Blockchain Technology and the Art Market

Discrepancies between the reception and the application of the technology by the art market and its stakeholders

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ABSTRACT

The phenomenon of blockchain technology has been increasingly recurring in the discussion over the online art market: summits, conferences, talks, articles and events have been hosted and presented to the audience of art consumers in order to illustrate the innumerable benefits that the inclusion of blockchain technology may provide to the art market.

However, since blockchain has caught the attention of the art market's stakeholders only over the last two years, little academic literature has been addressing it so far, failing at providing stakeholders with a comprehensive overview of all the possible outcomes of blockchain technology to the art market. For this reason, the present research answers the following research question: "*What is the reception of blockchain technology by the art market and its stakeholders*".

In order to provide an exhaustive screenshot of the art market through the use of blockchain technology, the research question is addressed by first evaluating the presence of blockchain technology in the art market over the years from 2015 until 2019 based on the findings of The Hiscox Online Art Market Report; second, it establishes what is the perception of blockchain technology by the art market and its stakeholders; third it investigates what is the application of blockchain technology in the art market.

In order to answer these questions, a qualitative content analysis based on most recent articles from art, economics, tech magazines and websites addressing both topics of art market and blockchain has been collected.

Combining the answers to these questions, this research concludes that there is a significant discrepancy between the way blockchain is perceived and how it is applied in the art market: although blockchain is perceived by the press as a positive tool promising to solve the issues of the art market and aimed at increasing trust in purchasing art collectibles over the online platforms, the activity of art firms applying blockchain to their businesses shows that

there are still too many concerns on its application by art investors. Due to its lack of information, of understanding, explaining and of successful ventures, blockchain technology is received by the art market and its stakeholders as a highly unreliable tool that distances possible new buyers and collectors rather than incentivise them into purchasing art online.

KEYWORDS: art market, blockchain technology, transparency, democratisation, monetisation

Table of Contents

1. Introduction

Over the last three years, the topic of blockchain technology has been quite persistent in the art market. Panels, discussions, summits and reports have presented this technology as the way to revolutionise the art market and to solve its main issues of transparency, reliability and exclusivity (Christie's, 2018).

Because of the relevance that the blockchain technology has continuously gained in the art press and its stakeholders, this research aims at providing a screenshot of the current interactions occurring between blockchain and the art market: this is done to test whether the promise of blockchain, as presented to the audience of art consumers, is a concrete one or not. In order to do so, this research is lead by the following research question: *"What is the reception of blockchain technology by the art market and its stakeholders?*".

The first section of this research will provide an overview of the primary and the secondary art markets, followed by an introduction to the understanding of art collectibles as financial assets. Moving on, a basic explanation of blockchain technology is provided, and later applied to the dynamics of the art market.

The lacking of academic sources addressing blockchain technology and the art market, highly influenced the research method later carried on: because of the novelty of the topic and the lack of grounded theory to build on to, the research question has been answered by means of a qualitative content analysis, built on a sample of forty-two recent articles from art, economic, and tech magazines and websites.

With this sample, the main research question has been addressed through three consecutive sub-questions: first, *what is the presence of Blockchain technology in the art market?* provides an overview of the findings from the Hiscox Online Art Trade Reports from 2015 until 2019 aimed at assessing the entrance and the relevance of blockchain technology in the art market. From this analysis, a timeframe to answer the main research question has been determined.

Having established this, the following sub-question is "*What is the perception of Blockchain technology by the art market and its stakeholders?"*. The three main categories of transparency, democratisation and monetisation have been identified to show how blockchain

technology is perceived and presented by art sources, economic sources and tech sources respectively.

Lastly, the question *"What is the application of blockchain technology by the art market and its stakeholders"* has been asked in order to test whether the perception of the technology from the press is consistent with the activity of art firms using blockchain technology. The analysed firms have been categorized with respect to their activities into the categories of: auction houses, art galleries, online marketplaces, art investments and art registries.

From the analysis of their nature and of their activity, it emerges that these frims are all suffering from drawbacks limiting their full development mainly due to the uncertainty surrounding the application of blockchain.

Furthermore, it emerges that there are high levels of inconsistency between the perception and the application of blockchain technology by the art market and its stakeholders. For this reason, the answer to the main research question of *"What is the reception of blockchain technology by the art market and its stakeholders?*" is a quite disenchanted one: indeed, blockchain is received as an unreliable tool far away from the promise presented by art press, mainly due to its lack of understanding, explanation and full development by the stakeholders of the art market.

Nonetheless, in the discussion of the main answer, it is necessary to highlight the significant challenges that have limited the investigation of this research: first of all the novelty of the topic has considerably limited the range of grounded theory to build on to, therefore leaving room for financial and technological questions that couldn't be answered. Later, the high levels of privacy of the art market and its exclusivity have influenced the research design twice: indeed the first research method chosen to carry on the present research was that of quantitative analysis aimed at investigating the reliability of information entered on art registries, however, due to privacy policies of both art collectors and art registries, and due to the scarce number of art registries working with blockchain technology, this research method could not be carried on. Secondly, the research was to be built on in depth qualitative interviews so to provide an overview of how different actors of the art market had perceived and, possibly, adapted blockchain technology into their businesses; yet again, due to privacy issues, and to a wide lack

of knowledge regarding the functioning of blockchain technology this research method could not be carried on either.

A further limitation of this research is that it is based on information stemming from the secondary art market alone, therefore leaving out a significant portion of market represented by the primary art market and private sales of the secondary art market.

Lastly it is to be acknowledged that due to the novelty of the topic here addressed, new information and new research on the possibilities of blockchain technology in the art market are continuously changing and evolving, with new advantages and disadvantages being addressed every new day. Therefore, the results here presented are to be considered as a mere screenshot of the events occurring in the online art market as of Spring 2019, not an immutable description of the phenomenon.

2. Theoretical Framework

2.1 The Art Market

The art market is made up of the primary and secondary art market, with the latter being recognised as the dominating one due to its higher prices and monetary values (McAndrews, 2018) (Findlay, 2014). Both these markets, where works of art such as paintings, antiquities or sculptures are periodically exchanged between sellers and buyers, are not at all integrated. Indeed, every sale is influenced by each country's currency exchange, regulations, limitations, cultural policies, transaction costs, context and culture at large (Malik and Phillips, 2012).

The primary market is the one typically characterised by artists producing new works, presenting them to dealers or to commercial art galleries, that will sell the paintings through their businesses or at art fairs after having hold a percentage of each sale as a compensation for their work. Prices on the primary market are usually lower than those on the secondary one because it is the first time a collectible enters the market: it holds no previous record history, no extended visibility and no established value. Sometimes it also happens that the artist himself is first entering the market as well: this lack of visibility, adds more uncertainty on the consensus over

the artwork. In this latter case, the dealer must not only set the value of the artwork, but also the value of the artist and his establishment among the public of collectors (Findlay, 2014) (McAndrews, 2018).

A survey conducted among art dealers acting on the primary market supports the differences between the two markets: the primary market's average sales of 2017 were around $1million (McAndrews, 2018:71). For the sake of this research, it is important to highlight that of this total sale an average 10% and 30% is represented by the dealer's premium fee (McAndrews, 2018:31).

The secondary market is the one where an artist's work accrues its commercial value by being presented on the market for subsequent sales through dealers or auction houses (Findlay, 2014). Works presented on this market tend to have higher prices as their artistic value is usually already established; this claim is supported by the record of overall sales of public auction of fine arts in 2017 reaching $28.5 billion due to several artworks hammered at over $50 million dollars, and with an annual growth of 27% (McAndrews, 2018). Around half of the top sales of the same year, resulted from auctions held by Christie's, Sotheby's, Poly Auction, China Guardian and Heritage Auction, which represent the top five auction houses globally (McAndrews, 2018:106). The most responding secondary markets for artworks and art collectibles have been China, the US and the UK: these markets alone have registered a joint share of 84% of the global secondary market for 2017 (McAndrews, 2018).

Another market that is gaining relevance within the art industry is the online market, as digitisation, which refers to the transformation of analog information to a digital form, has not only significantly modified the way art is produced, but also how it is consumed, exhibited, traded and valuated (Arora & Vermeylen, 2013). Indeed, the effect of digitisation has had a staggering growth over the last five years eventually reaching its peak of $5.4 billion in 2017 (McAndrews, 208). The benefits of the online art market are manyfold: it provides a user-driven platform where information is accessed and consumed in a more democratic and universal way compared to the traditional market, it allows for the creation of databases containing essential

information for potential art buyers and collectors and facilitating knowledge acquisition, it provides actors of the art market a tool to conduct research on the behaviour and trends of their customers, excludes revenues and commissions requested by intermediaries and it attracts a new category of art consumers (Lind & Velthuis, 2012). However, the online art market is yet to be fully developed (Hiscox Online Art Trade Report 2018). Indeed, the categorization of artworks as experience goods, that bases the quality of an artwork on its active consumption entailing personal contacts, attending auctions and galleries, and being able to touch the artwork, has not yet been translated to the online sector (Malik & Phillips, 2012). This is linked to the impossibility to capture the aura of artworks and recreate it digitally: also those with access to high-quality digital experiences can't seem to get a hold of the full aura as it is experienced when in presence of the physical object (Renneboog & Spaenjers, 2015). Lastly, buying art online has not made the art market an integrated one, as buyers still have to face transaction costs, diverse taxation rates, trade restrictions and currency exchanges (Arora & Vermeylen, 2013)**.**

Over these three markets together, the motivations behind the purchase of a work of art are mainly three. First, "collectors buy art because of its aesthetics: it pleases them, it decorates interiors or fits a collection of artworks" (Velthuis, 2011:33).

Second, collectors may buy art for social reasons: art is often associated with a specific social group and purchasing art collectibles may ideally be compared to an entrance ticket to that social group. In this case, art is bought and appreciated for its extrinsic qualities: its high price, the popularity of its author rather than its aesthetics (Velthuis, 2011).

Third, collectors buy art for financial motifs, as an investment representing a financial asset or a collateral or just to diversify a financial portfolio. However, as noted by Velthuis (2011), when art is understood as a financial asset it "carries low rates of return and high risks in both the long and the short run" (Velthuis, 2011:34) (Malik & Phillips, 2012). Moreover, it is to be noted that only during brief periods art can outperform traditional financial assets as it is made of assets that are safe against inflation (Vadi & Schneider, 2014). This was the case on 15 September 2008, with the official announcement of bankruptcy from the investment bank Lehman Brothers and the following financial crisis which had no effect on both Damien Hirst's

sale of $127 million hammered at Sotheby's on that same evening and on the art market at large: indeed, eleven of the 20 highest prices ever hammered at auction happened in 2008 (Horowitz, 2011) (Davidson, 2012).

Next to these three main drivers of the art market, other reasons that have made the art market so appealing to buyers refer to the economic boom, rising wealth inequality, money laundry and tax benefit. The economic boom refers to the popularity of the market and the high liquidity of an economy: in this case, potential buyers look for luxurious goods to invest in, eventually hoping for some returns; rising wealth equality has been recognized as one of the main drivers of the art market as it depends on the growing group of high net worth individuals that have been proven to be expanding over the years, with an increasing financial disposal, and to be ever more willing to invest in art collectibles. Tax benefits represent another significant drive of the market as collectors might reduce mandatory costs associated with the purchasing of an artwork by donating to museums or loaning pieces of their collection for exhibitions having tax exemption in return (Malik & Phillips, 2012).

Regardless of the motivations behind the purchasing of a work of art, when this is traded on all three markets it is then classified as a heterogeneous good (Velthuis, 2011). Some works of art have no substitutes at all, as they carry one specific characteristic that cannot be found in any other authentic piece or because the artist is deceased. In this case, their supply curve is fully inelastic, which explains the case of works from the same author being sold at auctions with great differences in prices. This dynamic argues for the characterisation of the art market as a "large set of monopolistic markets" (Velthuis, 2011:35). A different demand curve, however, is to be found in the case of collectors buying art for its artistic value. In this case, substitutability does exist and it creates an elastic curve because of collectors expressing preferences for a style rather than an artist.

Once an artwork is purchased, regardless of the motivations behind it, there are costs that are to be bared: transactions costs in the form of premiums can raise up to 20% of the final price and they must be paid by both the seller and the buyer; insurance costs due to the vulnerability of art objects; transportation costs; storage costs and luxury taxes (Velthuis, 2011:35).

Conscious of the consequences coming with the purchasing of an artwork, the understanding of art as a financial asset, makes the art market a very unattractive financial platform for investment. Indeed, selling an artwork requires long time, with auctions taking place only a few times a year and due diligence work to be conducted before presenting the artwork to the market. Artworks are also traditionally thought of as hardly divisible goods traded on a market that lacks liquidity. Both buyers and dealers are somewhat reluctant to provide information regarding the quality of the art supplied and the details of the sale (Malik & Phillips, 2012) (Velthuis, 2011). Resulting from the lack of transparency, a situation of information asymmetry creates, which allows some players of the market to hold more information in order to score higher returns (Akerlof, 1970). This traditional aspect of the art market is, however, being changed by companies who have specialized in providing information on living artists (Artefacts.net) and by databases that register comprehensive auction data (Artprice.com; Artnet.com).

Finally, the ultimate characteristic of the art market is the trading of credence goods. As credence goods, the value of artworks cannot be objectively determined, but instead relies on the opinions of experts' evaluations: changing taste, fashion, time, and place have huge effects on the monetary and artistic evaluation of a piece of art, which still results uncertain (Findlay, 2014).

