choose and adjust from these results to get a satisfying image, enhancing both creative efficiency and the speed of idea generation. In contemporary artistic practice, artists are increasingly using artificial intelligence to expand the expressive forms of art and communicate more complex ideas. They can integrate AI with virtual reality technologies to create visual effects that are impossible to realize in the physical world, thereby breaking through the limitations of traditional human experience. They can also design interactive installations that incorporate human-computer interaction, enhancing the viewer's sense of immersion and engagement. In addition, with AI's powerful computational and generative capabilities, artists can produce fantastical, imaginative images that go beyond human experience and logic, enabling them to explore new artistic languages and dimensions of expression.

5.1.2 Combinations of new ideas

The influence of AI on the artistic landscape goes beyond simply expanding the boundaries of artistic expression, it stands as a powerful tool that can boost creative potential, open up new creative possibilities, extend the artist's creative ability, and

allow us to push the boundaries of what we can imagine and achieve in the digital age (Cetinic and She, 2022).

A key feature that sets artists apart from other types of workers is that creativity is an essential input into their production processes (Bryant and Throsby, 2004). Throsby suggests that four human capitals are involved in artistic production: general education, arts training, experience, and creativity. Among these, creativity is more important in increasing the quantity of output than education and arts training variables. This is because, unlike in other industries, artists cannot be treated as a homogeneous input in the combination of production factors used to generate output (Throsby, 2006). Therefore, augmenting creativity and leading to innovative ideas for artists is a key indicator of how artificial intelligence contributes to artistic productivity (Bieser, 2022).

Firstly, ideas we see affect ideas we create (Nijstad, 2006). Artificial intelligence is a technology capable of autonomous learning and continuous evolution. The machine learning technologies at its core possess greater autonomy, deeper learning capacity, and are more inscrutable than any of the "intelligent" IT artifacts that have come before (Baird and Maruping, 2021). It generates new information by processing large volumes of data existing data, forming a continuous cycle of learning and output. The more it is used, the larger its underlying database becomes, and the more powerful its ability to generate new content. Based on an ever-evolving database, AI can create unique creative combinations, offering artists more ideas and inspiration.

Secondly, Artificial intelligence can also automatically identify associations between different pieces of information (Bieser, 2022). The Romer/Jones model (Agrawal et al., 2018) argues that the creation of new knowledge relies on access to the existing stock of knowledge and the ability to combine different elements within it to generate valuable new ideas. What makes AI promising as a meta-technology for idea generation is its ability to navigate complex knowledge spaces more efficiently. It not only improves access to relevant information but also enhances our capacity to predict the value of new combinations. As shown in previous chapters, artificial intelligence, as a general-purpose technology, has been widely applied across various industries and plays a significant role in restructuring and generating new information

within the field of visual arts. From the artist's perspective, AI is undoubtedly a powerful tool that assists in sparking creative inspiration.

Furthermore, artificial intelligence can be used to present content in a form that is more easily absorbed by humans than plain data and numbers (Bieser, 2022). For example, AI's style transfer technology enables complex concepts or data to be presented in an aesthetically engaging form that is visually more accessible and easier for humans to understand. AI can transform scientific data, social trends, or complex emotional analyses into dynamic images or art installations. In this way, audiences perceive the underlying meaning of the data through the artwork's visual expression, which enhances the emotional impact of the art and helps audiences connect with the artwork in a more intuitive way, gaining a deeper understanding of the data.

Licklider and Engelbart (1960) proposed the influential concepts of "man–computer symbiosis" and "augmenting human intellect." They imagined a future in which human minds and computers would be tightly coupled, forming a partnership capable of thinking in ways no human brain ever could. The goal was to enable humans to solve problems that were previously considered unsolvable — in other words, to allow computers to support and amplify human creativity across nearly all fields of professional activity. Although such a vision may still seem unrealistic given the current state of AI development, it nonetheless highlights the deep integration between humans and intelligent machines.

Meanwhile, Frey and Osborne (2017) draw on the definition of creativity as the ability to generate combinations that are both novel and valuable. They argue that while computers are indeed capable of producing new combinations of familiar ideas, the real challenge is to determine which of these combinations are truly meaningful and valuable (Boden, 2004). This difficulty arises from the fact that the processes behind human creativity are complex and not yet fully understood or easily specified. Therefore, artists must draw on their own experience to assess the value of these combinations and determine how best to integrate AI-generated ideas into their creative process to improve efficiency.

5.2 Impact on Artists' Income

Efficiency wage theory emphasizes that productivity depends on wages (Stiglitz, 1969). While enhancing the efficiency of artistic creation, artificial intelligence has also impacted artists' income and interests, thus affecting artistic productivity. Many AI models are trained using artworks created by human artists, yet these artists typically receive no compensation from the commercial use of AI-generated content, revealing the unfairness of profit-sharing. Additionally, the high efficiency and low cost of AI-generated art have intensified market competition, driving down the value of human-made art and affecting artists' earnings. Moreover, differences in artists' access to and ability to use AI technologies have caused uneven distribution of opportunities and income within the creative industry.

5.2.1 AI Reducing the Market Share of Traditional Artists

As more people get access to AI-generated art, there's been an explosion of AI-generated content (Rombach et al., 2022), and commercial users are choosing to use free AI-generated content instead of paying for artwork made by humans. What's even more worrying is that some text-to-image apps can mimic the styles of specific artists (Matulionyte, 2023), which provokes a global debate around how AI-generated content can disrupt central revenue streams of the creative industries, in particular, the collection of dividends from intellectual property (IP) rights (Burk, 2020).

In 2022, members of the online art community ArtStation launched a widespread protest against AI-generated artwork by uploading "No AI Art" images to their portfolios. Just a few days later, these protest images had taken over ArtStation's trending page. The artists aimed to express their opposition to the presence of AI-generated content on the platform and to potentially disrupt the training of future AI models that rely on artwork collected from the site. During the protest, freelance digital artist and concept illustrator Alexander Nanitchkov[28] shared a striking logo featuring the letters "AI" in bold white uppercase, crossed out by a circular strike-through symbol. Beneath it was the caption: "NO TO AI GENERATED IMAGES." The logo quickly spread across ArtStation and became the foundation for many protest visuals

[28] https://www.artstation.com/artofinca [last access 13 June 2025]

still present on the platform. Just four days later, a widely shared tweet by Zekuga Art helped amplify the movement on Twitter, drawing broader public attention, a search for "No AI Art" on ArtStation yielded 2,099 results, while "no to AI generated images" returned 2,111 results—each representing a unique artist's account.[29]

The reason behind the protest was that artists' works were used to train artificial intelligence systems, which then generated new AI artworks—without providing any compensation to the original creators. As a result, many artists felt that their rights and interests had been infringed undermined by the use of AI and went on to describe issues they experienced in feeling less inspired and less motivated to continue their practice, and fearful over how AI will create barriers to future artists entering the profession.

According to *Hiscox Art and AI Report 2024*,[30] a large majority of both art collectors (77%) and art enthusiasts (78%) feel that artists should be compensated if Al companies use their artworks to train their models. Many artists find it difficult to accept that the artworks they have created through significant time and effort are being used—often without compensation—to train AI models that then generate new artificial artworks. This situation has led to a form of crowding-out effect, where the rise of AI-generated art reduces public attention and appreciation for human-made works. As a result, some artists may choose to exit the market, which could hurt the long-term development of artistic creativity and productivity. US artist, illustrator and AI commentator Karla Ortiz [31]suggests that AI training models must be based on the 'three Cs: Consent, Credit and Compensation'. Receiving compensation through copyright is a key driving force that enables artists to invest more passion and time into their work and contribute to artistic production. Once copyright loses its significance, artists may no longer be able to make a living, which would ultimately harm overall artistic productivity.

Meanwhile, AI has disrupted the traditional notion of scarcity in art by enabling the rapid creation of large quantities of images in diverse styles (Danaher and Nyholm,

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[29] https://arstechnica.com/information-technology/2022/12/artstation-artists-stage-mass-protest-against-ai- generated-artwork/ [last access 13 June 2025]
[30] https://www.hiscoxgroup.com/sites/group/files/documents/2024-11/Art%20and%20AI%20report%202024%20-%20Phase%202.pdf [last access 13 June 2025]
[31] https://www.judiciary.senate.gov/imo/media/doc/2023-07-12_pm_-_testimony_-_ortiz.pdf [last access 13 June 2025]

2024). Clients who prioritize low cost, fast turnaround, or use art in a more functional way—and who may place less emphasis on artistic originality—are more likely to choose AI-generated works. This shift has driven down the market value of human-made art and negatively impacted the income and opportunities of traditional artists. However, it is important to recognize that AI-generated art relies on human-created artworks as its foundational data. If AI-generated works continue to occupy the space traditionally held by human artists, the databases that support AI will gradually be depleted. In the long run, this could lead to a decline in the quality of AI-generated art, ultimately stalling artistic innovation and progress.

5.2.2 Intensifying income polarization

The labor market is undergoing significant changes due to technological advancements, and these changes affect individuals differently based on their experience, skills, and education. Economists refer to this phenomenon as Biased Technological Change (Acemoglu, 2002). Based on trends from the past few decades, if no interventions are made, artificial intelligence is likely to intensify income polarization (Bresnahan T F, Trajtenberg, 1995)—that is, wage growth will primarily benefit high-income groups, while the income growth for low-income groups will remain limited.

There are two main reasons for income polarization. First, many jobs held by low-skilled, low-wage workers are repetitive in nature and can be easily automated with more intelligent machines and robots, whereas high-skilled, high-income jobs are much harder to replace with AI. Second, AI is driving rapid economic transformation, and the speed at which it contributes to growing income inequality is unprecedented (Bresnahan and Trajtenberg,1995).