2.2 Art and Finance

The art market radically differs from the finance market. The main differences between the two markets have somewhat limited the applicability of financial techniques to the art sector mainly due to scarce liquidity, as art collectibles are not traded on an open exchange like other financial instruments; impossibility of division; high transaction costs, mainly represented by insurance, transportation costs and auction fees; long duration of the selling and of the buying process (Kaire, 2015) (Worthington, Higgs, 2004) (TEFAF Digital Report Art Dealer Finance, 2018). Further incompatibility between the two sectors arises with regard to the extensive knowledge required to make an art investment: not only in the art sector this knowledge refers to the artwork of interest and to the art world at large, but it also highly relies of subjective opinions based on

beliefs, tastes and fashions that make the art investment highly risk pervasive. This subjective knowledge is linked to high levels of risks represented by incorrect attribution, fakes, forgeries and physical damages that mine the monetary value of any artwork (Kraussl et al., 2016). Pursuing art as a financial asset requires a large amount of capital to be invested in a well-known artwork which is often sold through one of the few established auction houses that dominate the market. Because of its exclusivity, the art market has always being considered an opaque and niche sector (Worthington, Higgs, 2004).

On the other hand, financial investments are non-physical assets whose value comes from a contractual claim. They are typically homogeneous and are traded on a monopolistic market characterised by numerous, diverse and liquid platforms that easily convert the asset into cash. The selection process of financial assets to invest in is ruled by few and clear criteria, which do not require transaction, insurance nor transportation costs (Kraussl et al., 2016).

Even though the interactions between art and finance are considered to be quite recent (Horowitz, 2012), Stein had already described paintings as collector goods back in 1977, indicating them as "economic goods that are at once durable consumer goods and financial assets" (Stein, 1977:1021). In his empirical research, aimed at investigating the monetary appreciation of paintings over time, he proves that over the years 1950s and 1960s the return rates from investments in paintings was higher than the rates of returns of other financial assets, making artworks eligible for financial investments too (Stein, 1977).

Although Baumol (1986) had already started analysing art and the art market in pure economic terms, getting acquainted with the idea of artworks as financial assets, it was just in the last two decades that the art market undertook several initiatives to reduce its lack of transparency providing its actors with price indexes, catalogues raisonée, a widening of assets present at auction as well as a widening of the client base (Findlay, 2014). These changes have increased the number of auctions per year and shifted the art market closer to the financial one (Worthington, Higgs, 2004). The changes here discussed are followed by the art return index of Goetzmann (1993), used to prove the existence of a strong positive correlation between the

demand for art and financial wealth, ultimately signalling that the demand for investing in art grows together with the wealth of art collectors.

Because of the literature contribution to the expansion of the art market into the sector of finance, mainly depending on Baumol (1986) who was the first to really discuss art collectibles in economic terms, Frey and Eichenberger (1995) have argued the main reasons why studying art as an investment has come to be a necessity. First, studying the art market as any other market opens possibilities of comparisons between returns yielded by art and by other forms of investments; second, it favours the application of financial and econometric tool and techniques to the art sector; third, through the application of new tools, traditional features of the art market can be investigated and can open the way to new findings. (Frey & Eichenberger, 1995).

The application of economic and financial tools to the art market has consequently favoured changes which have allowed new wealth in the terms of emerging art markets, wider collector base, and databases collecting information to enter the sector of art; in so doing, new reasons to buy art and changes in tastes of the collectors have come along (Lind & Velthuis, 2012). Indeed, the 2017 Art and Finance Report by Deloitte and ArTactic showed that at around 50% of collectors were encouraged to buy art because of its investments returns, whereas 36% were pushed to buy art in order to diversify their financial portfolio.

A further consequence of the art market entering the financial sector, is the emergence of new gatekeepers in the forms of art advisors, middle men figures between the art and finance markets. Art advisors, as proved by the research of Mei and Moses (2002), have a tendency to advise clients willing to invest in artworks, into buying the most expensive artworks they can afford. This tendency is based on two assumptions: first, that art buyers are wealthy individuals with a large capital, second that masterpieces have a higher expected return than lower works of art. Even though Mei and Moses (2002) eventually discard the latter assumption, following the study of Pesando (1993) on repeated sales of prints, no further evidence of the underperformance of masterpieces has been found so far. In line with the findings of Pesando (1993), Mei and Moses's (2002) investigation is consistent in advising art investors to buy less expensive

artworks and await for their value and demand on the marke to grow in order to get maximum returns.

With the recent merger of the art market into the finance sector, McAndrews and Thompson (2006) have identified a new financial role for art collectibles and a consequential new task for art advisors: art can indeed be understood as a collateral, intailing that some auction houses or firms offer loans up to 40-50% of the low estimated auction value using artworks as collateral. Banks operating art loans use art as a collateral too, and have art advisors whose main duty is to conduct valuations of the collectibles, relying these on the estimates of the market values and, eventually, set a monetary amount that allows art to be used as collateral in the loan process (McAndrews & Thompson, 2006).

2.3 Blockchain Technology

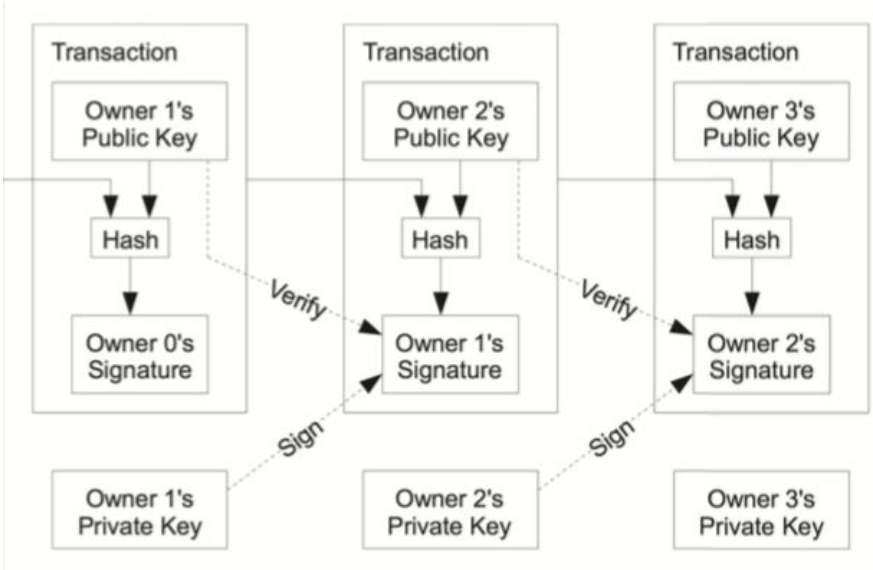
Blockchain technology[1] is a "peer-to-peer electronic payment system based on cryptographic proof instead of trust, allowing any two willing parties to transact directly with each other without the need for a trusted third party" (Nakamoto, 2008:1). It is arguably among the most trending technologies, and it became famous as the mechanism underlying Bitcoin, a cryptocurrency that was first introduced to the public in 2008 by Satoshi Nakamoto (McConaghy et al. 2017).

In its essence, blockchain technology is a text file providing a decentralized network where all events, such as transactions are recorded. The ledger is open to anyone, who is also allowed to write and hold a copy of said file. As individuals access the ledger and operate on it, transactions accumulate and are written together as a "block" in the list itself; said block is then added to the previous block of transactions, therefore creating a chain of blocks of transactions. Every block has its own signature, a cryptographically generated code which is added to the previous block of transactions so to lock the blocks together, tracing a linear record and making sure that no transaction can ever be duplicated. The chain that eventually creates, is based on the

[1] In the following also interchangeably referred to as "blockchain", "decentralized blockchain", or "blockchain system".

authenticity of each block, which is recorded and verified by the blocks that were backed up before (Mansfield-Devine, 2017)(McConaghy et al. 2017).

Figure 1: Chain of transactions (Mansfield-Devine, 2017)



The technology process behind blockchain as described above, highlights its main characteristics: decentralization, transaction speed, security, auditability and control. These essential aspects promote the vision of a trust-free economy as they allow individuals operating through blockchain to trust each other in the way they conduct and control mutual transactions without the necessity of any intermediary (Risius et al. 2017).

In the paper by Nakamoto (2008) the characteristic of decentralization is determined by the proof-of-work system. Through the proof-of-work system, individuals operating the technology make sure that each block begins with a determined number that follows the one of the previous block. This way the two blocks are linked together and their values cannot be changed unless redoing the whole process and changing the values of all later blocks that are chained after it. Following this procedure, chains of blocks are created. In order to determine which chain is the correct one, the decentralized system finds in the chain with the larger number of blocks, which is the longest, the most reliable one as it represents the one with the greatest proof-of-work invested. (Nakamoto, 2008).

The same procedure, does not only guarantee a decentralized system, but also transaction speed as all blocks are tightly linked together through consequential numbers. If the chain is controlled by honest links between blocks, the chain will grow fast and smoothly without incurring into errors (Nakamoto, 2008).

Because as just mentioned, changing the value of a block implies changing all the following blocks as well, the longest chain safeguards for the security of the technology at large. Blockchain technology is built so that the proof-of-work system operates based on a moving average targeting an average number of blocks per hours (Nakamoto, 2008:3). Therefore, if a hacker wanted to alter the value of a block he or she would have to alter all the following values inevitably slowing down the growth of the chain. Such event would show in the platform and raise concerns among its users.

As for auditability, this is granted not only by the proof-of-work system, but also in the rules of the transaction process, which is built on a chain of digital signatures. For transactions to be verified by every payee, they need to be publicly announced and publicly agreed on. Furthermore, payment verification allows users to keep a copy of the block headers of the longest chain and check on it by linking it to a random step of the chain and follow the smooth adding up of following blocks. In order to control the chain, a user has to add up the copy of block headers to the chain and it is accepted by it, it means they have been accepted into the larger network of the system (Nakamoto, 2008).

The control of blockchain mainly refers to control of privacy of users. Indeed, one benefit of this technology is that although all transactions must necessarily be publicly announced for users to see currency been moved, no one needs to know who is moving it. Through this process, which builds up on the information system used in stock exchanges, the third party intermediary that usually limits the spillover of information in the traditional banking system is suppressed.

Nonetheless, the design of blockchain technology as first presented by Nakamoto carries benefits as well as constraints to its full exploitation and adaptability to different fields. Research over design features which could play a double role in the technology's success has been conducted with regards to anonymity, scalability and decentralisation. The characteristic of

anonymity, investigated by Fabian et al. (2016), shows it carries positive as well as negative effects in a blockchain transaction. Indeed, results from a survey conducted through active bitcoin users, show that over 20% of them would consider anonymity a reason to abandon the technology. However, as pointed out by Risius et al. (2017), the analysis of anonymity fails to explain where its contrasting effects come from and how they can be overcome. When anonymity is investigated together with the interoperability of the blockchain ledger it can be beneficial to third parties who develop services such as money laundering, customer knowledge, insurance or prevention (Risius et al., 2017). The result of this intersection of characteristics brings to protocols for smart contracts that anonymize transactions and protect privacy of users (Risius et al., 2017). However, as anonymity is a double-edge sword for blockchain technology, the benefits that emerge from its intersection with interoperability also allow for criminal purposes such as information leakages (Jules et al., 2016). Unfortunately, no remedy to this misuse of blockchain technology has been found yet.

With an increasing number of individuals from many and different sectors are using blockchain technology, it still leads to the issue of scalability which arises with the costs and volatility of blockchain transactions (Risius et al., 2017). Due to volatility of cryptocurrencies, which are often non regulated, whenever these issues arise, threats to the security of the chain are consequential.

Even though decentralisation is usually thought of as one of the main characteristics of blockchain technology, as it enables a democratic participation on the platform, Abrahoma and Bohme (2016) have proven that it is instead perceived as the smallest benefit of the technology when compared to the velocity of transactions process and control over investments.

Decentralisation is strictly linked to smart contracts, which enable autonomous communication between transaction partners without the need for validity of trust among them: through its open technology, blockchain provides an inexpensive alternative to intermediary services (Risius et al., 2017). Smart contracts are not only beneficial to safe transactions between devices, but also in real-world settings as they feature transparency and immutability (Christidis and Devetsikiotis, 2016).

2.4 Blockchain Technology and the Art market

Blockchain technology, as discussed in the previous section, was initially developed as a way to record transactions of cryptocurrencies. The information recorded from each transaction was not stored in one place as it traditionally happens, but, rather, embedded in a digital code that linked it to a digital database. In these databases, information is protected from deletion, revision and meddling (Adam, 2018). If this information record process was to be thought of as a mechanism for assuring valuable things, then it could potentially apply to almost every industry, art market included.

The reason why blockchain technology is creating such a hype in the art market, with panel discussions being hosted at every art event, is that its technological integrity could revolutionize the opacity of transactions and lack of information that have always characterised the art market (Schneider, 2018). Indeed, a 2017's survey conducted among online companies active in the online art market showed that 56% of respondents believe blockchain technology would have an effect on the art market: among these, 80% believe the effect would be beneficial, mainly due to the possibility of linking a physical artwork to a public blockchain so that artists, intermediaries, and consumers could check directly online the same information on provenance and authenticity that would result from traditional due diligence research and which is necessary for determining any artwork's value (TEFAF Art Dealer Finance, 2018)(McAndrews, 2018). This way, the art market would be able to reduce its opacity and fight forgeries as well (Mansfield-Devine, 2017). Ideally, in a utopian world of art, there could exist a unique blockchain holding complete information on artworks and simultaneously share it across the art industry so to cut research costs and to open new, clear ways for the art market.

The first concrete application of the blockchain technology to the art market is to be found in the tracking of provenance. With this regard, Ethereum blockchain platform is an already existing and operating chain that offers, among other things, art registries. In art registries, information regarding cataloguing details, provenance records, certificate of authenticity, sales prices and ownership of an art-piece must be entered in the chain, where it is

then recorded. Other works of art follow along in the same way as blocks of transactions do, so that modifying information on an art piece is highly difficult (Adam, 2018). Collecting these information, the registry presents itself as beneficial not only to art consumers who can check every artwork listed in the registry, but also to artists themselves who can track sales and claim droit de suite (Adam, 2018).

Based on art registries, new ventures have been created aiming at reducing the opacity of the art market: Artory or Verisart for example, register artworks by first checking their authenticity and provenance, and then releasing a certificate to their owners (Adam, 2018). These companies act as guarantors of the information entered on the platform: being the information regarding the artwork vetted and entered by art specialists only after proper due diligence work, the trust of the consumers using the blockchain platforms is boosted and incentivized. The necessity of information regarding each work to be entered by art experts is deemed as a basic assurance for the records to be considered trustworthy and, most of all, complete.

However, because blockchain platforms are characterised by decentralization that allows everyone with access to the platform to enter information on it, issues of verifiability and reliability of information are rising. Indeed, months after the record sale of Leonardo's *Salvator Mundi* at Christie's in November 2017, a tech personality registered himself on Verisart blockchain platform as the owner of the painting, although he clearly is not (Adam, 2018).

Solutions to the issue of linking a physical artwork to a blockchain record are still lacking, although one has already been presented for those artworks entering the market for the first time. By adding a "Tagsmart" to the artwork, the artist or the seller adds a stamp on the back of the artwork and then covers it with a QR code creating a tag that redirects to the online information. On top of this, a certificate and a digital passport are added to information entered in the blockchain platform (Adam, 2018).

This latter practice was the one chosen by Artory when in November 2018 it partnered with Christie's New York to hold the first ever blockchain auction of the Barney A. Ebsworth Collection. Almost one hundred lots for an estimated total value of $300 million, were provided by Artory with an encrypted certificate of authenticity where information regarding the title, the

description, the final hammer price and the date of the purchase were to be found. Along with the information issued by Artory, Christie's gave each buyer a key to access the encrypted information of the purchase on the blockchain platform. Acting in such way, Christie's and Artory have extended and enhanced the trust of their buyers to the digital market aiming at greater transparency of their sales (Ehrmann, 2018).

The adaptability of blockchain technology to art transaction, is to be exemplified by the case of auction house Paddle8, which provides its customers with a code to access the blockchain platform and certify their artworks (Reyburn, 2018). This simplifies one of the constraints of blockchain applied to the art market: accessing the blockchain platform. Indeed, as pointed out by Pickford (2018) most top-lots buyers are used to purchase art in the traditional room-sales as established by Christie's and Sotheby's back in 1700. Dealing with blockchain purchases therefore is tedious for most buyers, who have to acquire a digital wallet, cryptocurrencies of each art firm, and negotiate the purchase in technical language. Acquiring access to these platforms is contrasting with the commitment of blockchain technology to be open to a broader audience, making art more accessible and democratized. This impediment is partly solved by the art firm supplying an already generated key that allows buyers to access a blockchain platforms and to fill in the information of their artworks. Moreover, such system allows buyers to avoid filling in their personal information and yet respecting the secretiveness of art buyers.

Another way of adapting blockchain technology to the art market is investment in art. With this regard, art is not only used as a collateral but it is a pure investment aimed at portfolio diversification. With this purpose in mind, investors are now acquiring fractions of ownership of paintings. On the one side, this practice allows investors to buy small fractions of works of art and then trade them on the financial market; on the other, it leads to greater liquidity in the marketplace of artworks (Adam, 2018). The most famous venture in this sector is Maecenas, an investment firm based in Singapore, which gained popularity after dividing 49% of the value of Andy Warhol's *14 Small Electric Chairs Reversal Series*, 1980 into shares and selling them on the company's blockchain platform. (Reyburn, 2018).

Most startups dealing with fractional ownership of artworks issue their own cryptocurrencies: investors pay for shares through the cryptocurrency issued by the art firm, the transaction is recorded on the blockchain and, then, investors are free to exchange their tokens - which represent the share of the artwork. The value of each token increases together with to the value of the artwork. According to this practice, making profit through a share of a painting does not require for an investor to sell the artwork, but just to trade the tokens representing the percentage of ownership of said artwork (Adam, 2018). This new attempt to sell art, which is clearly built on finance and not on the traditional dynamics of the art market, is destined to and taken on by risk averse players of the finance world, not the art field. Following these new selling dynamics it could be that the use of blockchain in the art market entails a shift of sector, from art to finance, where traditional and established art consumers will have to adapt and learn new rules and practices. This is most likely the drive behind most of the panels dealing with the growing relationship between blockchain and the art market: art players need to learn the rules of blockchain game if they want to keep on being active in the art market. This was indeed the drive behind London's Serpentine Galleries conferences in 2016, where figures from the world of technology and from the art sector were brought together to discuss the implications that blockchain has for governance, global supply chain and reality of everyday-life with regards to the arts (Michalska, 2016).

A further advantage of implementing blockchain technology into the art market relates to the possibility to create limited editions of digital art, so to avoid threats of piracy and duplication (Zavelev, 2018). Blockchain could definitely improve issues of the art market by providing a secure database listing essential information such as provenance, authenticity, transactions and ownership. Moreover, with the blockchain system of privacy that provides users a code, it can ensure the privacy of its users also on public blockchain platforms.

3. Methodology

3.1 Research Design

The purpose of this research, which answers the research question *"What is the reception of blockchain technology by the art market and its stakeholders*", is to test whether the promise of blockchain technology to solve the traditional problems of the art market is a concrete one or not.

In order to prove so, I first establish the presence of blockchain firms and platforms in the market for figurative and digital art over the years 2015, 2016, 2017, 2018, 2019 based on the reports from The Hiscox Online Art Trade Report. Through a comparative analysis of the findings over the established timeframe, I accomplish my first step by determining the presence of blockchain technology from the art market and its stakeholders.

From this standpoint, further questions of how the technology is perceived and eventually applied by the audience of art buyers and consumers have been addressed in order to provide a complete answer to the main research question.

Having established this, I will compile a mapping of the technology by means of qualitative content analysis aimed at estimating the acceptance of blockchain technology by the art market and its stakeholders. The decision to rely on qualitative research is due to the fact that the technology is relatively new to the art market: blockchain first entered the art world solely as a tool to make financial investments, being used more in terms of assets by finance experts rather than art ones. It was only in the last two to three years, with summits and panels being hosted at major art fairs by major auction houses and commercial art ventures, that decentralised blockchain has entered the artworld with the clear purpose to improve transactions involving artworks, artists, art collectors, and dealers in order to eventually bring along a significant changes in the art system at large (Schneider, 2018).

I expect to find that the promise of blockchain technology to solve the issue of transparency of the art market is bigger than its actual applicability. Indeed, there is no way to

prove that the information entered on the majority of these platforms is the result of accurate due diligence, or that it reflects the equivalent information of the tangible artwork.

Furthermore, the other promise of democratisation of the art market made possible by buying art through cryptocurrencies on blockchain platforms, is inconsistent as well: indeed, in order to access any of these platforms, either private or public, the number of users is limited as they must be provided by an art institution - such as auction houses or galleries, or investment banks - with a key that grants access to the platforms. Moreover, in order to buy an artwork on a blockchain platforms users are limited once more as they must own a certain amount of the cryptocurrency used by the specific platform, otherwise they are excluded from finilizing the trade. With these two expected findings alone, the promise of an online art registry counting all tangible and intangible artworks presented at auctions, past and future, available and accessible not just to the actors of the art market but to everyone interest in art collectibles as it was forecasted during the Christie's Art + Tech Summit: Exploring Blockchain (Miami, 2018) is already unattainable.

The main challenge of this research is the privacy of the users of blockchain platforms, which, summed to the privacy of art buyers, makes the data available on these platforms and registries extremely difficult to access. Indeed, the first approach to the methodology of this research was to rely on a quantitative method, collecting data from different art registries to test how often the information entered on each chain was edited; however, due to high privacy concerns and the novelty of most blockchain registries this could not be proceeded with. The same issue of privacy presented itself when the method was changed to in depth interviews towards stakeholders of the art market and the finance world: again, due to privacy reasons and to a significant lack of information held by stakeholders on the possibilities presented by the combination of blockchain in the art market, this research method was not carried on with.

A further challenge was represented by the fact that most record entered on blockchain platforms only refer to public sales, therefore the big portion of the market represented by private sales is not included in any analysis of blockchain art ventures.

Also, when accessing the platforms, a very specific and technical language is used, which to some extent limits the understanding and overall comprehension of blockchain dynamics by the art sector. This might influence the final output of the findings.

Geographical limitations of blockchain art ventures are also to be considered: the use of blockchain for art collectibles is mainly recorded over two locations, the US (NYC or California) and Europe (UK, or Switzerland) which significantly restricts the overall representativeness of the market for online purchases, therefore limiting a comprehensive adaptability of blockchain.

3.2 Data Collection

This qualitative research will build on thematic analysis: in so doing, it will rely on data collected with a systematic snowball sampling approach towards selecting and analyzing literature in the form of articles from online art magazines and art websites as well as economics, finance and tech articles addressing both the topic of blockchain and the art market. Following the direction of the research question "*What is the reception of blockchain technology by the art market and its stakeholders*", the protocol developed for identifying articles to be included in the analysis consisted of screening most recent articles (2017-2018-2019) published on established art market sources (The Art Newspaper, Artnet, Artprice, Artreview, Christies.com, Artbasel.com, Tefaf.com); economics and financial sources dealing with the art sector (The Financial Times, The New York Times, The Wall Street Journal, Bloomberg, The Art Law, Forbes, Hiscox Online Art Trade Report[2]) as well as tech specific sources mentioning blockchain and the art market (WIRED, Techcrunch, Cryptonews, Computer Freud and Security). Common to all the sources are the keywords of "art", "art market", "art investment", "art industry", "blockchain", "cryptocurrency", "online platform", "revolution". As a result, forty-three articles are used to draw a representative screenshot of the presence, application and perception of blockchain technology in the art market for figurative and digital art. The total of these articles is later divided into the three categories of Art sources, Economic sources and Tech sources so to

[2] I have chosen to enter the Hiscox Online Art Trade Reports in the category of Economic Sources as their nature of insurance venture is highly affecting their purpose of drawing an economic and financial overview of the art market. Nonetheless, I am aware of the bias that this decision might create to the research.

show how the different perceptions and concerns of each field towards the topic of this research shapes the perception by different audiences.

Being such new phenomenon, theory and research literature on blockchain in the art market is still scarce, with the few data recorded not being available to the public due to privacy issues of middlemen and art collectors. Instead, the quantity of articles from art-specific magazines and websites is constantly growing: because of the promise of blockchain to revolutionize the art market in terms of transparency of transactions, more and more art related magazines, interviews and panel talks are following the hype of the technology, introducing it to their audience of art collectors, providing an estimation of its various applications, from art registries to museums, galleries and auctions. Nonetheless, a portion of the art market's stakeholders, whose actions are not driven by the need to increase trust in buyers nor to urge them into making art transactions on blockchain platforms claiming its security and privacy, are rather providing an overview of the current state of the art market. In so doing, pitfalls and drawbacks of blockchain applied to the market are taken into account: indeed, the hype surrounding the topic of blockchain is being highly questioned from experts who are simultaneously laying out all the possible scenarios that the promise of blockchain may bring along in the art sector.

3.3 Data Analysis

Having selected and divided the sources into each appropriate category, the research question *"What is the reception of blockchain technology by the art market and its stakeholders*" is addressed by first compiling a time trend of five years (2015-2019) which shows the entrance and raise of blockchain technology in the art market. Further on, having established how and when blockchain and the art market have merged, I will proceed into my research by answering two subquestions: *what is the perception of Blockchain technology in the art market* and *what is the application of blockchain technology in the art market*. These two questions are useful to first establish how the technology is perceived by the stakeholders and by the actors of the market and whether they pinpoint the benefits rather than the challenges and how their perception reflects on the opinion of the public; second, it establishes what is the concrete application of the technology

in the market: how many art firms are using blockchain and in what way, whether they are successful or not, and if their actions are consistent with the findings of the first subquestion.

In order to answer the first subquestion, Appendix B1: *The perception of Blockchain Technology by the Art market and its stakeholders* is created. The maximum criterion used to answer the question "*what is the perception of Blockchain technology in the art market?"* refers to the three main categories that have been found to occur the most throughout the forty-two articles: transparency, democratisation, monetisation. For each category, equally meaningful subcategories have been identified: altogether, these categories highlight how blockchain is supposed to influence and change the art market. The first most recurring category is that of transparency, which is built on by the subcategories of: authenticity, provenance, ownership, trust and security; second category is democratisation, entailing subcategories of fractional ownership, liquidity, privacy, efficiency, reliability and expansion of the collector base; and, lastly with regards to the third main topic of monetisation the subcategories are: scarcity, creation, verification, copyright, value preservation and elevation of status. Useful to the final analysis on the reception of blockchain technology by the art market and its stakeholders, the main challenges resulting from the application of blockchain mentioned by the sources analysed are reported at the bottom of Appendix B1: *The perception of Blockchain Technology by the Art market and its stakeholders.*

Table 1 Main Categories and Subcategories

Category	Subcategory
Transparency	Authenticity
	Provenance
	Ownership
	Trust
	Security
Democratisation	Fractional Ownership

	Liquidity
	Privacy
	Efficiency
	Reliability
	Expansion of collector base
Monetisation	Scarcity
	Creation
	Verification
	Copyright
	Value Preservation
	Elevation of Status

To answer the second question of "*what is the application of blockchain technology in the art market?"* another table has been created: *Mapping of Blockchain Technology in the Art market* (Appendix B2). Here, the articles selected are sampled through a maximum criterion useful to pinpoint categories of auction house, art gallery, online marketplace, investment platform and art registry which are used to evaluate the concrete applicability and estimate the success of blockchain technology to the art market. Every firm taken into consideration, falls into the appropriate category, followed by the description of its nature, its purpose, and its activity in order to provide a complete list of what firms are operating in the art market, how they have adapted blockchain technology to the sector and how successfully they are doing so. Stemming from the data in Appendix B2, an evaluation of the applicability of blockchain is observed first for each sector, then, for the art market at large. A comprehensive analysis for consistency between the starting promise of blockchain technology as received by stakeholders of the art market and the concrete activity of art firms using blockchain is eventually drawn.