The growth in high-skilled incomes can be explained by a key phenomenon: the declining cost of performing routine tasks through computers, which enhances the support for more abstract and creative services. From a production function perspective, the outward shift (i.e., increase) in the supply of routine informational inputs has raised the marginal productivity of workers who depend on these inputs (Frey and Osborne, 2013). For instance, technologies such as text-to-image generation, image-to-image translation, image editing, and data mining have improved the quality

and efficiency of innovation and production in the artistic creation process. Before the widespread adoption of artificial intelligence, these tasks were typically carried out by lower-paid workers. As a result, the labor market has become increasingly polarized: on one hand, the incomes of high-skilled workers continue to rise, while on the other hand, low-income groups face further income stagnation or decline (Graetz and Michaels, 2017). If automation primarily replaces low-skilled labor, it tends to widen wage inequality; however, if it replaces high-skilled labor, it may help reduce income inequality (Acemoglu and Restrepo, 2018). At the current stage, the occupations most affected by automation are those involving routine tasks and requiring relatively low skill levels. In contrast, automation mainly plays a supportive role for non-routine, high-skilled jobs. For example, Gathmann et al (2024) analyzed how AI affects the earnings of high-skilled and low-skilled workers. They utilize data from the BIBB/BAuA Employment Surveys,[32] which have previously been used to study changes in job tasks over time as well as the impact of task heterogeneity on worker mobility and earnings growth. The BIBB/BAuA Employment survey has been conducted every six years since 1979 and includes a representative sample of employed individuals aged 15 and older who work at least 10 hours per week at the time of the interview. Gathmann et al (2024) focused on the 2006, 2012, and 2018 waves, restricting the sample to individuals aged 18 to 65 who are independent full-time employment (working at least 35 hours per week), collected detailed information including educational attainment and age, as well as specific occupations and industries. The analysis distinguishes between high-skilled workers and low-skilled workers. The result of this analysis is shown in Figer 21, movers mean workers who change their roles, and stayers mean workers who stay where they are. The chart shows that earnings for low-skilled workers tend to decline whether they remain in their current jobs or transition to new ones. This trend may suggest that automation has disproportionately impacted low-skill workers, offering limited opportunities for them to benefit from productivity growth, reassignment to other tasks, or better employment options elsewhere. In contrast, high-skilled workers exhibit a different trend. Those remaining in jobs within industries affected by automation see their wages rise by approximately 1.5 percentage points. Unlike low-skilled workers, high-skilled workers

[32] https://www.bibb.de/en/2815.php [last access 13 June 2025]

might thus benefit from productivity gains or even new tasks associated with AI. The average effect on movers is zero suggesting that some high-skilled workers benefit from improved job matches while others face less favorable outcomes. Overall, high-skilled workers are more likely to benefit from AI-related shifts than low-skilled workers. As a result, in the "AI revolution," high-skilled workers have not experienced income declines—in fact, their earnings have increased.

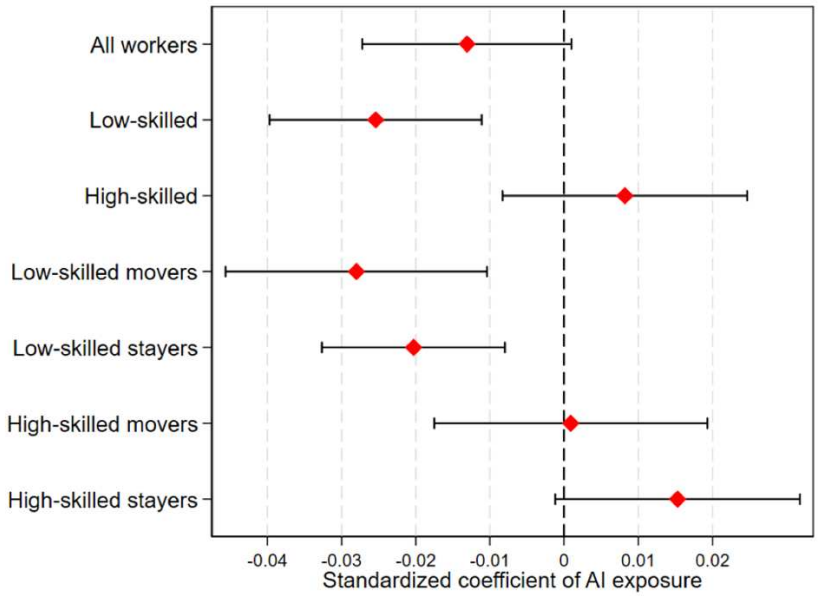

Figure 21. Impact of AI on Earnings
Source: Gathmann et al (2024)

The widespread adoption of artificial intelligence is regarded as a "new industrial revolution." Compared with previous industrial revolutions, this transformation is happening ten times faster, at 300 times the scale, and with an impact approximately 3,000 times greater (Dobbs et al., 2015). Throughout history—from the printing press to the steam engine and the internet—technology has always been a powerful force in overturning the status quo. What truly sets today apart is the ubiquity of technology and the unprecedented speed of change. In the past, the widespread adoption of a new technology often took decades. For example, it took over 50 years after the invention of the telephone for it to reach half of American households. Radio took 38 years to attract 50 million listeners. In contrast, Facebook gained 6 million users in its first year, that number multiplied 100 times over the next five years (Dobbs et al., 2015). According to a report by the Bank for International Settlements, the Gini coefficient is significantly higher (at the 99% confidence level) in countries with greater AI

investment, indicating a rise in income inequality (Cornelli et al., 2023). Furthermore, Acemoglu and Restrepo find that for every 0.1% increase in the rate of machine substitution for human labor, wages decline by approximately 0.25% to 0.50% (Acemoglu and Restrepo, 2020).

Therefore, both in terms of income polarization income disparity and the speed of technological disruption, artificial intelligence is significantly intensifying the polarization of artists' earnings. On the one hand, a small group of artists equipped with technical expertise and access to AI tools are able to enhance productivity, reach wider audiences, and generate more income through new forms of digital creation. On the other hand, a large number of traditional artists face shrinking opportunities, reduced demand for their work, and growing competition from automated systems capable of producing art at scale and speed. This gap reflects unequal access to technology and digital skills, showing the need for policies that promote a more inclusive and balanced creative economy.

5.3 Impact on Employment

The Information Age further accelerated employment transformation. Personal computers, the internet, and digital communications established an interconnected world ripe for new forms of employment (Challoumis, 2024b), meanwhile artificial intelligence has the potential to disrupt labor markets in a major way, affecting workers across many professions and skill levels (Korinek et al., 2018). Most general-purpose technologies play the role of 'enabling technologies', opening up new opportunities rather than offering complete, final solutions (Bresnahan and Trajtenberg, 1995). Artificial intelligence also plays the role of an enabling technology in the art market. However, the notion of "opportunity" varies across different groups. For creative professionals in the art industry, the opportunities brought by AI are twofold: on one hand, it helps some artists improve their creative efficiency and productivity; on the other hand, it has triggered employment instability for others, creating new challenges.

5.3.1 Technological unemployment

Technological advancement, while driving productivity gains, often leads to technological unemployment. Compared with previous technological revolutions, the

“AI revolution” is expected to have a broader impact on employment, with stronger intensity and longer duration (Kaplan, 2015).

Keynes (1930) referred to unemployment caused by technological advancement as “a new disease” and introduced the concept of “technological unemployment.” He argued that when labor-saving technological progress advances faster than the creation of new jobs, it leads to unemployment. However, concerns about the impact of technology on employment predate the formal introduction of this concept. A classic example of technological unemployment can be traced back to the year 1589, William Lee invented the stocking frame knitting machine with the intention of reducing the manual labor required in hand-knitting. Seeking patent protection for his invention, he traveled to London and rented a building where Queen Elizabeth I could personally witness the machine in operation. However, to his disappointment, the Queen was more concerned about the impact of the invention on employment. She declined to grant him a patent, reportedly saying, “Mr. Lee, thou art intent upon serving thy own interests; thou hast devised a machine to do the work of craftsmen. Consider what this invention might do to my poor subjects. It would assuredly bring them to ruin by depriving them of employment, reducing them to beggary.”[33] This anecdote reflects an early anxiety about the “job displacement” effect of automation—despite the potential gains in productivity, such technologies can also trigger significant social disruptions (Acemoglu and Robinson, 2012). This example reflects early societal concerns about the "job displacement" effect caused by automation technologies. Although such technologies may significantly improve efficiency, they can also bring about major social disruptions. It is clear that technological change has broad and far-reaching impacts on workers.

As artificial intelligence sees widespread application in art creation, this emerging form of art has not only brought about new artistic discussions but also raised a sense of crisis among many artists. People are beginning to speculate whether technological advancements will trigger a wave of technological unemployment in the art market, and how such progress might affect those working in the art industries.

Frey and Osborne (2013) analyzed the potential employment impacts of artificial intelligence. According to their research, the extent to which a job is affected by

[33] https://www.britannica.com/biography/William-Lee [last access 13 June 2025]

technological advancement in the age of AI largely depends on its level of creativity and flexibility. In their predictive model, whether a profession is likely to be affected by technological unemployment mainly depends on how much it relies on social intelligence. As shown in the figure (see figure22), variables such as “fine arts,” “originality,” “negotiation,” “persuasion,” “social perceptiveness,” and “assisting and caring for others” fall into the low-risk category, meaning they are less likely to be replaced by automation. In contrast, variables like “manual dexterity,” “finger dexterity,” and “cramped workspace” are categorized as high-risk, suggesting a greater chance of being replaced by AI.

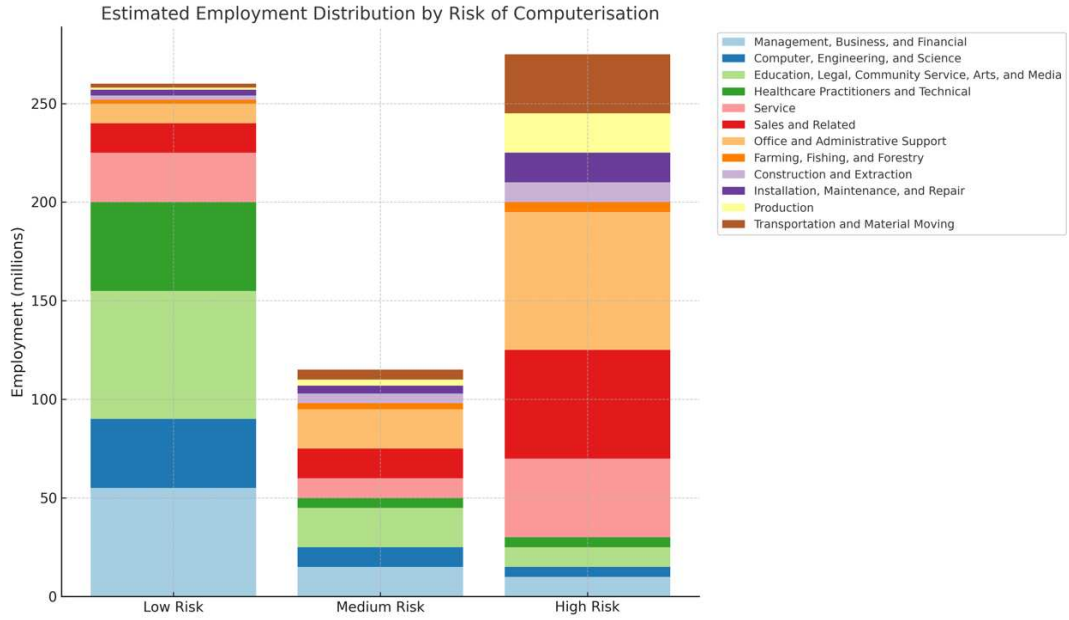

Figure 22. Estimated Employment Distribution by Riak of Computerisation
Source: Frey and Osborne (2013).