From the results of the two tables of Appendix B1 and B2, an overview on the reception of blockchain is put together in order to show how different standpoints of stakeholders alter the

reception of the promise of blockchain for the art market given to art consumers. Not only different sources have different ways to understand and present blockchain, but they also highlight different aspects and different challenges. Putting all the different takes on blockchain in the art market and its uses, I aim at drawing a complete screenshot of what is its concrete application in the current art market, as of spring 2019 comprehensive of its creative, financial, and technological benefits as well as its pitfalls.

3.3.1 The presence of Blockchain technology in the Art Market

Over the last five years, experts working on the Hiscox Online Art Trade Report in partnership with art market research and analysis firm ArtTactic, have closely analysed the entrance of blockchain technology in the art market. Although they have first highlighted the challenges of the online art market that blockchain technology was supposed to fix, over the last three years they have gradually shifted the discussion to the pitfalls of online art platforms relying on blockchain.

Indeed, in the 2015 report, a staggering revenue increase of 148% and 146% was reported for Auctionata and Paddle8 respectively, two online only auction houses which, following this positive wave, expanded their collector base and doubled their sales growth in the following year. Still in 2015, up to 80% of respondents found the main advantage of the implementation of blockchain technology onto the art market to be the ability to easily search, discover and buy different art and collectibles, further sustained by 71% of respondents who have benefited from the breaking down of geographical barriers and a 46% enjoying greater democratisation of the market as a consequence for the introduction of different price segments and different offers. (Hiscox Online Art Trade Report, 2015). Already in the same year, the most remarkable advantages of the online art market were keen to the promises of blockchain for the democratisation of the art market, which is traditionally exclusive and elitist, and for the takeover of online marketplaces fulfilling the tastes of a global spectrum of potential buyers. The possibility to search, discover and buy directly artworks and luxury collectibles from different countries and at different price ranges, was so welcomed from the public that in one year only it

almost doubled, being chosen by 41% of online art buyers as the most preferred online platform to use for online purchases (Hiscox Online Art Trade Report, 2016).

The two above mentioned Auctionata and Paddle8 online auction houses merged in May 2016, aiming at expanding the online global market for luxury goods and art collectibles. However, the venture failed less than a year after, in March 2017 when Auctionata had to file an insolvency lawsuit. This failure raised concerns regarding the ability of online only players working with blockchain to fully develop and grow in the art market. Indeed, the art market report of 2015 registered 66% of respondents recognizing the lack of transparency as the second most significant drawback preventing customers from buying art online after the impossibility to physically inspect the artwork; following the failure of Auctionata and Paddle8, together with the low evidence of successful online art businesses, raised the concerns on transparency up to 88% in 2017 (Hiscox Online Art Trade Report, 2017).

Although many actors of the art market have argued that blockchain technology will solve the issues of transparency, trust and lack of information that have been indicated from the analysis of ArtTactic as key issues of the online market for more than five years, and over 38% of them declare they are thinking of embedding their businesses with blockchain, the Hiscox Online Art Trade report of 2018 revealed that only 8% have in facts proceeded with using blockchain technology in their working activities (Hiscox Online Art Trade Report, 2018).

Cryptocurrencies, which were considered by 60% of online art business as the payment method to adapt to in order to have blockchain technology fully enter the art market and bring along its forecasted benefits, were only provided by 7% of online art galleries and marketplaces. The main reason behind the scarce inclusion of blockchain technology into online art business is that, although price transparency, quality of collectibles and logistics have been identified as the main concerns from 88%, 94% and 37% of online buyers respectively, the greatest challenge carried along by blockchain is building consumers trust (Hiscox Online Art Trade Report, 2018).

Because galleries, auction houses and marketplaces are struggling to gain consumers' trust, more than half of the online art business have agreed that the main attractiveness of blockchain to the global art market is that it could create a global art registry providing its users

with the high level of security, anonymity, decentralisation and openness embedded with blockchain technology.

Contrary to the positive forecast of blockchachain that emerged in the Hiscox Online Art Trade Report of 2015, the latest report opened its analysis stating that the adaptation of the art market to blockchain technology is "slow, as convincing users cases fail to materialise" (Hiscox Online Art Trade Report, 2019:2). Although concerns from the buyers' perspective are still the unavailability to physically inspect the artwork, the lack of information, of price transparency and the quality of the collectibles offered online, analysts of the art market agree that embedding blockchain technology in the online art market will prove to be relevant and useful with regards to provenance tracking and ownership registry alone (Hiscox Online Art Trade Report of 2019).

It is nonetheless true that in the long run, blockchain might be able to solve more traditional issues of the art market but the pitfalls are still too big to present online art platforms' users with convincing and secure solutions. Indeed, the Hiscox Online Art Trade Report of 2019, as a result of greater education and knowledge on the entity and mechanisms that blockchain technology entails, has followed the lead of the previous year's report highlighting the failure of art related ventures using blockchain. The first stepback addressed is the one of cryptocurrencies: in 2018, 60% of online art business considered the introduction of payments in cryptocurrencies was the way for blockchain to enter the art market, yet, over the last year most values associated with art cryptocurrencies have registered a significant deflation due to an overall collapse of cryptocurrencies. In the last year, art cryptocurrencies have experienced high levels of price volatility and inconsistency that have raised many concerns over the security of cryptocurrencies in the art sector, reason why only 4% of art buyers have invested in art related cryptocurrencies. As a consequence, the tokenisation or fragmentation of artworks that was said to support the democratisation of the art market has raised doubts over the fairness of values exchange and the possibility for speculation to exceed (Hiscox Online Art Trade Report of 2019).

3.3.2 The perception of Blockchain Technology by the Art market

To answer the question *what is the perception of blockchain technology in the art market*, this research has been built on qualitative content analysis of forty-two journal articles and websites dealing with the topic of blockchain technology and the art market. The total number of articles analysed has been divided into three categories based on the nature of their source: art, finance and economics, and technology.

The majority of the material analysed comes from the art sector and it mostly endorses the promise of blockchain by presenting new art-technology ventures and reporting on the numerous summits and conferences discussing the topic of blockchain in the art market. The overall perception of blockchain from the art sector is a positive and promising one, mainly built on the key factor of transparency: indeed, as widely argued, because of the decentralised, immutable and open nature of blockchain the traditional opacity of the art market will come to an end when its actors will start using open platforms filled with complete due diligence records. More positivity is linked to the possibilities presented by blockchain technology to digital art: registering a digital artwork on a blockchain platform allows artists to claim ownership and resale rights over their work. Because digital artworks will be registered immutably on an open ledger, their reproduction will be limited and controlled: this will create scarcity of digital artworks and, consequently, elevate the status of digital art to that of traditional art.

Economic and finance based sources differ from the ones just mentioned as art is not considered for its cultural value but rather for its financial asset possibilities. From a purely economic and finance point of view, blockchain technology has created opportunities for portfolio diversification through blockchain: fractional ownership or tokenisation is the financial activity that has allowed the art market to be more democratised as it allows potential buyers to purchase fractions of blue chip art through cryptocurrencies. The possibility to buy a small portion of a highly valuable artwork has made the art market more attractive to investors and to new buyers, breaking down geographical barriers and expanding the collector base. Art

collectibles purchased and sold with financial purposes solve the lack of liquidity of the market, further favoured by payments with cryptocurrencies on a decentralised peer to peer ledger that simplifies transactions and increases efficiency.

Lastly, sources mainly dealing with technology address and explain the nature of blockchain and how applicable it is to the sector of digital art. The main topics addressed are copyright, value preservation, creation and verification. Art created through an algorithm, then stored and traded on a blockchain platform has a full and immutable record showing a clear ownership and creation that increase verification and trust in the seller. Being stored on a public open platform backed up by secure information helps creating business opportunities of monetisation for digital artists who can permanently preserve the monetary value of their work avoiding illegal reproduction and commercialization.

Having seen the three key topics of transparency, democratisation and monetisation of digital art related to blockchain and the art market as they have been perceived by the art, finance and tech sectors, subcategories follow.

3.3.2.1 Transparency

Directly linked to transparency is authenticity, provenance, ownership, trust and security. Authenticity entails a clear condition report made available to online buyers who cannot physically inspect artworks and collectibles to secure the correct attribution of artworks; provenance records provide online buyers with a record history of a previous owners, locations and art dealers who have purchased and sold the artworks, together with an exhibition history that will boost consumers' trust and help them make sure they are paying a fair price or that they will have a positive turnover from their financial investment (Findlay, 2014). Ownership records are useful to increase trust but also act as proof of traceability and of clear history of artworks, significantly reducing the risk of buying a forgery or a fake. Trust and security are the two most significant subcategories of transparency: indeed, using blockchain to increase transparency has the ultimate goal to strengthen trust in new buyers and to reassure them into buying on the online

platform other than traditional salerooms; part of the reassurance is also built up by the security of information on authenticity, provenance and ownership that is stored on the blockchain platform and therefore made immutable and unalterable. The combination of these categories together makes the implementation of blockchain technology in the art market in the form of online art registries the most likely to be successful as they would provide buyers with clear and immutable information that increases trust and confidence into purchasing art they cannot physically inspect.

Table 2 Definition of Transparency and its Subcategories

Category	Subcategory	Definition
Transparency	Authenticity	The authorship of an artwork has been correctly attributed
	Provenance	Record history of a previous owners, locations, art dealers and exhibitions
	Ownership	Current owners of the artwork, and its sales history
	Trust	Clear and available information on the activity of the platform
	Security	Immutability and inalterability of information

3.3.2.2 Democratisation

Subcategories of democratisation are fractional ownership, liquidity, privacy, efficiency, reliability and expansion of the collector base. Fractional ownership, as declared in Maecenas white paper, consists of breaking down into equal parts the ownership of blue chip artworks which are traded through cryptocurrencies. This selling method, which highly relies on finance, increases liquidity in the market by making it more appealing to potential investors, able to quickly convert their crypto investment into money flows as a benefit of blockchain platforms

(Malik & Phillips, 2012). In fact, in order to access and write on a blockchain platform, users are provided with a key that secures their anonymity yet allowing them to search and track all information stored online. The necessary condition for users must be verified and registered means that all transactions are as reliable as the information stored on the platform. Being able to search, discover and purchase and sell art and luxury collectibles directly online simplifies transaction methods by making the buying experience more efficient since the traditional figure of the middleman is not necessary any longer. Democratisation of the market, affordability of blue chip art and increased efficiency of the buying and selling experience has had a positive effect on the expansion of the collector base, incentivizing buyers from different countries to buy art online through cryptocurrencies and without having to face insurance and storage costs as those are covered by decentralised galleries.

Table 3 Definition of Democratisation and its Subcategories

Category	Subcategory	Definition
Democratisation	Fractional Ownership	Breaking down into equal parts the ownership of blue chip artworks which are then traded through cryptocurrencies
	Liquidity	Possibility to quickly convert the good into money flows
	Privacy	Anonymity of users
	Efficiency	Peer to peer selling and purchasing method
	Reliability	Only verified users can enter information on the chain
	Expansion of Collector Base	Incentivised by the absence of transaction, insurance or storage costs

3.3.2.3 Monetisation

Monetisation of digital art is the category that entails scarcity, creation, verification, copyright, value preservation and elevation of status. Blockchain technology, as argued before, has presented the art market with new possibilities to monetise digital art: indeed, digital artists and owners of digital art can register their ownership of collectibles on a blockchain ledger in an immutable and unalterable way that is verified or entered by the artist himself. Being able to record digital artworks prevents from illegal reproductions and, instead, favours scarcity and limited editions: this way, both artists and collectors can better monetise their properties and preserve the cultural and monetary value of the work. From an artist's perspective, the possibility to register the creation and ownership of a digital artworks equipped with a full record history brings along the possibility to track the selling history of the artwork and claim resale rights at every purchase. This way the status of digital art is elevated close to the one of salesroom art, therefore attracting a wide new range of potential collectors.

Table 4 Definition of Monetisation and its Subcategories

Category	Subcategory	Definition
Monetisation	Scarcity	Limited availability of digital artworks
	Creation	Registration of creation from the artist directly, which allows the claim of resale rights
	Verification	Information entered on the chain is verified by vetted partners
	Copyright	With scarcity and creation, artists registering digital art online benefit from copyright

Value Preservation	Monetisation of limited edition digital art favours value preservation against illegal reproductions
Elevation of Status	All the above characteristics elevate digital art to the level of traditional art, increasing chances of higher prices.