For example, occupations in engineering and science are considered low risk primarily because they require a high degree of creative intelligence, which remains difficult for computers to replicate. In contrast, roles such as paralegals and legal assistants—which have already seen some level of automation—are classified as high-risk due to their more routine and structured nature. In contrast, lawyers are currently less likely to be replaced due to the profession’s strong reliance on creative judgment. In general, jobs that rely on human heuristics—such as intuition, experience, and contextual understanding—or those that involve generating original ideas and

concepts, tend to be more resistant to automation. This includes a wide range of generalist roles in management, business, and finance, which typically involve complex interpersonal tasks and social intelligence. Similarly, arts are also considered less potentially displaced by automation due to their reliance on creativity, empathy, and human interaction.

Autor's ALM hypothesis (Autor et al., 2003) is a labor market theory proposing that jobs consist of multiple discrete tasks and that the impact of technology on employment is best understood by analyzing the characteristics of these tasks. It is considered a foundational framework for studying the effects of artificial intelligence and automation on employment, particularly by economists focusing on AI and the labor market. In the ALM model, production involves two types of tasks: routine tasks and non-routine tasks. Routine tasks refer to artistic work that follows clearly defined rules, can be formalized and executed step by step, meaning that by following a set technical process, similar works can be repeatedly produced. Routine tasks are highly repetitive. In contrast, non-routine tasks involve subjective judgment, creative thinking, and emotional expression. Such tasks typically do not have fixed patterns and cannot be "replicated" simply through technical proficiency. They require experience, sharp intuition, and deep cultural insight, and their outcomes are often unpredictable. Artificial intelligence can perform routine tasks through algorithmic learning, but it cannot effectively carry out non-routine tasks. Therefore, AI tends to substitute routine artistic production, while it tends to complement non-routine artistic creation. In this context, the impact of artificial intelligence on artistic workers is asymmetric. It tends to harm those engaged in routine tasks by increasing their risk of unemployment and reducing their income levels. On the other hand, it benefits non-routine workers by assisting them in achieving artistic creation at lower costs and with greater efficiency.

Meanwhile, As Van Liemt (2014) points out, the employment pattern in the arts sector differs significantly from that of other industries, as the majority of artists are self-employed and tend to share a strong personal commitment to their work, a comparatively low incidence of regular employment, and a high incidence of self-

employment. Data from Eurostat[34] show that in 2023, the European Union had over 1.7 million artists and writers, around 45.2% of whom were self-employed. This is significantly higher than both the overall EU self-employment rate (13.8%) and the rate within the broader cultural sector (31.7%). In Germany, for example, the self-employment rate among artists and writers was 5.2 times higher than the average for the national economy. Other countries with notably high rates of self-employment in these professions include Italy (64.9%), Ireland (55.9%), Czechia (54.8%), Austria (51.6%), Portugal (50.6%), and Slovakia. For artists working independently, the decision to continue pursuing artistic work is largely a matter of personal choice. As a result, structural shifts in the labor market caused by technological change may have less immediate impact on their careers.

Therefore, as a profession that is highly creative, socially driven, and characterized by a high rate of self-employment, artists do not need to worry about widespread technological unemployment. The foundation of art is innovation, and while the neural network systems behind AI can provide a massive number of materials and ideas for reference in artistic creation, creativity itself is a non-linear and rule-defying capacity. AI may be capable of imitating human output well enough to pass a Turing test, but it lacks the free, intuitive, and original creativity that humans possess. As a result, AI can serve as a powerful tool to assist in the artistic process, but the artist remains the central subject and creative force behind the work. However, professionals engaged in repetitive, templated, or style-based tasks—such as illustrators, graphic designers, and post-production image technicians—face a higher risk of technological unemployment.

5.3.2 Education Matters

In the traditional art market, formal training has not been as crucial to economic success as in many other industries, instead, learning by doing has played a more significant role (Throsby, 2001). However, the emergence of artificial intelligence is changing this situation. Frey and Osborne (2013) suggested that in the age of AI, the extent to which a profession is affected is associated with the level of education it

[34] https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Culture_statistics_-_cultural_employment [last access 13 June 2025]

requires: the higher the educational threshold, the lower the risk of being replaced by AI (see figure 23). For professionals eager to stay flexible in an AI-driven job market, education and the ability to keep learning have become more important than ever (Challoumis, 2024a).

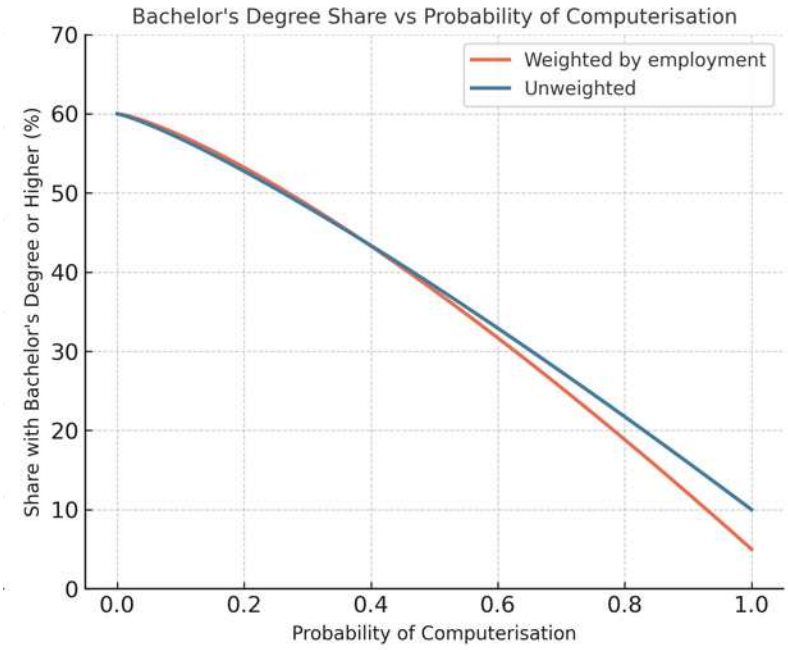

Figure 23. Bachelor's Degree Share vs Probability of computerisation.
Source: Frey and Osborne (2013).

DACS,[35] a non-profit organization that protects artists' rights and maximizes their royalties, published a recent report titled *"Intelligence and Artists' Work: A Survey of Artists on AI."* The report highlights that artists are worried about being left behind by the technology. Among all the surveyed artists, 96% stated that they had never received any formal training in artificial intelligence, and many believed that a lack of skills was a major barrier to incorporating AI into their practice. Given that 85% of the respondents have been engaged in artistic creation for more than ten years, this suggests that artists in the UK face difficulties in accessing professional development and skills training outside of traditional higher education pathways. When asked about the potential impact of AI on their work as artists or artist representatives, 77% agreed or strongly agreed with the statement that "AI will replace jobs and opportunities." In particular, practicing artists elaborated on the types of work they do and the extent to

[35] https://www.dacs.org.uk [last access 13 June 2025]

which it has already been—or they fear it will be disrupted by AI. In the survey, the terms “replace” and “obsolete” appeared frequently, reflecting a growing concern that human-created artworks may no longer hold any special or unique value in the marketplace, and could therefore be marginalized or even replaced by AI.[36]

Not all artists hold a negative attitude toward artificial intelligence. A closer examination of prominent contemporary artists reveals that many have received formal education related to artificial intelligence. Instead of being constrained by emerging technologies, they have successfully integrated interdisciplinary knowledge into their creative practice, resulting in more dynamic and innovative artistic expressions. The following examples such as Roope Rainisto, Anna Ridler, and Sougwen Chung highlight how this expertise supports their artistic innovation and professional success.

Roope Rainisto[37] holds an M.Sc. in Information Networks from Helsinki University of Technology. He began studying photography at the age of 13 and has since explored a wide range of creative disciplines, including writing, music, and filmmaking. His diverse artistic background, combined with a professional career in design, has equipped him with strong storytelling and problem-solving skills that deeply inform his current artistic practice. In 2021, Rainisto began teaching himself AI art techniques, progressing from early algorithms to advanced generative tools such as DALL·E and Stable Diffusion. Today, he focuses on developing new ways to tell stories through generative imagery and multimedia. He is widely regarded as a leading figure in the emerging genres of AI art and AI post-photography. Throughout his rapid ascent in the AI art world, Rainisto has consistently upheld the belief that technology—particularly artificial intelligence—should enhance, not replace, human creativity.

Anna Ridler[38] is an artist and researcher who works with systems of knowledge and how technologies are created in order to better understand the world. She is particularly interested in ideas around the natural world. Her process often involves working with collections of information or data, particularly self-generated datasets, to create new and unusual narratives in a variety of mediums. She obtained a Bachelor of

[36] https://cdn.dacs.org.uk/uploads/documents/News/Artificial-Intelligence-and-Artists-Work-DACS.pdf?v=1708424212 [last access 13 June 2025]
[37] https://www.rooperainisto.com [last access 13 June 2025]
[38] https://annaridler.com [last access 13 June 2025]

Arts in English Literature and Language from Oxford University in 2007 and a Master of Arts in Information Experience Design from the Royal College of Art in 2017.

Sougwen Chung[39] is a multi-disciplinary artist, who uses hand-drawn and technologically reproduced marks to address the closeness between person-to-person and person-to-machine communication. She developed an early interest in digital expression, creating her first personal website at the age of ten. Chung holds a Bachelor of Fine Arts degree from Indiana University Bloomington and later pursued further studies at Hyper Island in Stockholm, a school known for its focus on digital innovation, where she obtained a Master's Diploma in Interactive Art.

As the general-propose technology, artificial intelligence focuses on AI's assistive role, emphasizing the fact that cognitive technology is designed to enhance human intelligence rather than replace it.[40] Throughout art history, the evolution of art has been closely linked with advancements in technology, innovations in tools and techniques have driven the brilliance of every artistic era. This survey suggests that one of the most effective ways to retain individual value and remain competitive in the age of artificial intelligence is through continuous learning and skill enhancement and seek to overcome the barriers brought by technological advancement rather than resisting technological change. Embracing innovation, whether through machines or artificial intelligence, doesn't just lead to the disappearance of some jobs — it also creates new ones, highlighting again the need for a workforce that can adapt and learn new skills (Challoumis,2024b).

[39] https://sougwen.com [last access 13 June 2025]
[40] https://www.techopedia.com/definition/augmented-intelligence [last access 13 June 2025]

6. The Impact of AI on Art Institutions

6.1 The Role of Galleries and Auction Houses in the Art Market

Bresnahan and Trajtenberg (1995) argue that discussions on the impact of General Purpose Technologies (GPTs) on productivity emphasize their characteristic of "innovation complementarity." GPTs not only enhance productivity directly but also stimulate innovation in both upstream and downstream sectors. This complementarity amplifies the effects of innovation, allowing technological progress to diffuse across entire industries. Today the digital revolution has introduced a multitude of new technologies into the art world, including AI-generated art, NFTs (non-fungible tokens), virtual and augmented reality, and the metaverse. The increasing prevalence of AI in artistic creation represents a dual transformation—technological and cultural. This shift not only affects how artists create, leading to changes in artistic productivity, but also drives innovation in downstream sectors, such as art institutions (Quiñones Vilá, 2023). According to the Work-Preference Model proposed by Throsby (1994), artists are motivated both by the act of creation itself and by income incentives. When an artist's reputation and income are tied to the quantity or quality of their creative output, external incentives can contribute to enhanced productivity. Art institutions, serving as intermediaries between artists and the art market, directly influence these external incentives. Therefore, as AI artworks enter the art market, it becomes crucial to examine how the roles of art institutions evolve, how the new market environment shapes artistic production, and how these dynamics collectively impact artistic productivity. These are the core issues explored in this chapter.

If we observe the process of an AI artwork from creation to entering the market, it becomes evident that the roles involved are not limited to just the technology and the artist. The artist largely functions as a solo production system, which means that dedicating effort to sales necessarily reduces the effort available for creation. Therefore, the intervention of agents seems necessary. This results in a divided business model: on one hand, production is carried out by the artist. On the other hand, sales are handled by art institutions such as galleries and auction houses (Codignola, 2003). Galleries and auction houses, as key players in the art market, have a major role in bringing an artist's work to market and in sustaining the artist's reputation (Stokes,

2022). Although art dealers mediate supply and demand in both the primary and secondary art markets, most operate as small-scale businesses with only a few employees and are typically owned and managed by a single individual. Due to their private nature and lack of public financial disclosures, little is known about their revenue and profit margins, and surveys indicate that many dealers face financial challenges (Velthuis, 2011). Therefore, this paper primarily focuses on art institutions such as galleries and auction houses, which have a more significant impact on the art market. Most artists commercialize and sell their works through these intermediaries, without the help of art institutions, it is nearly impossible for artists to successfully promote their work (Towse, 2019). In the traditional art market, galleries and auction houses serve as intermediaries responsible for functions such as selection, promotion, pricing, and facilitating transactions. For artists, this means they do not need to spend a large amount of time independently searching for buyers, discussing terms, or organizing exhibitions—thus reducing the costs associated with bringing art to market. With stable commercial channels, artists are able to secure a more predictable income stream, which in turn enhances their willingness to continue creating and experimenting with new styles and media. Moreover, recognition by authoritative institutions serves as a market signal of quality, attracting more investors and collectors, thereby increasing the market value of the artworks. This not only boosts the artist's motivation but also enhances their productivity. At the same time, artworks are highly heterogeneous—they vary by artist, provenance, genre, date of creation, subject matter, condition, and many other characteristics. This diversity sets the art market apart from markets for more homogeneous goods, where substitution between items is relatively straightforward. For standardized products, economists typically expect a single market price to emerge under competitive conditions. However, due to the uniqueness of artworks, buyers require a significant amount of information to make satisfactory purchases, while sellers seek to reach as many potential buyers as possible in order to obtain the best price for their unique pieces. Art galleries and dealers act as intermediaries that facilitate the functioning of these complex markets (Towse, 2019).

In the art market, several distinctions can be made, one of the most important being the division between the primary and secondary markets (Velthuis, 2013). A primary market is one in which original artworks are sold for the first time. It includes

artists' studios, contemporary art fairs, and art galleries (Heilbrun and Gray, 2001). In the primary market, galleries serve as a key channel for the first-time sale of artworks. Artists consign their works to galleries for exhibition, and the galleries are responsible for promoting and selling these works. Galleries typically attract buyers through exhibitions, private viewings, and regular releases of the artist's new work. By collaborating with galleries, artists can build their reputation and establish price levels in the market. The defining feature of the primary market is that artworks are being introduced to the market for the first time, usually through direct collaboration between the artist and the art institution, allowing the artist to retain a relatively large share of the sales revenue. In contrast, the secondary market involves the sale of artworks that have already been owned or traded, meaning they are no longer directly sourced from the artist. Auction houses are the most prominent and widely recognized venues in the secondary market. Top-tier auction houses such as Sotheby's and Christie's host hundreds of auctions annually, specializing in artworks with collectible or investment value. Compared to the primary market, the secondary market—particularly auctions—is known for its greater transparency. Auction results are usually made public, enabling reliable and ongoing assessments of artwork valuations and sale prices. These activities provide important financial data related to art transactions (Codignola, 2003). In the traditional secondary market, the price of artworks is influenced by multiple factors, including the artist's reputation, market demand, the rarity of the work, and its sales history. Prices tend to be highly variable, and artists typically receive very limited direct income from these transactions, as ownership of the work has already changed hands. Subsequent auction or resale profits generally go to collectors, auction houses, or dealers, rather than the artists themselves. Although the UK government implemented the Artist's Resale Right (known as the Droit de Suite) on February 15, 2006, granting living artists the inalienable right to receive a royalty based on the resale price of an original artwork, this right applies only to artists who are nationals of the European Economic Area (EEA) or have permanent residence within the EEA. Consequently, artists from outside the EEA are excluded from its protection (Banternghansa and Graddy, 2011). However, when an artist's work fetches a high price in the secondary market—especially at major auction houses such as Sotheby's or Christie's—it significantly boosts the artist's market reputation and

visibility. As a result, can raise the prices of their works in the primary market and increase their overall income (Reutter,2001). Therefore, the impact of AI art differs between the primary and secondary markets and needs to be discussed separately.

Since the emergence of AI-generated artworks in the market, both galleries in primary market and auction houses in secondary market have been affected. A major driving force behind this shift is the "superstar firm" effect, triggered by artificial intelligence as a general-purpose technology, which has transformed the status and structure of art institutions within the art market.

Autor et al. (2017) pointed out that the widespread adoption of general-purpose technologies contributes to the rise of "Superstar Firms." These firms, based on strong technological foundations and data capabilities, rapidly accumulate resources in the market, compete with traditional institutions, and gradually establish dominant market power. The organizational forms of firms evolve alongside technological changes (Brynjolfsson & Hitt, 2000). With the application of artificial intelligence technology in art, the organizational structure of art institutions has also undergone transformation. Platforms have become an important form of contemporary art institutions (McAfee and Brynjolfsson, 2017). Platform economies increase in users on one side of the platform (e.g., buyers) benefits users on the other side (e.g., sellers), thereby enhancing the overall value of the platform. This positive feedback loop drives rapid platform growth and generates a "network effect," meaning the more users a platform has, the more valuable it becomes, attracting even more participants and further strengthening the platform's position (Autor et al., 2020). This mechanism enables platform firms to expand quickly, dominate the market, and create a "winner-takes-all" market (Rochet et al., 2003), leads to an increasing concentration of industry sales in a small number of companies. Industries with the fastest-growing concentration levels tend to exhibit more rapid productivity growth (Autor et al., 2020). In the art market, the emergence of AI artworks has accelerated the transformation of traditional art institutions. Some institutions have successfully reinvented themselves as "superstar firms" in the new environment by pioneering AI art trading platforms. The rising industry concentration has brought about economies of scale, effectively boosting transaction volumes and values. In the primary market, emerging AI art trading platforms such as Opensea and SuperRare constitute the main superstar firms; in the secondary market, the two major

international auction houses Sotheby's and Christie's have strengthened their positions in the new market by developing dedicated auction platforms for AI artworks. These platform-based superstar firms have not only reshaped the way artworks are traded but have also promoted increases in artistic productivity.

6.2 Primary Market

The primary art market mainly consists of two economic agents: on one side are the sellers, primarily art galleries and the artists they support; on the other side are the buyers, including art collectors and investors. The interaction between these two determines the competitive landscape and trading rules of the primary market (Schönfeld and Reinstaller, 2007). Although many artists undergo extensive professional training and hold qualifications from art institutions, they are only formally recognized as professional artists once their works have been successfully sold in the primary market. From this perspective, the primary market serves as a key platform for artists to showcase their value to the secondary market, acting as an important bridge for artworks to enter broader circulation—typically achieved through acquisition by renowned modern art museums or promotion by prominent galleries and dealers (Gérard-Varet, 1995). However, the primary market is not an "efficient" market, it is characterized by high transaction costs, incomplete and exclusive information, and expensive access to such information (Sharpe, 1970; Singer, 1978). With the rise of AI-generated artworks, digital trading platforms dedicated to this category have begun to emerge, reshaping the structure of the primary market and thereby influencing the market efficiency and productivity of artists as economic agents in primary market.

6.2.1 Enhancing Transparency and Traceability

Transparency refers to the degree to which all participants are able to access and understand product-related information they need, in a timely manner and without any loss, delay, distortion, or misinformation (Hofstede et al., 2004). Traceability is the ability to obtain detailed, item-level information related to various elements of the supply chain, including inventories, processes, or participating entities such as wholesalers and retailers (Pant et al., 2005). The primary market is the most innovative

segment in the distribution of artworks in terms of aesthetic value and trends. However, it also involves the highest risks because these artworks are entering the market for the first time and lack available historical data (Zorloni, 2005). Systematic disclosure of artwork sales prices is currently mostly limited to auction transactions. Auction houses publish or provide online lists of auction lots, catalogues, estimates, and other related information. In contrast, primary market art dealers generally have no systematic way to record or disseminate information related to their business activities. Prices of artworks in galleries are rarely made public. In particular, it is difficult to track sales prices of artworks in major art markets (Velthuis, 2013). Due to the lack of effective and consistent information channels, or the absence of transparent market structures, mechanisms, and a chronological information flow system for artwork valuation, price formation tends to be arbitrary, thereby increasing investment risks (Codignola, 2003). However, artworks differ from ordinary goods in that their valuation is much more challenging. The art market does not provide second-by-second price quotes like the stock market, let alone for works by emerging artists (Coffman, 1991). The high uncertainty in the primary art market causes some individuals lacking necessary art appreciation and valuation knowledge to avoid the market, even though they might be potential end users of the artworks (Gérard and Louis, 1995).