3.3.2.4 Challenges

Nonetheless, challenges and pitfalls of blockchain technology being applied to the art market have been pointed out too.

The art sector has been quite resistant in presenting the downturns and unsolved issues of blockchain technology, preferring to sell the hype of the revolutionary technology aimed at increasing trust and confidence on online sales too. However, two authors from the Art Newspaper (Adam,2018 & Michalska, 2018) and one from Artnet (Schneider, 2018) have correctly argued that the promise of blockchain might not be as convincing due to the lack of verification of information entered on the platform: to put it in the words of Nanne Dekking, founder of Artory, blockchain art registries still allow for a constant flow of "*garbage in, garbage out*" (Schindler, Wilson, 2019). Although art registries are in fact, the most promising application of blockchain for the art market, no authority has been appointed to verify the information entered on the platform, nor a way has been found yet to make the registries comprehensive and widely reliable as they only gather sales records from public secondary sales, leaving out a significant portion of the market. A further issue, addressed in a lighter way, deals with data privacy and cyber security: as proven by The Hiscox Online art reports, many online buyers and sellers are prevent from finalizing their purchasing processes online because they are too afraid of cyberattacks. As much as blockchain technology protects the privacy of its users, the regulations on cyber anonymity are still too blurred to present the online market as a safe environment.

A mutual issue regarding the potential of blockchain has been pointed out by both art sectors and the finance sector: as much as democratisation of the art market through tokenisation of artworks is taking place, it is still quite unclear how decentralised galleries and blockchain platform may link the physical object to the digital data. Unfortunately, this issue has not yet been solved as there is a considerable small amount of successful ventures working as decentralised blockchain art platform. Further issues brought up by economic and financial sources deal with the volatility of cryptocurrencies which, although they increased liquidity in the market, they also made it a highly insecure one. A further drawback from the promise of blockchain to make the art market a more democratised one, has to do with the fact that in order to access a blockchain platform, users are requested to create a digital wallet, subscribe and register on each platform which, instead of making the transaction process more efficient, it adds costs to it in terms of time.

A last concern being addressed over the integration of blockchain into the art market is the significant lack of regulation: because blockchain technology is relatively new, and its integration into the art sector is even more recent, regulations over its applicability and legit, use still have to be drawn out. This has been recognized as one of the reasons why the majority of blockchain ventures launched on the online art market is not yet operative after one or two years from their creation: the lack of a specific regulation and of concrete and actively working ventures to learn from, is a deterrent for potential investors.

3.3.3 The application of Blockchain technology in the Art Market

Having seen the evolution of blockchain technology in the art market over the last five years according to the experts of ArtTactic, in Appendix B2 *Mapping of Blockchain Technology in the Art market* information from the designated sample of sources dealing with art ventures using blockchain technology and tech ventures entering the art market has been analysed and divided into five categories: auction houses, art galleries, online marketplace, art investment, art registry in order to show how the technology has been applied by the market's stakeholders.

From the sample of articles and websites, a selection of the most significative art and tech ventures using blockchain technology in the art market has been drawn; all ventures from this list

have been filled in the proper category, along with information regarding the date of creation or, the date of their first blockchain activity, the geographical location of the headquarters, their nature, their activity, and a list of keywords that would be systematically associated with them over the sample.

3.3.3.1 Auction Houses

The first category presented in Appendix B2 *Mapping of Blockchain Technology in the Art market* is the one of Auction Houses. The merged activity of Paddle8 and Auctionata is the first venture reported: Paddle8 was an auction house with headquarters in New York City, presenting its clients with diverse luxury collectibles targeted to a young audience of millenial collectors. In 2016 Paddle8 merged with online only auction house Auctionata, therefore becoming the first online auction house accepting payments with cryptocurrencies. Alongside their selling activity, Paddle8 and Auctionata also started to provide their customers with digital passports for purchased collectibles, later registered on a blockchain platform so to make the provenance and the ownership secure. The purpose of creating a more democratic market for luxury collectibles, and for it to be open to a wider collector base ceased in 2017, when partner Auctionata filed a lawsuit for insolvency.

Later on the same year, Paddle8 merged with a technical group of integrated digital marketing based in Basel, Switzerland. The Native and Paddle8 started an innovation hub aimed at designing solutions to integrate blockchain technology into the art market by means of securitizing and digitizing the physical artworks on the digital platform. As a result, P8Pass was presented: a blockchain passportization that cryptographically protects the record of each artwork approved on the chain with the intention of boosting trust and security in customers, both traditional art collectors and new art lovers as well, and to make the experience of collecting art more accessible (Adam, 2018). Once luxury collectibles are sealed with the approval of P8Pass - which will be offered as a free service to museums and cultural institutions - they will be featured at auctions and tradeable through the cryptocurrency of Paddle8 auction house, PaddleB.

Christie's is, together with Sotheby's, the most renewed auction house for figurative art. Established in 1766, in 2018 it partnered with art registry Artory therefore becoming the first major auction house using blockchain technology to its consignments. The sale of the Barney A. Ebsworth Collection, which realised a staggering $317,801,250 was recorded on the blockchain platform of Artory. Following each sale, Artory provided the collectors with encrypted provenance records made available and safely secured on the temper proof online registry (Gerlis, 2018) (Schindler, Wilson, 2019). The choice of Christie's to team up with Artory fulfills the desire to enhance transparency, trust and security together with the willingness to provide art collectors with simplified transaction methods (Arroyo, 2018). Christie's has also been one of the leading ventures to introduce blockchain technology to the art sector: in July 2019, it launched the Art and Tech Summit, specifically titled "*Exploring Blockchain: is the art world ready for consensus?*" which attracted many actors of the art sectors and, among a general enthusiasm surrounding the potential benefits carried along by the technology, also raised many concerns on its concrete application (Charlesworth, 2018).

The last auction house analysed is Portion, established in 2018 with headquarters in New York, this auction house only accepts transactions made with cryptocurrencies. Portion's main feature is that it provides its users with immediate purchasing opportunities, connecting them directly to artworks and their files through smart contracts, therefore eliminating the need for a middleman. In so doing, the start-up aims at democratizing the safety, transparency and the overall experience of buying art collectibles and collecting artworks (Hancock, 2018).

Table 5 Mapping of Auction Houses

Auction Houses	Paddle8 & Auctionata
	The Native and Paddle8
	Christie's Online
	Portion

3.3.3.2 Art Galleries

The category of art galleries is characterised by start-up ventures created especially on the basis of blockchain technology applied to the art market, and by traditional galleries that have switched to blockchain technology over the last few years as a reaction to the hype created in the market. Maecenas, a decentralised art gallery established in 2016 with headquarters in London and Singapore, is based on the idea of democratising blue chip art through fractional ownership of artworks (Reyburn, 2108). Works presented at online auctions or for investment on the Maecenas gallery platform, are equipped with all relevant records of due diligence, therefore removing the involvement of a third party in the purchasing process. Furthermore, by the process of tokenisation, Maecenas uses blockchain technology to divide the ownership of an artwork into multiple fractions of valuable assets that investors and collectors can exchange instantly in a peer to peer transaction with the gallery's cryptocurrency, ART token (Charlesworth, 2018). For every transaction, a tamper-proof digital certificate is automatically created and permanently linked to the artwork on the blockchain, so that for every new buyer or investor it is easy and quick to access the information on the artwork.

Ronchini Art Gallery was initially founded in 1992 in Italy; after relocating in London it first provided its customers with the possibility to pay for artworks in bitcoins in 2018. Indeed, having a tradition with exhibiting the works of international artists and with collaborating with museums and foundations in order to provide its audience with a greater understanding of the latest trends in the art world and to support the enhancement of future trends, Ronchini Gallery was the first one in the history of New York's Armory Show to accept payments in cryptocurrency for the work of Dutch artist Berndnaut Smilde *Nimbus Power Station 2017* (Gerlis, 2018).

Another traditional art gallery that has recently relied on the benefits of Blockchain technology is Dadiani Gallery, located in the neighborhood of Mayfair, London. Much of the attention drawn to the galley since 2017 is because of to its pioneering decision to accept payments in six different cryptocurrencies. A further step into the expansion of the collector base, was undertaken by Dadiani when in 2018 it announced the partnership with Maecenas for

the first public art sale using blockchain: Andy Warhol's *14 Small Electric Chairs* (1980) has been fractionalised and up to 49% of it was purchasable through cryptocurrencies of Bitcoin, Ethereum and ART. Following the echo created by this first time event, Dadiani is also set to be the first gallery in the UK with its own cryptocurrency (Reyburn, 2018).

Following the idea of fractionalisation of artworks already undertaken by the two galleries above, Look Lateral is an Italian art gallery based in Seattle, US. In 2017 it changed its main purpose and presented itself as an online platform for collectors and investors interested in tokenisation of luxury and art collectibles. With the project FIMART - Fractional Marketplace of Art - Look Lateral has launched a decentralised blockchain platform aimed at facilitating the purchasing process, furthermore, through the adoption of the gallery's own cryptocurrency "Look" it ensures security of transactions to all its clients. The reason behind the fractionalisation of artworks from Look lateral are manyfold: first, it democratises a very elitist and close environment of art collecting by providing access to new, more digital, art lovers; second, the registration on blockchain platform and the following records permanently linked to the artwork and publicly accessible increases trust and transparency, two main issues of the art market; third, it is supposed to increase liquidity as there are no middleman involved: any investor can chose to sell directly and with the record already linked to the artwork; fourth, the public access of blockchain platforms is a claim for greater global availability of art.

Lastly, Tend. Swiss, founded in Zurich, Switzerland as a tech company, turned to the art market in 2017 by creating a co-investment platform for art and luxury collectibles. After running work of due diligence, the information of an artwork is recorded permanently on the blockchain, and linked to all shared owned assets, which are purchasable by anyone registered on the Look Lateral platform and provided with a crypto wallet. However, Tend. Swiss has raised concerns over the fractionalisation of art collectibles: first, it is unclear on the location where artworks with a fractionalised ownership are to be stored, second there is opacity also on who is conducting and verifying the due diligence work recorded on the blockchain. Both doubts have raised further concerns over the claim of tokenisation to increase trust and security in the collector base.

Table 6 Mapping of Art Galleries

Art Galleries	Maecenas
	Ronchini Gallery
	Dadiani Gallery
	Look Lateral
	Tend. Swiss

3.3.3.3 Online Marketplaces

Online marketplaces, the third category analysed in appendix B1, refers specifically to digital art: indeed, all ventures listed focus their activity on the trading and sharing of unique digital artworks created by an algorithm and stored on blockchain platforms.

Cryptopunks and Cryptokitties, both launched in 2017, are the most popular online marketplaces of today's' blockchain based digital art. Cryptopunks is a series of 10,000 24x24 pixel art images created by the New York based creative technologists duo Larva Lab (Pickford, 2018). All images are unique and generated by an algorithm using Ethereum blockchain platforms: each punk is therefore presented, bought, sold, and safely stored on the blockchain platform, together with its direct link to a complete and not forgeable record history. Because each Punk is unique and can only be owned by one collector at a time, Cryptopunks has paved the way for the application of blockchain technology to safeguard the scarcity of digital art: indeed, as of April 2019, transactions of Cryptopunks counted a total volume of 10,660.81 USD.

Cryptokitties is a virtual game based on one-of-a-kind cat figures characterised by a genome granting their uniqueness. Because the genome is created and registered through the blockchain platform Ethereum, no virtual kitty can be replicated, taken away or destroyed: they can only be purchased, collected, sold and breeded. Calling for a new class of collectors as well as a new form of collectible, Cryptokitties has proved the possibility for safeguarding the scarcity of digital artworks too: the interest for these collectibles has recently seen Ethereum specialists facing technical problems on the blockchain platform due to the high usage and storing place that the market for Cryptokitties has taken over (Botz, 2018).

Dada.nyc is social network platform where users interact with each other through drawings. Started in 2012, the social network foresaw the possibilities of blockchain platforms and stored all images on the platforms, so that they wouldn't be replicated nor forged. As of today, the social network allows its users to support artists, to sell digital imagery and to help artists keep a clear record of their artworks in order to claim resale rights over all transactions.

RARE Bits is a peer to peer marketplace for crypto assets found in San Francisco in 2017. With the main intention to merge production, distribution and monetisation processes under one platform, RARE Bits has opened the experience of collecting art to a wider public and to smaller artists now able to present their works to a global audience (Charlesworth, 2018). With this core intention, the American venture has made it easy for collectors to buy and sell crypto assets of digital art with zero fees as they are allowed to interact directly with the artists through every step of the purchasing process (Zavelev, 2018).

Monegraph, founded in New York city in 2014, is a publicly open platform for the trading, buying, and selling of digital art collectibles. Monegraph's main activity is to authenticate digital artworks using cryptographic blockchain hashes linked to the Bitcoin cryptocurrency system and publicly registered on the blockchain ledger. This database for digital art functions as a register securing scarcity of digital collectibles, transparency of each collectibles' virtual transactions, and as a tool to increase trust in potential new collectors and investors first approaching the art market and looking for guarantees of authenticity and security.

Ascribe was a platform for artists founded in 2013 in Berlin, which ended its activity in 2018. Through the platform, artists were able to upload their physical and digital artworks, securing their authentication, keeping track of their movements, selling them and requiring future royalties of reuse (Vaizey, 2019). This platform was a pioneer in overcoming the hurdles of collecting digital art and keeping its scarcity as it allowed artists to keep control over where, when and by whom their works were seen, copied and reused.