Currently, the circulation of AI artworks in the market mainly exhibits two patterns: one continues the traditional art market practice, where artists directly sell their creations; the other relies on blockchain technology, minting works as NFTs (non-fungible tokens) for trading.[41] The art industry was one of the first sectors to be disrupted by NFTs (Fairfield, 2022). AI artworks demonstrate transparency and traceability throughout the transaction process due to the integration of art and blockchain technology. (Whitaker, 2019). These works are typically displayed, sold, and distributed via digital platforms that provide accessible and verifiable information about the artist, provenance, pricing history, and past transactions. Moreover, the introduction of NFTs assigns each digital artwork a unique blockchain-based certificate of authenticity. This not only guarantees the originality and singularity of the work but also ensures that every transfer, sale, or auction is permanently recorded on the blockchain and publicly accessible. Such a technical foundation greatly

[41] https://sellfy.com/blog/sell-ai-art/ [last access 13 June 2025]

mitigates issues long associated with the traditional art market, such as pricing ambiguity and difficulties in verifying authenticity caused by information asymmetry. In other words, the operational logic of the AI art market rests on transparency and traceability, which are essential to sustaining value. These features not only increase trust between buyers and sellers but also facilitate the AI art market's evolution toward greater efficiency and regulation.

NFTs are digital or crypto assets (Aharon and Demir, 2022) that consist of a document attached with an immutable contract certificate created through blockchain technology and stored on a digital ledger. Each NFT traces all previous owners back to the original creator, supporting its authenticity and transparency (Anselmi and Petrella, 2023). NFTs are not artworks themselves. They are cryptographic tools that use blockchain technology to verify and securely record the existence and ownership of digital and physical assets. However, an increasing number of AI artworks are being linked with NFTs, making NFT art the primary circulation method for AI art (Murray, 2021). Compared to traditional artworks, NFT artworks typically offer higher reliability and greater transparency for buyers (Schwiderowski et al., 2023). Firstly, the price of an NFT artwork mainly depends on the value of the cryptocurrency in which it is denominated. The vast majority of NFTs are priced in cryptocurrencies—for example, an NFT may be sold for 1 ETH rather than a direct price tag of 2000 USD. Since 1 ETH might be worth 2000 USD today but only 1800 USD tomorrow, even if the NFT price (e.g., 1 ETH) remains unchanged, its fiat currency equivalent fluctuates with the cryptocurrency market. The exchange rates of cryptocurrencies against currencies like the US dollar or euro can be precisely checked at cryptocurrency market platforms such as CoinGecko and CoinMarketCap, similar to stock market data. This makes NFT art pricing more transparent (Anselmi and Giovanni, 2023). Secondly, the advantages of blockchain technology—decentralization, immutability, and traceability of stored information—ensure that NFT artworks are stored with tamper-proof and verifiable data, which serves as a key source for verifying the artist and securing the artwork's value (Murray, 2021; Huang et al., 2023). Each NFT artwork has a unique ID that corresponds to a distributed database maintaining an immutable record of every transaction. Since the creator's first sale to early collectors, all changes in ownership have been recorded in this database, as well as subsequent transfers.

When an NFT transaction occurs, the data is timestamped and must be verified across the entire blockchain. The entire transaction history traces back to the original creator, who digitally "signs out" the artwork to guarantee its authenticity. The ownership and transaction records of NFT artworks can be fully traced and publicly accessed, effectively reducing trust costs and transaction risks caused by information asymmetry, authentication difficulties, and complex circulation processes in the traditional art market. The enhanced transparency and traceability in the art market directly fosters consumer trust, a crucial factor influencing purchasing decisions.

Urban, G. L. (2003) argues in his Trust-Based Marketing theory that modern consumers are more likely to buy from brands they trust. He emphasizes that information transparency, defined as the clarity and accuracy of the information provided about a product, is a crucial factor influencing consumer purchasing decisions in modern market. The more a person knows about an artwork, the greater the satisfaction they are likely to derive from consuming related works in the future. This creates a path-dependent mechanism in which individuals are more inclined to repeatedly engage with familiar artistic forms rather than frequently switch styles or explore unfamiliar creators. Within this process, the importance of information transparency becomes increasingly evident. When AI artworks are accompanied by clear information on the artist's background, transaction history, and market evaluations, it effectively lowers the entry barrier for new buyers and reduces their cognitive burden. Transparency also sheds light on the mechanisms behind the emergence of "stars." As Adler (1985) argues, stardom functions as a market device that lowers learning costs in domains where "the more you know, the more you enjoy." By concentrating information and attention on specific artists or art styles, the market helps consumers navigate choices more confidently and efficiently. In this context, the emergence of digital platforms dedicated to AI art further enhances this dynamic. These platforms create a more transparent and accessible environment for the circulation, collection, and investment of artworks, thereby improving overall market efficiency and lowering entry barriers for both collectors and artists, incentivize continuous artistic output and innovation, thereby fostering a more dynamic and inclusive creative ecosystem.

6.2.2 Lower Market Entry Barriers and Enhance Artist Income

AI art trading platforms break down the traditional gallery barriers as intermediaries, lowering the entry barriers for buyers purchasing art and for artists entering the art market, thereby increasing artists' income. With the rapid development of artificial intelligence and the maturity of concepts such as blockchain and cryptocurrency, digital art platforms have become new intermediaries for exhibition and sales beyond traditional galleries (Ahmadi and Rahbarnia, 2023; Huang et al., 2023). Unlike the traditional art world, AI artists do not need permission from gallery owners, agents, or other gatekeepers to exhibit and sell their works. Instead, they independently use digital art trading platforms to showcase their creations and make them available for transaction (Franceschet et al., 2021).

For example, since 2018, some pioneering platforms such as SuperRare, Opensea, Rarible and Foundations began tokenizing digital content and accepting creators on their platforms. Like traditional galleries, they started to exhibit, promote, and sell these digital artworks. In 2020, Decentraland was launched and became the world's first decentralized social virtual platform. Built on blockchain technology, Decentraland is a virtual reality platform that offers an open and customizable virtual world through virtual land ownership, digital asset ownership, decentralized governance, and rich interactive features. Users can not only entertain and socialize but also create and trade digital assets. In Decentraland, artists can use platform tools such as Builder or SDK to create and design virtual artworks, or upload pre-existing digital art. These artworks are then minted into blockchain-based NFTs to ensure their uniqueness and ownership. Artists upload minted works to Decentraland's marketplace, set prices, and select accepted cryptocurrencies. Once published, other users can browse, purchase, and trade the artworks through the marketplace. Additionally, artists increase exposure and potential buyers by creating virtual galleries and organizing exhibitions and other social events, thus promoting the display and trade of their works. Besides independent artists, NFT art generation platforms like Cheeze have also built virtual art galleries on Decentraland for trading. Creators on the platform can retain up to 97.5% of their revenue from sales, which is one of the highest shares in the industry. The platform also boasts high accessibility, with virtual gallery visitor traffic reaching up to 30,000 visitors per day. In 2021, digital art spaces

Deca and OnCyber were established. These two platforms have since become leading virtual gallery platforms in the current digital ecosystem. Deca offers a 2D curated social exhibition network where users can freely arrange collections, write descriptions, collect, like, and interact, enabling personalized curation and promotion of artworks. The platform supports connecting users' crypto wallets (e.g., MetaMask) to manage their digital assets and to display and trade NFTs. Users can also directly jump from browsing digital artworks to corresponding NFT marketplaces (such as OpenSea or Rarible) for transactions. OnCyber features immersive 3D galleries where artists can arrange their works in visually rich virtual spaces and attract visitors to view, collect, and purchase artworks through links or VR browsing. These platforms not only reshape the way art is exhibited but also integrate the entire process from art presentation to on-chain transactions, playing a vital gallery-level platform role in the emerging digital art ecosystem. They break the physical barriers formed by traditional primary market galleries, attract more art collectors, cultivate potential art consumers, and promote the development of the art market (Lee and Soo, 2019).

6.2.3 Increasing Artists' Long-Term Income

Compared to the traditional art market, which heavily relies on galleries, curators, and agents as intermediaries, digital art platforms grant artists greater autonomy, enabling them to create, publish, and sell directly to a global audience. For AI artists, their value creation ability mainly depends on two key factors: first, the ability to continuously produce unique, attractive NFT artworks with collectible value in the market; second, the design of a reasonable and efficient royalty model to ensure substantial income from subsequent transactions (Schwiderowski et al., 2023). Specifically, in the AI-driven NFT art market, artists generally have two primary sources of income: one is the direct sale of their NFT artworks in the primary market; the other is ongoing royalty earnings from secondary market resales of those works (Hartwich et al. 2023). This model differs significantly from the traditional art market, where artists not protected by the droit de suite. However, by leveraging blockchain's traceability and transparency, artists typically receive only a one-time payment at the initial sale, while subsequent resales, auctions, and appreciation profits mainly benefit intermediaries or collectors. However, leveraging blockchain's traceability and

transparency, NFT artists around the world can earn around 10% royalties on resale prices in the secondary market (see Figure). This mechanism offers creators better long-term income security. From the creator's perspective, this is an exciting feature as it addresses the issue of sustained income in the art industry—something unattainable through traditional primary market galleries and sales (Pawelzik and Thies, 2022).

Digital art platforms offer lower transaction costs and greater exposure (Schwiderowski et al., 2023). The commission charged by art dealers is typically the main source of revenue for traditional galleries, ranging from 33% to 44% of the sale price; in top-tier commercial galleries, this figure can even reach up to 60%. The commission rate usually correlates with the artist's reputation, the dealer's prestige, and the level of investment in marketing and promotion (Zorloni, 2005). In contrast to the high commissions in the traditional primary market, digital art platforms generally charge transaction fees between 2% and 15%. As shown in the data presented in the Table 2, among these platforms, OpenSea is currently the largest digital art trading platform. As of October 2023, OpenSea had over 3 million users[42] and held a 71.5% market share.[43] As a high-traffic platform, OpenSea charges only a 2.5% commission per transaction, significantly reducing transaction costs in the primary market (Tapscott, 2021). Hic et Nunc also charges sellers a 2.5% fee per transaction. Rarible charges both buyers and sellers a 2.5% commission. SuperRare, Foundation, and KnownOrigin charge a 15% commission on primary sales—allowing creators to retain 85% of the sale price. Although this is higher than OpenSea's 2.5% fee, it is still significantly lower than the traditional gallery rate of 25%–50%. Additionally, for secondary sales, platforms charge only 3% to 12.5% per transaction, and creators can receive a 10% royalty on each resale.