Table 7 Mapping of Online Marketplaces

Online Marketplaces	Cryptopunks
	Cryptokitties

dada.nyc

Rare Bits

Ascribe

Monegraph

3.3.3.4 Art Investment

Art Investment ventures are the ones which, according to experts of the art markets, were supposed to be among the greatest recipients of the application of blockchain technology to the art sector. Because blockchain platforms allow transactions to happen at a very immediate pace, art traded this way has characteristics of financial assets rather than of experience goods. If this understanding of art traded on blockchain diminishes the relevance of the argument for a clear record history being provided to art collectors, it emphasises the democratisation of the art market. Indeed, trading art online has attracted a new audience of buyers whose purchasing decisions are mainly based on portfolio diversification and assets exchange. Although these possibilities seemed to be the most applicable ones, the ventures here analysed are facing difficulties in taking off their activity.

Masterworks, investment platform for fine art founded in 2017 with headquarters in New York City, wants to provide fractions of blue chip art made available and understandable to a broader audience of potential buyers. By democratising blue chip art, Masterworks intends to expand the collector base and increase the liquidity of the online art market, yet, practical information regarding the way Masterworks intends to fulfill its purpose still has to be provided.

Artblx, founded in 2017 but not yet working, is a platform for art investments too. Its activity has the clear intent of bridging the gap between the number of art lovers and art collectors by making the trading of art more accessible and easy to understand. Greater transparency and security of transactions should gain the trust of new buyers, and bring more liquidity and diversification into the sector of art investments.

Bit2art.com is a Hong Kong based cryptocurrency platform. Art holders gaining access to the blockchain platform can store and trade art collectibles exclusively through Bitcoin

cryptocurrency and with anonymous keys, aimed at granting high levels of privacy and security. Although Bit2art.com seems to be the only investment platform to be actually working, its geographical location is influencing its target audience and its services, therefore limiting its applicability to the overall market.

Table 8 Mapping of Art Investment

Art Investment	Masterworks
	Artblx
	Bit2art.com

3.3.3.5 Art Registries

The last category of art registries is the one that has seen the highest numbers of ventures launched with a positive outcome of the application of blockchain technology too, although two important challenges are common to the entire category: first, records inscribed on art registries are only representative of public auctions, therefore leaving out the great portion of the market represented by private sales; second, there is much uncertainty on the verifiability of the information recorded on art registries platforms (Adam, 2018).

The only art registry that has provided its clients with a solution for the verification of information of an artwork is Artory, a secure digital registry of verified information on artworks, established in 2016 with headquarters in New York City and Berlin. Information on artworks and collectibles is secured from a list of vetted partners from the art and the technology sectors that Artory has collected over the years: these specialists have the task to verify that all information entered on Artory website is accurate, reliable and complete (Adam, 2018). Once the seal of approval is provided, the information is recorded on Artory's blockchain platform, making it tamper proof, not forgeable, durable and accessible. This new form of partnership between auction houses and art registries has registered progress in fixing issues of mistrust and opacity of the secondary art market, as the openness of registries increases trust and favours purchases (Gerlis, 2018) (Charlesworth, 2018) (Christie's, 2018).

Verisart is another art registry based in Los Angeles and founded in 2015. Verisart's main activity is to certify and verify artworks instantly by creating secure digital art passports including provenance, authentication and transactions record. Blockchain technology is used to protect records of creation and ownership found in each art passport, by translating the information into tamper proof certificates secured by cryptography (Zavelev, 2018) (Botz, 2018). Although Verisart significantly reduces the room for fraud and forgery, the instant issuing of a certification creates room for wrong and incomplete information to be recorded on the platform, as no expert has yet been appointed to verify it; perhaps it is because of this drawback that the registry is still not available to the open public, but works on invitation only. Furthermore, with its protection of records of creation and of ownership over an artwork, Verisart is a key actor in protecting scarcity for digital artworks and creating business opportunities for digital artists and collectors (Zavelev, 2018).

Codex Protocol launched in 2017 with headquarters in London, UK. Codex Protocol is an immutable blockchain platform functioning as a registry of provenance, transactions, copyright and ownership. It is targeted not just to collectors and investors but also to curators, artists, and auction houses, improving information access to third parties services, especially those of art lending and fractional ownership. Indeed, with over 5,000 actors of the art market registered already, Codex Protocol's main purpose is to increase liquidity in the market (Adam, 2018).

On the platform it is possible to store luxury collectibles' information through Codex Protocol own cryptocurrency, CodexCoin; the information entered is safely stored, permanent, not forgeable and shared on the blockchain, although it is not verified by any art specialist (Hancock, 2018).

Bidpoc was found in 2016 in Shanghai as a provenance service provider specifically intended for physical artworks. The activity of Bidpoc focuses on finding a secure and permanent way to link the physical artwork to an immutable digital identity on the blockchain, based on verification technologies (Christies, 2018). In order to do so, Bidpoc has recently partnered with providers of AI that should facilitate their mission and further increase trust and connection of the collector base.

Binded, copyright platform previously known as Blockai, started its activity with digital art and photography in 2016. The San Francisco headquarters have created a platform that allows digital artists to claim copyrights on their works from the moment these are entered on the registry; moreover, with a private and permanent link to the blockchain of the artwork, artists can keep record of every movement and transaction involving their products. In so doing they democratise copyright accessibility (Michalska, 2018).

Tagsmart follows the platform model of Binded: founded in 2017 in London, it created a registry platform as a form of prevention from unauthorised copies of digital art material to be exploited and distributed regardless of copyright issues (Schindler, Wilson, 2019).

Artchain is an Australian online platform aimed at tracking, protecting and ensuring accountability for original digital artworks. Although it was founded in 2017, Artchain is not yet active; however, its white paper clearly describes the activity it will undertake once made operative: through the possibility of blockchain technology together with AI, Artchain will provide digital artworks with a digital identity to be transferred and permanently recorded on a blockchain platform. Once recorded, the technological system of blockchain will transfer titles between owners and track artists' royalties significantly reducing the room for human error to occur.

Lastly, Artmyn, a Swiss tech provider, has developed a system of digital fingerprints in the form of art passports: with the intention to provide the art collector with a high resolution and real life experience of works of art viewed and bought online, Artym created a way to combine the UV light spectrum of each artwork and its scanning process to generate a unique digital fingerprint that safely captures the artworks DNA. Once recorded, the passport is stored on the blockchain registry, and therefore made immutable and not forgeable, and at the same time ensuring its traceability, condiction, authentication and transaction history.

Table 9 Mapping of Art Registries

Art Registries	Artory
	Verisart
	Codex Protocol

	Bidpoc
	Binded
	Tagsmart
	Artchain
	Artmyn

4. Discussion

Having seen the little academic literature available and having combined it with the information gathered through non academic sources, it is possible to state that although the reception of blockchain technology would first appear to be positive it is, in fact, struggling to find its way into the art market, raising more doubts and concerns rather than optimism. The most significant data available that supports the distinction between how the technology is perceived and how it is actually applied by the art market and its stakeholders, is provided by this year's Hiscox Online Art Trade report, which states that in 2018, 38% of art firms were thinking of implementing blockchain in their activity yet, only 8% actually proceeded in using the technology. Indeed, this research first concludes that the reception of blockchain technology by the art market and its stakeholder is a highly unreliable one, that still has to be understood, explained and regulated in order to be fully developed. For this reason, and for the recent collapse of cryptocurrencies, potential art buyers and investors are stepping away from art firms operating through blockchain technology.

Although the great majority of the articles collected has professed blockchain technology as a novelty that will revolutionise the art market (Adam, 2018) (Dekking, 2018) (Schindler & Wilson, 2018), from the time trend compiled through the Hiscox Online Art Trade Reports (2015-2019) it emerges that blockchain has been present in the art market already since 2015, with the ventures of Auctionata and Paddle8. However, it was only in the 2018's report that blockchain technology gained significant relevance in the analysis of the online art market:

indeed, as shown in Appendix B2, most blockchain art firms have been founded and presented to the public during 2018, all promising higher transparency and democratisation in the art market. Yet, from the same table of Appendix B2, it emerges that most of these firms are still as of today not fully developed, as they have encountered major drawbacks in their development, limiting their concrete application. The latest Hiscox Online Art Trade Report 2019, highlights this turn of attitude towards blockchain: consistent with the findings in Appendix B2, in the opening statement the analysts of Art Tactic clearly revise their position on the technology, saying that, "contrary to the previous year's forecast, blockchain has raised significant concerns as convincing users cases fail to materialise" (Hiscox Online Art Trade Report, 2019:2).

Nonetheless, the resistance of the art market towards technology and innovation, and blockchain in this specific case, may have saved its stakeholders: in fact, 2018 and 2019 have witnessed a collapse of cryptocurrencies from other fields, such as finance and investment, with over 40% of blockchain ventures shutting down in the past year (The Hiscox Online Art Trade Report, 2019). With these events happening, higher precautions are taken into account from the stakeholders of the art market before buying cryptocurrencies to purchase and sell art online.

Having established the presence of blockchain technology in the art market and having considered the year 2018 as the most relevant to answer the research question of *"What is the reception of blockchain technology by the art market and its stakeholders*", findings from Appendix B1 *The perception of blockchain technology in the art market*, and Appendix B2 *Mapping of Blockchain Technology* have developed the following results.

With regards to transparency, which as stated previously, is characterised by authenticity, provenance, ownership, trust and security it is possible to assess that this is the feature most cited throughout the sample of this research. With an average of twenty sources mentioning it, the lack of transparency is presented to the art consumers and stakeholders as the issue of the art market to be mostly affected by the integration of blockchain technology. Among this category, authenticity and provenance are the features most cited by art sources, whereas ownership, trust and security by economic sources. Indeed, according to Appendix B1: *The perception of*

blockchain technology in the art market the lack of transparency of the art market will be solved by blockchain technology through the use of open and public ledgers, where full and immutable information on art collectibles will be entered and, then, safely stored, preventing from any human error on wrong attributions, fakes and forgeries to enter the market. This claim supports the analysis first started by Baumol (1986) to look at the art market in pure economic terms: if the lack of transparency has traditionally being a significant impediment to the economic and financial analysis of the art market, a full and clear set of information available to a wide public could potentially provide the tools for a more detailed and accurate overview of the dynamics of the art market.

The category of authenticity finds its best application in the form of art registries: the eight firms taken into consideration in the analysis of Appendix B2: *Mapping of Blockchain Technology* have all expressed the topic of transparency, and its subcategories, as the main driver of their activities. Their main claims involve a ledger where anyone can enter information of their own artwork, register the ownership and create an immutable record which will eventually increase the monetary value of the artwork with a certified provenance and condition report.

Because owners and artists can directly enter and access the information on the blockchain platforms, art registries have in fact revolutionised the art market as they have removed the figure of the art dealer and middleman: information now provided by these registries used to be shared by third parties figures who were collecting and verifying it before it was presented to potential buyers and sellers. Because of the research and networking activity that each art dealer had to invest in, so to gain such information, they would add an average dealers premium fee of 10-30% on top of total sales (McAndrews, 2018:31). With public platforms, this information is already available and accessible to both sellers and buyers, who do not have to cover the costs represented by third parties, making the online buying and selling experience more efficient.

Nonetheless some issues arise from the claim of transparency of art registries: the predominant issue is the one of data integrity, raised by only four of the twelve art sources addressing transparency. Although the claim of the art sector for an open registry of art could in facts revolutionize the art market by making work of due diligence faster and easier, the

information entered on the chain must be correct and verified as it highly influences the monetary evaluation of each art collectible. Following this claim, the fact that wrong information stored on a chain could be visible to everyone and easily corrected, it would significantly decrease the trust of its users. Indeed, whenever information recorded on a block is modified, the chain breaks and a new one is created, so that the longest chain is the most trustworthy one (Nakamoto, 2008). Changing information entered by users would negatively affect the security and reliability professed by blockchain art registries. Only one art registry, Artory, has faced and solved this issue by verifying information through a selection of vetted partners, made up of art historians and art experts.

A following issue is that of a conformity between the physical artwork and its online record: indeed it is still unknown how these registries are going to link the physical artwork to the online record, and none of the art registries considered in Appendix B2 has provided any clarification on the topic. For transparency to work properly, especially for physical and tangible art, it is essential that the information stored on the blockchain platform is attributed to the correct artwork, or no improvement will be made from the current dynamics of the traditional art system.

Lastly, the lack of transparency has been replaced by the lack of regulation: although one of the advantages of a blockchain registry is that the information on artworks is publicly available, such accessibility has opened the way to leak information. The anonymity of users has favoured fraud and speculation through cryptocurrencies and leakage of information, which is in contrast with high levels of security and privacy deemed by the art market's stakeholders. Due to the novelty of the usage of blockchain in the art market, no regulation has yet been proposed to fight this last issue.

Democratisation is specifically addressed by economic sources by means of fractional ownership, liquidity, privacy, efficiency, reliability and expansion of the collector base. Fractional ownership and liquidity are the two most cited features by art and economic sources for this category: indeed, they represent the promises of blockchain technology to make the art market a more democratic, expanded and appealing one. The commitment of democratisation,

which has expanded the potential of the online market as a tool to conduct research, to gain new consumers, to break down geographical barriers and to provide a more educated audience, has been undertaken by art galleries, auction houses and art investment firms. From the sample, it is arguable that blockchain technology is used to incentivise the values of art bought online: indeed, it has been argued that through fractional ownership and efficiency, more buyers are attracted to the purchasing of blue chip art on online platforms too. In order to achieve this, galleries and auction houses had to provide their potential buyers with different price ranges and a broader choice of art genres, as users of blockchain platforms are subject to worldwide tastes. In this sense blockchain has made the art market a more approachable and relatable one, stemming away from its traditional exclusivity of salerooms' circuits.