[42] https://dune.com/queries/2877/5680 [last access 13 June 2025]
[43] https://crypto.news/opensea-market-share-sea-token-2025/ [last access 13 June 2025]

	OpenSea	Rarible	SuperRare.Co	Foundation	Makersplace	Hic et Nunc	KnownOrigin
Blochchain	Ethereum	Ethereum	Ethereum	Ethereum	Ethereum	Tezos	Ethereum
Fees	Seller: 2.5%	Seller: 2.5% Buyer: 2.5%	Seller: 15%	Seller: 15%	Seller: 15%; Secondary Market: 12,5%	Seller: 2.5%	Seller: 15%; Secondary Market: 3%
Currencies	$ETH $WETH $DAI	$ETH $WETH $DAI $ATRI $RARI	$ETH	$ETH	$ETH $DEFI (Paypal/ Stripe)	$XTZ	$ETH
Auction Styles &Listing Types	Timed Auction; Fixed Price	Auction; Fixed price	Timed Auction; Fixed Price; Open-ended Offers	Reserve price to be met, then 24 hr Auction	Fixed Price; Open Ended Offers; Reserve Prices;	Fixed Price	Auction without countdown; Fixed Price
Accepted Types	Image; Audio; Video	Image; Audio; Video	Image	Image	Image	Image; Audio; Video	Image
Categories & Dominant Genres	Art; Music;Utility; Collectibles; Trading Cards; Sports, etc.	Art; Music; Gaming; Collectibles; Trading Cards; Photography; Metaverse.	Fine Digital Art	Fine Digital Art; Crypto Art	Fine Digital Art	Fine Digital Art Collectibles; Trading Cards; Photography	Fine Digital Art; Crypto Art
Launch	2018	2020	2018	2020	2018	2021	2020
All Time Volume	€ 4.028B	€ 169.002M	€ 93.324M	€ 58.512M	€ 18.882M	€ 19,046M	€ 5.608M
All Time Traders	447,804	71,058	4,612	15,559	4090	23,546	5003
Royalties	Choice of artist	Choice of artist	10% on secondary sales	10% on secondary sales	10% on secondary sales	10% on secondary sales	10% on secondary sales

Table 2. Comparison of Digital Art Trading Platforms
Source: Pawelzik and Thies (2022)

In addition to commission fees, traditional artwork incurs high costs for transportation, storage, and insurance. In contrast, digital artworks exist in blockchain-based or file-based formats, eliminating the need for physical transportation and significantly reducing storage expenses through digital means. The traditional art market is often characterized by information asymmetry—buyers must invest considerable time and money to find suitable works and sellers. Digital platforms, however, provide search, filtering, and recommendation systems that quickly match buyers and sellers, thereby reducing the time and cost of information retrieval (Plichta and Plichta, 2023). Furthermore, traditional art transactions often involve cross-border remittances and banking procedures, which are slow and expensive. Digital platforms use cryptocurrency for automated settlement, reducing both the time cost and transaction fees associated with payments and settlements. Therefore, digital art platforms offer significantly lower transaction costs (Schwiderowski et al., 2023; Jiang and Liu, 2021). This low-cost, low-barrier, and high-volume digital art market

provides artists with financial independence, enhances their motivation to create, and effectively contributes to the overall improvement of artistic productivity.

6.3 Secondary Market

Dorward (1987) argues that when consumers have limited knowledge about a particular type of product, they often regard price as an indicator of quality. This viewpoint reflects the economic theory of Signalling, which suggests that in situations where there is information asymmetry between market participants and the quality of a product is difficult to assess directly, price becomes a key reference for consumers to evaluate the product's value (Stiglitz, 1987). In the art market, AI artworks represent a relatively new category that currently lacks sufficient market regulations and authoritative standards. Due to the limited availability of historical data and market references, public understanding of the value of AI art remains at an early stage, resulting in considerable uncertainty in its valuation. Consequently, potential buyers are more likely to rely on external and authoritative value assessment mechanisms when evaluating AI artworks to inform their purchasing decisions. In most cases, auction houses are perceived as reliable indicators of value, with their estimates often regarded as accurate reflections of an artwork's true worth (Mei and Moses, 2002). In this context, auction houses—long-standing authoritative institutions in the art market—serve as important transmitters of value signals through their professional valuation frameworks and transparent transaction processes. A key advantage of the auction pricing system is its efficiency in conveying market information, accurately reflecting both the intentions of buyers and sellers and the overall market acceptance of an artwork. According to signaling theory, under ideal conditions of perfect competition, auction prices are expected to align with the true market value of the work (McAfee and McMillan, 1987). In the art auction market, for buyers who are uncertain about their ability to distinguish between "good" and "bad" art, the seemingly objective valuation emerging from the competitive pricing process of auctions is often regarded as an indicator of an artwork's quality (Wilson-Anastasios, 2009). Even when purchasing in the primary market—such as through galleries—many collectors refer to auction prices in the secondary market, using the performance of the artist or artwork at auction as a benchmark for assessing its value and potential. When people see a piece of art achieve a high price at auction, it genuinely increases their confidence.

This demonstrates that auction prices not only indicate market interest but also help to establish public trust in the quality of the artwork (De Coppet and Jones, 1984). Therefore, for AI artists, gaining recognition in the auction market serves not only as an important indicator of their work's acceptance by the mainstream art world but also significantly enhances their social reputation. This validation from an authoritative market mechanism strengthens the artist's market influence and also provide positive incentives for their creative efforts, encouraging the continuous production of high-quality artworks.

6.3.1 Enhanced Visibility and Revenue for AI Artists

With the rise of AI artworks, traditional auction houses have gradually recognized the potential of this emerging market and accelerated their digital transformation. Christie's and Sotheby's have established a global duopoly in the high-value art market, attracting widespread attention and becoming the main authoritative forces that dominate fashion and trends (Zorloni, 2005). In the field of AI art, these two top-tier auction houses fiercely compete with each other while also striving to establish their positions within the AI art domain and maintain their leading market positions in the new era by launching dedicated AI art auction platforms or incorporating AI artworks into specialized auction sessions. These platforms not only provide a stage for showcasing AI art but also leverage the auction houses' strong brand influence and professional curatorial capabilities to enhance the market status and artistic value of AI artworks. Through the high exposure offered by these platforms, AI art has attracted the attention of collectors and investors. This series of changes has driven the commercialization and market expansion of AI art, enabling it to occupy an increasingly important position in the global art market. AI artists have thereby gained greater recognition and visibility while also benefiting from broader acknowledgment and economic returns through the auction houses' platforms.

In October 2018, Christie's Paris auction house sold the artwork *Portrait of Edmond de Belamy*, created by the artist collective Obvious, at an astonishing price. The piece was generated using Generative Adversarial Network (GAN) technology and depicts a portrait in the style of the 18th century. This AI-generated portrait demonstrated the potential of artificial intelligence in the art market and sparked

profound discussions about artistic creation and the value of art, leading the public and collectors to develop a new understanding of AI art's worth. The work ultimately sold for $432,500, far exceeding the original estimate of $7,000, becoming the first AI artwork sold through a traditional auction house and marking AI art's successful debut in the mainstream art market.[44]

In May 2021, Christie's continued to expand its operations in the AI art market by hosting three consecutive auctions related to the field. On May 11, Christie's introduced an NFT lot for the first time in its 21st Century Evening Sale. Lot 11 featured nine CryptoPunks avatars created by Larva Labs—algorithmically generated digital artworks that were highly sought after and came from the creators' private collection. The lot ultimately sold for $16.9 million, more than twice its low estimate. The following February, CryptoPunk 5822—one of only nine blue alien Punks—was sold for $23.9 million, setting a new auction record for the series. This move set a precedent: for the first time, 5,184 pixels' worth of a revolutionary NFT project go up for auction at a traditional auction house, and it marked the debut of AI-generated NFT artworks at Christie's prestigious contemporary art evening sale. The 20th and 21st Century Evening Sales are among Christie's most significant annual events, bringing together some of the most influential and high-profile artworks in the market. This auction not only highlighted the emerging status of AI-generated artworks on digital platforms but also further solidified the presence and influence of AI art in the mainstream art world.[45]

On March 5, 2025, Christie's held its first-ever auction dedicated exclusively to artificial intelligence at its Rockefeller Center gallery. Titled Augmented Intelligence, the auction featured artworks entirely created by AI or produced with AI assistance. The sale brought together over 20 pioneering artists working at the intersection of art and technology, including Refik Anadol, Harold Cohen, Pindar Van Arman, Holly Herndon, Mat Dryhurst, Alexander Reben, and Claire Silver. The collection encompassed a wide variety of media, ranging from sculpture, painting, printmaking, and works on paper to digital-native art, interactive screen-based installations, and

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[44] https://www.christies.com/en/stories/a-collaboration-between-two-artists-one-human-one-a-machine-0cd01f4e232f4279a525a446d60d4cd1 [last access 13 June 2025]

[45] https://www.christies.com/en/artists/cryptopunks?lotavailability=All&sortby=relevance [last access 13 June 2025]

lightboxes. The total sales reached $728,784, surpassing industry expectations. This successful outcome demonstrated the growing market potential of AI-generated art and marked a significant milestone in its entry into the high-end art market. Through this auction, Christie's affirmed its leading role in promoting emerging artistic forms and offered collectors and investors a gateway into this rapidly evolving creative domain.[46]

In addition to hosting AI art auctions, Christie's officially launched its dedicated NFT art platform, Christie's 3.0, in September 2022. As one of the world's leading auction houses, the establishment of this platform opened the doors for AI art to enter the high-end art market, significantly elevating its artistic status. Christie's 3.0 collaborates with blockchain and virtual reality companies such as Manifold, Chainalysis, and Spatial to provide comprehensive support for AI artworks, including minting, compliance, and immersive exhibition experiences. This multi-party collaboration allows Christie's 3.0 to retain the auction house's authoritative curatorial expertise and brand prestige in the traditional art world while making use of Web3 technologies to offer a secure and efficient transactional environment. Within its first year of operation, Christie's 3.0 hosted six auctions featuring over 100 works by more than 70 artists, attracting a substantial number of new registered users and bidders. The launch of Christie's 3.0 represents Christie's strategic expansion into the NFT market and it is a pivotal move by a traditional auction institution to embrace Web3 technologies—redefining its market influence and role in shaping new systems of artistic value. It brings mainstream art mechanisms into the blockchain realm while simultaneously advancing the professionalization of the AI art market.[47]

Following Christie's leadership in AI and NFT art auctions through its "Christie's 3.0" platform, another leading international auction house, Sotheby's, has also been actively expanding its presence in the AI art market. In 2024, Sotheby's reached a milestone by hosting its first auction of artwork created by a robot. The piece, titled A.I. God. *Portrait of Alan Turing,* was created by the AI robot Ai-Da and sold for over 1.08 million USD. This auction marked the first time that AI-generated

[46] https://press.christies.com/augmented-intelligence [last access 13 June 2025]
[47] https://press.christies.com/christies-30-revolutionary-platform-established-christies-as-first-global-auction-house-to-host-fully-on-chain-sales [last access 13 June 2025]

artwork created by a humanoid robot entered a world-renowned art auction platform, placing it alongside works by prominent contemporary and historical artists. The sale not only highlighted the growing significance of AI in artistic creation but also symbolized a paradigm shift—machines are increasingly recognized as active participants in the creative process. This event showcased the emerging status of AI and robotic art within the traditional art market and signified further recognition and acceptance of AI artworks in the global art market.[48]

There is another Sotheby's on a digital platform called Decentraland. In 2020, Sotheby's established its own metaverse art gallery—the Sotheby's Metaverse Gallery (see Figure 24)—within the decentralized virtual world of Decentraland. Decentraland is a blockchain-powered decentralized virtual environment that allows users to purchase land, build structures, and exhibit artworks. Sotheby's gallery on this platform hosts virtual art auctions that correspond with its real-world auction events. The gallery is located in Decentraland's "London District" and is modeled after Sotheby's London headquarters, featuring complete exhibition halls, reception areas, and interactive experiences. Users can create and explore the virtual world there and use blockchain technology to curate and sell digital artworks or non-fungible tokens (NFTs). This metaverse space not only showcases and sells AI-generated works but also serves as a brand extension, demonstrating Sotheby's embrace of digital art and virtual culture. It successfully transforms the auction house's image from a traditional auctioneer into a cultural institution of the Web3 era. Since its debut, the gallery has quickly become a highlight of the virtual art market, providing artists, collectors, and investors with a new interactive platform to experience, purchase, and exhibit digital art. The launch of Sotheby's Metaverse Gallery created a new channel for displaying and selling artworks and helped Sotheby's secure a position in the increasingly competitive NFT and digital art markets. Furthermore, this virtual space frequently synchronizes offline and on-chain auction events, attracting a global audience into Sotheby's online ecosystem and significantly expanding the global influence of AI art.[49]

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[48] https://www.sothebys.com/en/buy/auction/2024/digital-art-day-auction-2/a-i-god-portrait-of-alan-turing [last access 13 June 2025]

[49] https://www.sothebys.com/en/articles/next-stop-the-metaverse [last access 13 June 2025]

Figure 24: Sotheby's Metaverse Gallery

Source: https://decentraland.org

Although online platforms such as OpenSea and SuperRare serve as major primary marketplaces for AI artworks and operate secondary markets allowing collectors to trade through bidding, their impact on enhancing the value of artworks is far less significant compared to top-tier auction houses like Christie's and Sotheby's. For example, at Christie's "Augmented Intelligence" auction held on March 5, 2025, Refik Anadol's work Machine Hallucinations ISS Dreams sold for $277,200,[50] whereas during the same period, the highest selling price for his Machine Hallucinations – NYC series on platforms like OpenSea and OKX was only 0.68 ETH (about $2171.5).[51] Similarly, the AI NFT works by Holly Herndon and Mat Dryhurst fetched $94,500 at Christie's auction,[52] while their prices on OpenSea were much lower—such as the Infinite Images series with a highest sale of 11.11 ETH (about $27,800),[53] and the Minnesang series with a highest sale of 5 ETH (about $12,500).[54] The significant price gap between AI artworks sold at traditional auction houses and

[50] https://press.christies.com/augmented-intelligence-totals-728784? [last access 13 June 2025]

[51] https://web3.okx.com/zh-hans/nft/collection/eth/machine-hallucinations-nyc-by-refik-anadol [last access 13 June 2025]

[52] https://onlineonly.christies.com/s/augmented-intelligence/holly-herndon-b-1980-mat-dryhurst-b-1984-3/249745 [last access 13 June 2025]

[53] https://opensea.io/collection/infinite-images-by-holly-herdon-mat-dryhurst?sortDirection=desc [last access 13 June 2025]

[54] https://opensea.io/collection/minnesang-by-holly-herndon-mat-dryhurst?sortDirection=desc [last access 13 June 2025]

those on online platforms highlights how international auction houses like Christie's, leveraging their strong brand influence, professional curatorial systems, and participation of high-net-worth collectors, play a positive role in raising both the market recognition and pricing levels of AI artworks. This phenomenon indicates that although online platforms provide convenient channels for the circulation of AI artworks, traditional auction mechanisms still play an irreplaceable core role in enhancing the market status of AI art and the standing of AI artists.

6.2.2 The Role of Auction Houses in Elevating Young AI Artists

Given the high uncertainty surrounding the quality of artworks, the reputation of art galleries and their represented artists is a necessary condition for the functioning of the primary art market. Reputation thus serves as an especially powerful signal. The reputations of galleries and artists are closely intertwined and mutually reinforcing. A strong reputation helps artists establish their position within the art world, thereby enhancing the overall operation of the market (Schönfeld and Reinstaller, 2007). Purchasing works by emerging artists involves higher risks, as there are no existing works for comparison and their reputations are not yet established (Zorloni, 2005). For this reason, the traditional secondary market is generally less favorable for the entry of young and emerging artists.

Art Market Report 2023[55] shows a total of 4,135 contemporary artists had works traded on the art market. Among them, artists born in the 1940s accounted for 10% of the total sales, those born in the 1950s and 1960s accounted for 57%, and those born in the 1970s, 1980s, and 1990s made up 33%. The top 100 contemporary artists generated a combined total of $1.38 billion in sales, representing 78% of the global contemporary art market in 2023. This group included 11 artists born in the 1940s with a total sales volume of $130 million, 42 artists born in the 1950s and 1960s with $860 million in total sales, 42 artists born in the 1970s and 1980s with $350 million in sales, and 5 artists born in the 1990s, whose works achieved $29.31 million in total. The global top 10 contemporary artists remained relatively stable, with 80% born in the 1950s and 1960s, 18% in the 1970s and 1980s, and 2% in the 1940s (see Figure 25).

[55] https://artpro.com/news/45662 [last access 13 June 2025]

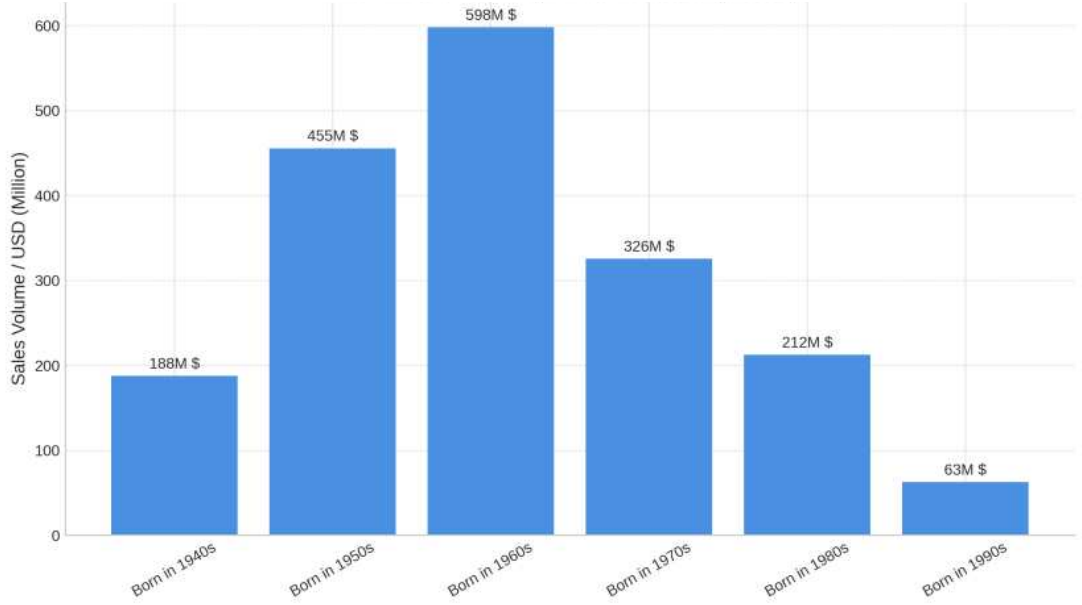

Figure25: Total Auction Sales by Artist Generation

Source: https://www.artprice.com/artprice-reports/the-contemporary-art-market-report-2023/contemporary-and-ultra-contemporary-art-market-annual-report

According to this data, artists born in the 1950s and 1960s dominate the contemporary art market in terms of both personal recognition and the value of their works, accounting for 80% of the global top 10 artists. This indicates the market's heavy reliance on established artists and their reputations. In contrast, although artists born in the 1970s and 1980s are represented in similar numbers within the top 100, their total sales amount to only 40% of those born in the '50s and '60s. Artists born in the 1990s are even less represented, with only a handful appearing in the top 100 and achieving sales of less than $30 million—an extremely small market share. This structure reveals a significant "age barrier" in the contemporary art market, where younger artists struggle to gain broad recognition and achieve high prices in the secondary market, further affirming the central role of reputation. Against this backdrop, leading auction houses such as Christie's and Sotheby's are offering platforms for AI art and emerging artists, thereby challenging the traditional age-based hierarchy in the art world.

Although the current art market is still dominated by mid-career artists, who hold a significant advantage in terms of auction turnover and market influence. However, this landscape is gradually shifting. As major auction houses increasingly focus on supporting emerging artists—through dedicated auctions, promotional efforts, and

expanded visibility—young artists are gaining more opportunities in the market. With the support from major auction houses, a new generation of artists is entering the mainstream art world and becoming a driving force in the diversification of the contemporary art ecosystem (Zorloni, 2005).

Christie's digital art platform, Christie's 3.0, prominently supported the young digital artist Diana Sinclair, only 18 years old, in its inaugural auction, showcasing the unique perspectives and social consciousness of emerging artists. As a rising creator widely recognized within the NFT community, Sinclair's nine NFT works were auctioned in October 2022, achieving a total sale of 66.77 ETH (approximately $80,000). The success of this auction reflects the openness and recognition of traditional art authorities toward young creators.

From the AI-related auctions held by Christie's in recent years, it is evident that AI artists are showing a clear trend toward the younger generation. According to *The Contemporary Art Market Report 2023* published by Artprice, nearly one-quarter of the artists featured in Christie's New York "21st Century Art" auction was under the age of 40. This proportion indicates that young artists are gradually entering the high-end art market, with their level of activity significantly increasing and their presence on mainstream auction platforms becoming increasingly prominent.[56] From a broader market perspective, the "Ultra-Contemporary" segment—which specifically refers to works created by artists under 40—exhibited a similar trend in 2023. A total of 9,640 artworks were sold in this category over the year. Although the total sales value dropped by 38% compared to 2022, this segment still accounted for 15.5% of the entire contemporary art market. This share suggests that, despite uncertainties in the economic and market environment, there remains strong demand and collecting interest in the work of young artists. Additionally, within this submarket, NFT and AI-generated art accounted for 11% of total sales. This figure clearly reflects the extent to which digital art forms—centered around blockchain and artificial intelligence—have become embedded in the creative practices of younger artists and are gradually gaining recognition and acceptance in the art market.