A claim expressed by economic sources is that democratisation of the art market achieved through blockchain will solve issues of efficiency and liquidity. With regards to efficiency, which was already considered with the removal of third parties, it is possible to state that blockchain technology has made one step forward to a more integrated market as transaction costs, taxation rates, currency exchanges and trade restrictions do not apply to the online art market. Indeed, with fractional ownership, buyers do not have to worry about storage or insurance costs, as they only purchase a fraction of a painting which they can resell at any time. However, this method is contrasting with the classification of artworks as experience goods, as the artwork is safely stored in a free port zone and not even its buyers are allowed to consume it. For this reason, fractional ownership is frequently stressed by art investment firms, as it represents a feature appealing to individuals who buy art for its a financial asset value rather than to art consumers.

From the viewpoint of art sources, fractional ownership is perceived as a way to expand the collector base and increase blue chip sales: with no need to run into currency exchanges costs, auction houses and galleries are emphasizing the openness of blockchain platforms in order to attract new clients. Yet, from Appendix B2: *Mapping of Blockchain Technology* it emerges that said openness is a relative one. In fact, there are still barriers to entry in the form of cryptocurrencies, specific language and exclusivity of access. First, anyone interested in fractional ownership has to open a crypto wallet and buy cryptocurrencies for each platform - out

of the 11 firms analysed in Appendix B2, 9 have their own tokens necessary to purchase artworks; in order to accomplish this operation, a specific and technical language is necessary in order to fully understand the purchasing process using cryptocurrencies, which adds up to the restriction of specific language used in the art market; lastly, most of these firms are upon invitation only which strengthen exclusivity of the art market rather than reducing it.

One last remark on efficiency is that platforms relying on blockchain assure transactions speed, as all blocks are linked to each other. However, when art galleries, auction houses, or investment platforms are linked to art registries where their clients can check the provenance and condition report of the collectibles, information must be verified and immutable, otherwise new chains will stem, and inevitably increasing transaction times.

As for liquidity, 2018 has experienced a collapse of cryptocurrencies that have stopped potential investors: indeed only 4% of art buyers have invested in art cryptocurrencies (The Hiscox Online Art Trade Report, 2019). Before 2018, in line with Goetzmann (1993) analysis that demand for investing in art grows with the wealth of its collectors, cryptocurrencies of art firms attracted the interest of many buyers as they are easily bought, sold and translated into cash flow. Yet, their extreme volatility and uncertainty has abruptly stopped purchases through cryptocurrencies as the monetary values of artworks has been affected by their collapse.

As far as monetisation, online marketplaces have provided art buyers with one more reason behind the purchasing of artworks: by registering works of digital art on online marketplaces, artists and owners are creating scarcity of these collectibles and, consequently, increasing their cultural and monetary values. This topic has been consistent in tech sources, and often addressed by art sources as well. Indeed, it is specifically with regards to photography that the art sector has perceived the application of blockchain as the way to secure limited editions and therefore increase their monetary value. Tech sources have also stressed the importance of copyright as granted by blockchain: securing and registering artworks on platforms, artists themselves can enter information and follow future purchases of their works claiming resale rights. As for economic sources, these mostly point out the elevation of status and value preservation that comes along with monetisation: registering the copyright of a digital artwork

and establishing its scarcity raises the cultural and monetary values to the ones of figurative tangible art. This way investors may purchase digital artworks as financial assets, without worrying about storage, insurance, and maintenance costs nor issues brought along by fractional ownership. Furthermore, buying digital artworks on online marketplaces has widened the collector base as art is purchasable at any time which is a feature that increases the market flow for digital art and reduces geographical restrictions to potential investors.

The one pitfall stemming from online marketplaces is that they do not benefit from the recognition shared by traditional salerooms, therefore their potential in the market is significantly reduced both in terms of value of works being traded and of customer share. Furthermore, the benefit of online marketplaces to prevent fakes and illegal reproduction of digital art by registering the copyright on a blockchain ledger is yet to be fully developed in order to safeguard the market: indeed, as addressed above, no regulation for the use of blockchain technology in the art market has yet been proposed.

Overall, there are great discrepancies between the perception and the application of blockchain technology by the art market and its stakeholders. The perception is a fairly positive and promising one, that rarely addresses the many pitfalls that are carried along by blockchain technology. This positive take on the merger of blockchain in the art market is aimed at shaping the perception of the audience and at favouring online sales regardless of the limitations involved.

On the other hand, looking at the current screenshot for the application of blockchain technology in the art market, doubts and concerns arise: indeed, a lot is still to be understood and explained. Mostly because of the resistance of the art market to adapt and undertake technology and innovation, the use of blockchain is highly unregulated and uncertain, which prevents from a valid analysis of its possibilities.

In conclusion, the overall reception of blockchain technology is a highly uncertain one: because of the lack of academic literature on the topic, information available is the one provided by the press. Although established and recognized, art, economic and tech sources are all inevitably biased towards increasing trust in the online marketplace in order to foster online trade

of art collectibles. The promise of blockchain as announced by these sources is in contrast with its concrete application: indeed, art firms using blockchain technology are suffering from major drawbacks and limitations which prevent its full development. With questions to be answered and regulations to be proposed the reception of blockchain by the art market and its stakeholders is that of a temporary hype rather than of a reliable and valuable solution for the issues of transparency and exclusivity of the art market.

5. Conclusions

This research stemmed from the publication of the report "The Art Market 2.0 - Blockchain and financialisation in the visual arts" compiled by the Alan Turing Institute, London. Given the increasing attention towards the application of blockchain technology to the mechanisms of the art market from the art press and the scarce academic sources addressing the combination of art and blockchain technology, the following research question was formulated: *"What is the reception of blockchain technology by the art market and its stakeholders*".

The research was conducted through a qualitative content analysis which relied on a sample of forty-two articles collected among most recent press articles of art, economic and tech newspapers and websites. With the information collected, three questions have been addressed: what is the presence of blockchain technology in the art market form 2015 to 2019? What is the perception of blockchain technology from the art market and its stakeholders? What is the application of blockchain technology from the art market and its stakeholders?

Having established the slow adaptation of the art market to technology and innovation carried along by blockchain, a great level of inconsistency has been found between the perception of the technology and its concrete application. Indeed, it emerged that the perception of the press, especially art press, is a highly positive one, directed towards the increment of trust in art consumers and in the attraction of new potential buyers for the online art market. Economic sources, and tech sources, have perceived the application of blockchain as a tool to incentivize portfolio diversification and art investments in digital art. In order to achieve these goals, the three main claims addressed by these different sources are the ones of transparency, democratisation and monetisation.

Yet, when observing the concrete application of blockchain technology by the art market and its stakeholders, an opposite attitude has emerged: among the main art ventures exploiting the benefits of blockchain, which are auction houses, art galleries, online marketplaces, art investment firms and art registries, a considerate number of doubts and concerns have raised from the overall evaluation of their activities.

From the analysis of these findings, the answer to the research question has been formulated: the reception of blockchain technology from the art market and its stakeholders is a highly unreliable one, as the technology has not been yet welcomed, understood, explained nor fully applied in and by the market. Contrary to the perception of it, blockchain still raises many doubts and is having a difficult time finding its application in the online art market, mainly due to lack of regulation and resistance from the art market itself.

Although the possibility of art registries to increase transparency in the market seems to be the most feasible application for blockchain technology, issues of data integrity, data privacy and linkage between the physical object and the online record still have to be addressed. Furthermore, the information stored on these registries would be representative of a small portion of the art market, as they would leave out all sales happening on the primary market and in private sales of the secondary market.

A more concrete and promising application for blockchain technology is to be found in the market for digital art: indeed, through open blockchain platforms, digital artists now have the possibility to register the copyright for their artworks, therefore creating scarcity and chances to claim resale rights. An impediment to this application is the traditional exclusivity and reputation of art market firms, as digital art online marketplaces are struggling to attract the collector base of traditional salerooms.

Meaningful to the unreliability received through blockchain technology is the volatility of cryptocurrencies, which highly affects the monetary value of artworks and mines the financial returns of its investors.

Because of these reasons together, blockchain technology is received by the art market and those actively working and investing in it as a dangerous tool that will struggle to find its applicability.

Yet, if regulations are to be formulated and trust is to be gained from traditional salerooms' collector base, blockchain technology could elevate the status of digital art to figurative art, therefore creating a new market which would attract new collectors and investors.

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Appendix B

Appendix B1

Table 1: The perception of blockchain technology in the art market

Category	Definition	Citation
Transparency	Clear, complete and accessible information	Art sources Adam, 2018 Armstrong, 2019 Armstrong, 2019 Artprice, 2018 Carrigan, 2019 Charlesworth, 2018 Cryptokitties, 2018 Dekking, 2018 Maecenas, 2018 Michalska, 2016 Schindler & Wilson, 2019 Schneider, 2019 Economic Sources De la Merced, 2018 Elhanani, 2018 Gerlis, 2018 Gerlis, 2018 Hancock, 2018 Kazakina, 2018 Pickford, 2018 Zavelev, 2018 Hiscox Online Art Trade Report, 2017, 2018 Tech Sources Cook, 2019 Mansfield & Devine, 2017 Vaizey, 2019
Authenticity	The authorship of an artwork has been correctly attributed	Art Sources Adam, 2018

		Armstrong, 2019 Artprice, 2018 Botz, 2018 Carrigan, 2019 Charlesworth, 2018 Christie's Online, 2018 Cryptokitties, 2018 Dekking, 2018 Maecenas, 2018 Michalska, 2016 Schindler & Wilson, 2019 <u>Economic Sources</u> Castellanos, 2017 Gerlis, 2018 Elhanani, 2018 Kazakina, 2018 Reyburn, 2018 <u>Tech Sources</u> Constine, 2019 Cook, 2019 Mansfield & Devine, 2017 Vaizey, 2019
Provenance	Previous sales and ownership records	<u>Art Sources</u> Adam, 2018 Armstrong, 2019 Artprice, 2018 Botz, 2018 Carrigan, 2019 Charlesworth, 2018 Christie's Online, 2018 Dekking, 2018 Maecenas, 2018 Michalska, 2016 Schindler & Wilson, 2019 Schneider, 2018 Hiscox Online Art Trade Report, 2017, 2018, 2019 <u>Economic Sources</u> Elhanani, 2018 Gerlis, 2018 Gerlis, 2018

		Kazakina, 2018 <u>Tech Sources</u> Cook, 2019 Mansfield & Devine, 2017
Ownership	Proof of traceability/ ownership history	<u>Art Sources</u> Adam, 2018 Artprice, 2018 Cryptokitties, 2018 Carrigan, 2019 Dekking, 2018 Maecenas, 2018 Schindler & Wilson, 2019 Schneider, 2018 <u>Economic Sources</u> Castellanos, 2017 Cornish, 2018 De la Merced, 2018 Elhanani, 2018 Gerlis, 2018 Hancock, 2018 Kazakina, 2018 Pickford, 2018 Reyburn, 2018 Zavelev, 2018 Hiscox Online Art Trade Report, 2018 <u>Tech sources</u> Constine, 2019 Cook, 2019 Mansfield & Devine, 2017 Vaizey, 2019
Trust	Trust in online platforms and users of market platforms	<u>Art Sources</u> Adam, 2018 Armstrong, 2019 Armstrong, 2019 Artprice, 2018 Botz, 2018 Carrigan, 2019 Charlesworth, 2018 Dekking, 2018

		Maecenas, 2018 Michalska, 2016 Schindler & Wilson, 2019 Schneider, 2018 <u>Economic Sources</u> Castellanos, 2017 De la Merced, 2018 Elhanani, 2018 Gerlis, 2018 Hancock, 2018 Kazakina, 2018 Hiscox Online Art Trade Report, 2018 <u>Tech Sources</u> Cook, 2019 Mansfield & Devine, 2017
Security	Unalterable record of information	<u>Art sources</u> Adam, 2018 Artprice, 2018 Carrigan, 2019 Charlesworth, 2018 Christie's Online, 2018 Cryptokitties, 2018 Dekking, 2018 Maecenas, 2018 Michalska, 2016 Schindler & Wilson, 2019 Schneider, 2019 Schneider, 2019 <u>Economic Sources</u> Castellanos, 2017 Cornish, 2018 Gerlis, 2018 Hancock, 2018 Kazakina, 2018 Pickford, 2018 Reyburn, 2018 Vincent, 2019

		Zavelev, 2018 Hiscox Online Art Trade Report, 2015 <u>Tech Sources</u> Constine, 2019 Cook, 2019 Mansfield & Devine, 2017 Vaizey, 2019
Democratisation	Wider accessibility to the art market due to different buying and selling experiences	<u>Art Sources</u> Adam, 2018 Adam, 2018 Christie's Online, 2018 Cryptokitties, 2018 Maecenas, 2018 Schindler & Wilson, 2019 Schneider, 2019 Shaw, 2018 <u>Economic Sources</u> De la Merced, 2018 Elhanani, 2018 Gerlis, 2018 Hancock, 2018 Kazakina, 2018 Reyburn, 2018 Reyburn, 2019 Zavelev, 2018 Hiscox Online Art Trade Report, 2017,2018 <u>Tech Sources</u>
Fractional ownership	Ownership is divided into equal parts and later sold online	<u>Art Sources</u> Adam, 2018 Adam, 2018 Christie's Online, 2018 Cryptokitties, 2018 Maecenas, 2018 Schindler & Wilson, 2019 Schneider, 2019 Shaw, 2018