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[56] https://www.artprice.com/artprice-reports/the-contemporary-art-market-report-2023/contemporary-and-ultra-contemporary-art-market-annual-report [last access 13 June 2025]

At Christie's 2025 "Augmented Intelligence" auction, works by 20 artists were presented, including several born after 1990—such as Robbie Barrat (b. 1999), Jake Elwes (b. 1993), Claire Silver, and Sasha Stiles (both approximately in their early 30s), as well as Refik Anadol and Alexander Reben (both born in 1985). Excluding artists like Huemin and Jesse Woolston—whose birth years are not publicly available but who are actively engaged in the emerging field of digital art—over 50% of the participating artists were "Ultra-Contemporary," i.e., under the age of 40. This proportion is significantly higher than that seen in traditional art auctions, which are typically dominated by artists born in the 1950s and 1960s. The results of this auction suggest that artificial intelligence is providing a supportive environment for younger creators by offering new technologies and mediums for expression. These tools allow them to gain market recognition more rapidly and secure positions on major auction platforms. This trend aligns with the broader shift in the contemporary art market, where Ultra-Contemporary artists are gaining increasing attention, indicating that the future of AI art will likely be shaped by a new generation of artists.

Traditional auctions have developed sales modules for AI art, providing young artists with opportunities to enter the high-end secondary market and platforms to showcase their work internationally. They have also actively guided collectors to pay attention to digital art and AI creations. This series of changes demonstrates that the traditional art market is proactively embracing technological innovation to address the challenges of media transformation and institutional restructuring in the new era, while also supporting the further rise of AI art and young artists within the global art system.

7. Conclusion

This paper begins by examining the application of artificial intelligence (AI) in artistic creation and reviews relevant research in the field of economics on AI and artistic productivity. Based on the prior analysis, the paper analyzes how artificial intelligence influences their creative approaches through the lens of artistic creation, employment, and income, and further examines the direct and potential impacts of these changes on artistic productivity. By exploring the relationship between the development of AI and artistic practice, this study aims to more clearly reveal the specific role of AI in the art field and the mechanisms through which it affects artistic productivity, thereby offering insights for future research and practice in related areas.

7.1 Summary of Findings

- Artificial Intelligence Enhances the Diversity of Artistic Creation

Artificial intelligence (AI) plays a significant role in expanding the diversity of artistic creation. Firstly, AI algorithms have become practical tools for artists, assisting in tasks such as color adjustment, compositional design, and the integration of photography with generative imagery. These tools streamline the creative process and lower the technical threshold, making artistic creation more accessible to both professionals and amateurs. Secondly, AI enables new modes of artistic expression. It facilitates the creation of dynamic artworks and human-machine collaborations, allowing art to evolve beyond traditional static forms. Additionally, AI fosters the democratization of art. Through platforms such as virtual reality (VR) and the metaverse, artists can freely create and exhibit their work in digital spaces, independent of conventional galleries and museums. This digital transformation broadens public participation in artistic activities. Moreover, AI is reshaping both the production and dissemination of art. VR-based artworks powered by AI enhance audience engagement, while virtual galleries and digital marketplaces increase the speed and reach of art distribution. Technologies such as non-fungible tokens (NFTs) further facilitate the circulation and management of digital artworks. Moreover, AI-driven public art installations now appear in urban environments, enriching citizens' cultural experiences and contributing to tourism development. Overall, AI strengthens artistic

productivity by enriching creative tools, expanding expressive formats, and enhancing distribution channels—thus fostering greater diversity and inclusivity in the art world.

- Artificial Intelligence Increases the Speed and Efficiency of Creation

This impact is reflected in two dimensions: the transformation of creative workflows and the enhancement of idea generation and organization. First, AI automates many repetitive and technical tasks within the creative process, such as data collection, style emulation, and image generation. This division of labor allows AI to handle the initial stages of creation such as offering creative suggestions, so that artists can focus on the stages requiring human intuition and aesthetic judgment. This human-AI collaboration model improves creative efficiency, boosting both the quantity and quality of output. Second, AI supports not only execution but also ideation. By analyzing large amounts of information, it provides structured creative support such as organizing fragmented inspiration, identifying connections between ideas, and presenting abstract data through more intuitive formats. Thus, the diverse content generated by AI becomes a powerful source of inspiration for artists.

- Artificial Intelligence Intensifies the Polarization of Artists' Income Distribution

While AI enhances the efficiency and diversity of artistic creation, it also raises critical concerns regarding the distribution of income among artists. One key issue is reduce market share for traditional artists. On the one hand, original artworks created by human artists are frequently used for training AI models without consent. These outputs are then disseminated and commercialized without proper authorization or compensation to the original creators, undermining their intellectual property rights and decreace their economic benefits. On the other hand, the ability of AI to rapidly and massively generate artworks in a wide range of styles is disrupting the foundational principle of scarcity in the art market. As a result, the perceived value of unique, human-made artworks is increasingly challenged by AI-generated content. Furthermore, from a broader perspective of technological transformation, AI has accelerated the income and status polarization within the art world. Technological advancement tends to favor highly skilled individuals: artists with established reputations or those adept at using AI are more likely to secure creative opportunities

and achieve income growth. In contrast, artists with lower technical skills or those positioned at the margins of the art ecosystem face a higher risk of displacement. This structural shift, driven by automation and technological asymmetry, is fundamentally reshaping the ecosystem of artistic labor.

- Artificial Intelligence Increases Employment Opportunities for Some Artists but Causes Job Loss in Low-Skill Positions

Although technological advancements enhance productivity, they bring about the issue of "technological unemployment." As an emerging technology, AI is accelerating changes in the art sector while posing replacement risks to certain job categories. In the AI era, the susceptibility of a profession to automation largely depends on the degree to which it relies on creativity and flexibility. Research indicates that the likelihood of a job being automated correlates closely with the level of social intelligence required in its tasks. In artistic creation, some tasks are classified as "routine tasks," meaning they follow explicit rules and can be systematically decomposed, standardized, and repeatedly executed. For example, basic image editing can be performed through fixed processes to produce similar outputs repeatedly. Due to their high repetitiveness, these tasks are more vulnerable to AI replacement. Conversely, "non-routine tasks" involve subjective judgment, creative thinking, and emotional expression. These tasks are difficult to define through fixed patterns and cannot be replicated solely through technical skill, making them less susceptible to full automation in the short term. Based on this distinction, artists who possess creative abilities and engage in non-routine artistic creation remain largely irreplaceable even in an AI-pervasive environment. On the other hand, positions with lower creative demands, focusing mainly on technical execution such as some image processing or design assistance roles are more prone to technological disruption. Moreover, the advancement of AI raises the educational requirements for artists. Creators with relevant artistic education and technical understanding tend to use AI more effectively to produce high-quality, stylistically distinct works, thereby gaining competitive advantages. This deepens the gap between artists, making education an important factor in whether an artist can adapt to and work alongside AI.

- Artificial Intelligence Artworks Are Reshaping the Structure of the Art Market, Enhancing Circulation Speed and Lowering Entry Barriers for Young Artists, Thereby Effectively Boosting Overall Artistic Productivity

In the primary art market, galleries have served as one of intermediaries, playing crucial roles in helping artists enter the market, commodifying artworks, and providing financial support for their creation. Efficient circulation of artworks not only increases artists' income and exposure but also encourages further creation, thus strengthening the supply capacity of art. However, the traditional art market has long been plagued by structural issues such as information asymmetry and high transaction costs. AI artworks, leveraging digital technologies and platform-based mechanisms, overcome many of these shortcomings. For example, NFT trading models based on blockchain technology grant artworks enhanced liquidity and traceability, enabling clear recording of authenticity and transaction history. This development increases buyer confidence and opens low-cost market access channels for artists, reducing their dependence on traditional gallery gatekeeping and resource control. Especially for young artists, this decentralized transaction model significantly lowers market entry barriers and expands the dissemination and commercial opportunities of their works.

In the secondary market, auction houses, which traditionally serve as key links between artworks and the high-end market, have gradually expanded into the AI art filed. As AI artworks achieve high prices in mainstream auctions, market recognition of their value continues to rise, thereby improving AI artists' income levels and industry status. This positive feedback encourages more creators to engage in AI art practices and promotes a more open and diversified art market. Moreover, it is notable that AI artists tend to be younger, and the rise of this demographic challenges traditional perceptions in the art market regarding artists' age and seniority. The recognition of young AI artists by major institutions has boosted the creative enthusiasm and professional confidence of this new generation, further driving the improvement of overall artistic productivity.

7.2 Reflections and Suggestions

Firstly, artists should continuously foster an innovative mindset by actively exploring new artistic forms and integrating artificial intelligence with traditional

techniques. This integration can open up novel modes of expression and enrich artistic diversity, facilitating the development of distinctive personal styles. Practically, artists are encouraged to engage in learning AI-related technologies and familiarize themselves with various AI-assisted tools and platforms to enhance their technical proficiency. Moreover, AI can function as an effective assistant in the creative process by automating repetitive and routine tasks, thereby freeing artists to concentrate on creative ideas. It is crucial to recognize that while AI is good at handling routine tasks, the emotional depth, individual style, and conceptual originality of artworks remain fundamentally dependent on the judgment of the artist. Therefore, artists should prioritize cultivating and using these inherently human capabilities to preserve the authenticity and artistic value of their creations.

Second, regarding the intellectual property issues arising from the use of artistic works to train new AI artworks, relevant institutions should place greater emphasis on copyright protection by laws and regulations to effectively safeguard artists' rights. Industry associations and related platforms should also participate in establishing copyright management and benefit-sharing mechanisms, promoting the development of an art ecosystem that respects originality and encourages innovation. This will not only help protect artists'rights but also create an environment for the sustainability of AI art. Futhermore, artists need to enhance their awareness of copyright, especially in emerging areas such as the use of AI training data and the trading of digital artworks (e.g., NFTs). Artists should be careful of the use of their works in these fields and protect their rights.

Third, artists can fully use emerging online channels such as digital art platforms and the NFT (non-fungible token) market, which generally offer easier access compared to traditional art markets. Through these platforms, artists' works can reach a wider audience, increasing exposure and creating more opportunities for sales. Additionally, these platforms often facilitate direct interaction between artists, audiences, and collectors, helping to build closer connections and a dedicated fan base, thereby promoting the development of their artistic careers.

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言尽于此，来日方长。