		Economic Sources De la Merced, 2018 Elhanani, 2018 Gerlis, 2018 Hancock, 2018 Kazakina, 2018 Reyburn, 2018 Reyburn, 2019 Zavelev, 2018 Hiscox Online Art Trade Report, 2017, 2018 Tech Sources
Liquidity	Converting goods into money flows	Art Sources Adam, 2018 Charlesworth, 2018 Cryptokitties, 2018 Maecenas, 2018 Schneider, 2018 Schneider, 2019 Shaw, 2018 Economic Sources Castellano, 2017 Cornish, 2018 De la Merced, 2018 Elhanani, 2018 Gerlis, 2018 Kazakina, 2018 Reyburn, 2018 Reyburn, 2019 Vincent, 2019 Zavelev, 2018 Zavelev, 2018 Tech Sources Vaizey, 2019
Privacy	Anonymity of buyers and sellers	Art Sources Artprice, 2018 Charlesworth, 2018 Christie's Online, 2018 Dekking, 2018

		Maecenas, 2018 Schindler & Wilson, 2019 Schneider, 2018 Schneider, 2019 <u>Economic Sources</u> De la Merced, 2018 Elhanani, 2018 Hancock, 2018 Kazakina, 2018 Hiscox Online Art Trade Report, 2016, 2017, 2018, 2019 <u>Tech Sources</u> Mansfield & Devine, 2017
Efficiency	Peer to peer selling and buying method cuts off the cost of middle men	<u>Art Sources</u> Armstrong, 2019 Carrigan, 2019 Charlesworth, 2018 Christie's Online, 2018 Cryptokitties, 2018 Dekking, 2018 Maecenas, 2018 Michalska, 2016 Schindler & Wilson, 2019 Schneider, 2018 Schneider, 2019 <u>Economic Sources</u> Castellano, 2017 De la Merced, 2018 Elhanani, 2018 Pickford, 2018 Reyburn, 2018 <u>Tech Sources</u> Cook, 2019 Mansfield & Devine, 2017 Vaizey, 2019
Reliability	Information is securely stored online, and all users must be	<u>Art Sources</u> Artprice, 2018

	registered with a personal and unique key before they can access any blockchain platform	Armstrong, 2019 Carrigan, 2019 Christie's Online, 2018 Dekking, 2018 Maecenas, 2018 Schindler & Wilson, 2019 Schneider, 2018 Schneider, 2019 <u>Economic Sources</u> Elhanani, 2018 Gerlis, 2018 Kazakina, 2018 <u>Tech Sources</u> Cook, 2019 Vaizey, 2019
Expansion of the collector base	Incentive for buyers of different countries and with different currencies to buy online	<u>Art Sources</u> Adam, 2018 Armstrong, 2019 Charlesworth, 2018 Christie's Online, 2018 Cryptokitties, 2018 Maecenas, 2018 Schindler & Wilson, 2019 Shaw, 2019 <u>Economic Sources</u> Castellano, 2017 Cornish, 2018 De la Merced, 2018 Elhanani, 2018 Reyburn, 2018 Zavelev, 2018 Hiscox Online Art Trade Report, 2018 <u>Tech Sources</u> Vaizey, 2019
Monetisation	Recording of digital artworks preventing from illegal reproductions market	<u>Art Sources</u> Adam, 2018 Artprice, 2018 Cryptokitties, 2018

		Maecenas, 2018 Michalska, 2016 Schindler & Wilson, 2019 Schneider, 2018 Schneider, 2019 Shaw, 2019 <u>Economic Sources</u> Castellano, 2017 Cornish, 2018 De la Merced, 2018 Kazakina, 2018 Reyburn, 2018 Zavelev, 2018 <u>Tech Sources</u> Constine, 2019 Cook, 2019 Vaizey, 2019
Scarcity	Registration of creation and ownership of digital art allows limited editions	<u>Art Sources</u> Adam, 2018 Artprice, 2018 Charlesworth, 2018 Cryptokitties, 2018 Michalska, 2016 Schindler & Wilson, 2019 Schneider, 2018 Schneider, 2019 <u>Economic Sources</u> Castellano, 2017 Cornish, 2018 Reyburn, 2018 Zavelev, 2018 <u>Tech Sources</u> Constine, 2019 Cook, 2019 Vaizey, 2019
Creation	Registered creation allows the claim of resale rights	<u>Art Sources</u> Artprice, 2018 Cryptokitties, 2018 Michalska, 2016

		Economic Sources Castellano, 2017 Cornish, 2018 Reyburn, 2018 Tech Sources Constine, 2019
Verification	Artists register digital artworks with their record histories, which can be checked by anyone	Art Sources Adam, 2018 Armstrong, 2019 Artprice, 2018 Botz, 2018 Carrigan, 2019 Charlesworth, 2018 Christie's Online, 2018 Cryptokitties, 2018 Dekking, 2018 Maecenas, 2018 Schindler & Wilson, 2019 Schneider, 2018 Schneider, 2018 Schneider, 2019 Shaw, 2019 Economic Sources Castellano, 2017 Cornish, 2018 Gerlis, 2018 Hancock, 2018 Kazakina, 2018 Pickford, 2018 Reyburn, 2018 Vincent, 2019 Tech Sources Constine, 2019 Cook, 2019 Mansfield & Devine, 2017 Vaizey, 2019
Copyright	With scarcity and creation, artists registering digital art online benefit from copyright	Art Sources Artprice, 2018 Charlesworth, 2018

		Christie's Online, 2018 Cryptokitties, 2018 Michalska, 2016 Schindler & Wilson, 2019 Schneider, 2018 Schneider, 2019 <u>Economic Sources</u> Castellano, 2017 Cornish, 2018 Pickford, 2018 Reyburn, 2018 Zavelev, 2018 Hiscox Online Art Trade Report, 2018 <u>Tech Sources</u> Constine, 2019 Cook, 2019
Value preservation	Monetisation of limited edition digital art favours value preservation against illegal reproductions	<u>Art Sources</u> Adam, 2018 Armstrong, 2019 Botz, 2018 Carrigan, 2019 Charlesworth, 2018 Cryptokitties, 2018 Dekking, 2018 Maecenas, 2018 Michalska, 2016 Schindler & Wilson, 2019 Schneider, 2018 Schneider, 2018 <u>Economic Sources</u> Castellano, 2017 Cornish, 2018 De la Merced, 2018 Kazakina, 2018 Pickford, 2018 Reyburn, 2018 Zavelev, 2018

		Tech Sources Constine, 2019 Cook, 2019
Elevation of status	Scarcity, verification and creation are characteristics shared with traditional art	Art Sources Cryptokitties, 2018 Schneider, 2018 Schneider, 2019 Economic Sources Castellano, 2017 Cornish, 2018 Reyburn, 2018 Zavelev, 2018 Zavelev, 2018 Tech Sources Constine, 2019

Challenges		
Linking the physical object to its online record	Art Sources Adam, 2018 Schneider, 2018 Economic Sources Hancock, 2018 Zavelev, 2018	
Data Privacy	Art Sources Christie's Online, 2018 Schindler & Wilson, 2019 Shaw, 2019	
Data Integrity	Art Sources Christie's Online, 2018 Dekking, 2018 Schindler & Wilson, 2019 Schneider, 2019 Economic Sources	

Elhanani, 2018
Hancock, 2018
Vincent, 2019

Tech Sources
Mansfield & Devine, 2017

Appendix B2

Table 2: Mapping of Blockchain Technology

Auction House

	When	Where	Nature	Activity	Keyworkds
Paddle 8 Auctionata	2016-2017	New York, US	Luxury collectibles and artworks online only marketplace.	Acceptance of transactions in cryptocurrencies; provides blockchain passports to secure provenance of artworks.	Democratisation; expansion of collector base
Paddle8 Lab (Paddle8 and The Native)	2017	Switzerland	Innovation Hub for design and blockchain technologies applied to the art market	Securitisation and Digitistion: P8Pass (blockchain Passportization services); Cryptocurrencies auctions; Bitcoin certification of works of art	Accessibility; Expansion of collector base; Trust
Christie's Online	2018	New York	Auction House	November 2018: blockchain technology applied to consignments	Efficiency; transparency, trust and security

				featured with encrypted provenance records via Artory Registry.	
Portion	2018	New York	Auction house working exclusively with cryptocurrencies	By eliminating exchange fees and middle-men, it allows users to buy and sell immediately through bid/ask model.	Democratisation; safety; transparency; efficiency

Art Gallery

	When	Where	Nature	Activity	Keywords
Maecenas	2016	London, Singapore	Decentralised Online Art Gallery	Blockchain technology used to exchange shares in paintings and sculptures instantly; tamper-proof digital certificates linked to artworks; trades through ART Token cryptocurrency	Democratisation; accessibility; liquidity

Ronchini Gallery	2018	London	International Art gallery	March 2018: first gallery to accept payment for an artwork in bitcoin during an art fair (Armory Show)	Expansion of collector base
Dadiani Gallery	2017	London	Contemporary Art Gallery	First gallery in UK to accept payments in cryptocurrencies	Efficiency; expansion of collector base
Look Lateral	2017	Seattle (US), Mantua (Italy)	Online Art Gallery	FIMART: is a decentralized blockchain environment that facilitates transactions and ensures security for all users. Transactions are made with Look tokens	Expansion of collector base; Accessibility; liquidity; transparency;
Tend. Swiss	2017	Zurich (Switzerland)	Co-investment platform for art and luxury collectibles	valuable assets in the form of collectibles are divided into shared ownership, purchasable on blockchain platform.	Fractional ownership; democratisation; transparency; trust;

Online Marketplaces

	When	Where	Nature	Activity	Keywords
Cryptopunks	2017	New York	Series of 10,000 Cryptopunks, 24x24 pixel art images generated by an algorithm through the ethereum blockchain.	Each "punk" can be officially owned by a single person on the Ethereum blockchain.	Democratisation; scarcity
Cryptokitties	2017	Vancouver, Canada	Virtual game based with cats characterised by a unique genome defining their one-of-a.kind appearance.	Players can purchase, collect, breed and sell various types of virtual kitties, which cannot be replicated, taken away or destroyed	Scarcity; expansion of collector base; security
dada.nyc	2012	New York	Social networking platform whose users speak through drawings	Selling of original digital imagery. Provides a profit share to artists who get a cut of later resales.	Liquidity; copyright; monetisation; security
Rare Bits	2017	San Francisco	Peer-to-peer marketplace for crypto assets	Increases efficiency of purchasing process for collectors of crypto assets with 0 fees;	Expansion of collector base

				facilitates the control of production, distribution and monetisation for small artists	
Ascribe	2013-18	Berlin	Online platform for digital artists	Allows artists to upload their digital works, secure them and receive royalties of reuse.	Copyright; Monetisation, security; efficiency
Monegraph	2014	New York	Public platform for registration, trading, buying and selling digital art collectibles	Authenticates digital artworks using cryptographic blockchain hashes linked to the Bitcoin cryptocurrency system. Once generated, the verification hashes are accessible by everyone in the public blockchain ledger.	Scarcity, trust copyright; expansion of collector base

Art Investment

	When	Where	Nature	Activity	Keywords
Masterworks	2017	New York, Boulder (Colorado)	Investment platform for fine art	Allows to purchase shares of artworks	Democratisation
Artblx	2017 (not yet actively working)	New York	Platform for art investment	Aims at making the ownership of investment artwork accessible to everyone.	Democratisation, diversification of portfolio, transparency, trust
Bit2art.com		Hong Kong	Cryptocurrency platform for art holders and interested buyers	Transactions are made exclusively on the platform through bitcoins; high concern for privacy in order to reduce risks of fraud	Trust, privacy, security

Art Registries

	When	Where	Nature	Activity	Keywords
Artory	2016	NYC, Berlin	Secured digital registry of verified information on artworks from vetted partners.	Art and tech specialists verify the information on artworks entered in the blockchain platform, which is open	Trust, efficiency;security; privacy

				to the public.	
Verisart	2015	Los Angeles	Digital certification and verification platform for artworks	Applies blockchain technology to protect records of creation and ownership through temper proof certificates secured by cryptography.	Trust; liquidity; transparency; verification; ownership; verification; scarcity; monetisation
Codex Protocol	2017	London	Immutable blockchain platform functioning as a registry of provenance, transactions, copyright and ownership used by creators, auction houses and collectors.	Stores information about an item's identity and ownership history in a secure blockchain platform called a Codex Record. Transactions are made through CodexCoin Cryptocurrency	Trust; expansion of collector base; liquidity, ownership, provenance; efficiency
Bidpoc	2016	Shanghai	Provenance service provider for art industry	Uses verification technologies to link physical artworks to	Trust, security, permanent, accessibility,

				an immutable digital identity on the blockchain	
Binded (prev. Blockai)	2016	San Francisco	Copyright platform for photography and digital art	Allows artists to claim copyright on their work instantaneously and shows them where it is being used.	Democratisation copyright accessibility
Tagsmart	2017	London		Prevents unauthorised copies of digital art from being distributed	Authentication safety
Artchain	2017 (not yet active)	Victoria, Australia	online platform tracking, protecting and ensuring accountability for original artwork.	Blockchain and artificial intelligence are used to give artwork a digital identity, transfer titles between owners and track artist royalties	Transparency, trust, authenticity
Artmyn		Lausanne, Switzerland	Digital fingerprint, art passport	Creation of unique digital fingerprint that safely captures the "DNA" of the artwork, making it it	Trust, security, transparency, privacy

unique. Once captured, the fingerprint is stored on blockchain, therefore immutable and unforgeable, ensure its traceability, condition and authenticity