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THE REGULATORY GREY AREAS OF NON-FUNGIBLE TOKENS

An Analysis of the Issues Related to Intellectual Property Rights

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Anno Accademico 2021/2022

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Chapter 1

1.1 What is Blockchain?

1.1.1 Definition

Blockchain is defined as a time-stamped database of data or transactions, which are organized into blocks on multiple locations over a network of computers. It can be considered as a new kind of data structure[1] where each block is connected and chained together thanks to an alphanumerical code appearing on the first part of a block and on the last part of the previous one. Each piece of information[*] (or transaction) is stored on a computer (or "node"), it is encrypted and shared with all the other nodes of the network.

Blockchain is built on Blockchain technology, which itself uses a Distributed Ledger Technology (DTL). The latter has some main futures. It is secure, immutable and, as its name suggests, it is distributed. These characteristics are provided by the two technologies on which DTL relies on, namely Peer-To-Peer networks and encryption[2], which allow the transactions to be conducted transparently, without a centralized ledger, and to be stored permanently on the chain.

In fact, each record of transactions[3] stored in the chain is encrypted through a hash function, which attributes a fixed-length sequence of characters (hash) to any input. Then, the hashes of all the transactions in a block are tied together to create a new hash, functioning as a summary of transactions in that block. The major strengths of this method are that encryption (1) is very easily to implement, but decryption is almost impossible even for a computer, and (2) information stored on a blockchain can be kept private, since only the hashes can be shown[4].

The initial block of the chain is called the "genesis block", to which all other blocks of records are connected, and time stamped. It results that the system is extremely resistant to any attempt of tampering. This security and immutability come from the fact that, since portions of hashes are shared within blocks, it would be impossible to modify only one record in a block. Modifying one transaction, would alter all the other hash

[*] Records stored on a blockchain are usually called "transactions", but they can represent any piece of information.

[1] Blockchain For Beginners: What Is Blockchain Technology? A Step-by-Step Guide [Internet]. Blockgeeks. 2016 [cited 2022 Mar 26]. Available from: https://blockgeeks.com/guides/what-is-blockchain-technology/

[2] Tonya M. Evans, Cryptokitties, Cryptography, and Copyright, 47 AIPLA Q. J. 219 (2019). [cited 2022 Feb 15]. Available from: https://heinonline.org/HOL/P?h=hein.journals/aiplaqj47&i=227.

[3] Robinson M, Novak-Leonard J. Refining Understandings of Entrepreneurial Artists: Valuing the Creative Incorporation of Business and Entrepreneurship into Artistic Practice. 2021 [cited 2022 Mar 23];10(1):1–19. Available from: https://muse.jhu.edu/article/811885/pdf

[4] *Id.*

functions and the attacker should modify all the other affected blocks to succeed. Increasing difficulty is given by the fact that all of this should be done before all the nodes approve a new block (see section 1.1.4).

1.1.2 History

The origin of blockchain dates back to 1969, when packet-switching technology was adopted for the first time. Packet-switching is based on the idea that large messages transmission can be made more efficient if the information is split into smaller pieces[5]. This concept enabled the Department of Defense of United States to implement a network of connected computers, located at four different universities, which could permit the transmission of simple messages. This achievement represented the beginning of internet communication.
Later, in 1991, researchers Stuart Haber and W. Scott Stornetta noticed how reliance on digital records was increasing exponentially and soon manifested two main concerns. First, they realized that digital files can be easily manipulated, thus their reliability would be extremely affected. Second, they wanted to create trust on records created in the past without relying on a central authority.
Thus, they created a system that could time-stamp digital documents through cryptography, so that they could not be modified. Record was given a hash value, containing proof of the original date in which it was created. Then, hash values were stored and chained in a timestamped block such that each record included the hash values of previously recorded documents, basically creating a blockchain[6].

In the following years, other researchers and computer scientists contributed to the development of blockchain technology and to the application of cryptography-based secured chains, but it is only in 2008 that a developer (or group of developers), under the pseudonym Satoshi Nakamoto, published a White Paper explaining and introducing the model for a blockchain. In this nine-page paper, Nakamoto took the idea of the distributed ledger invented by Stornetta and Haber but introduced a financial feature serving as an incentive to maintain connection among the copies of the ledger. The author described a new model of digital economy, characterized by the absence of a central authority, in which online payments can be directly executed from one user to the other thanks to an electronic cash (cryptocurrency), the Bitcoin, based on peer-to-peer technology. His idea proved to be totally revolutionary and introduced a new version of the web, namely a "Web 3.0", in which users produce and control the exchange of information and value across the globe and without restriction to use[7]. His main objective was clearly to reduce the power held by not only governments, but also by multinational companies, through a system which is aimed at disrupting completely government

[5] Thomas N. Doty, Blockchain Will Reshape Representation of Creative Talent, 88 UMKC L. Rev. 351 (2019). [cited 2022 Feb 15]. Available from: https://heinonline.org/HOL/Page?handle=hein.journals/umkc88&div=18&g_sent=1&casa_token=&collection=journals
[6] See *supra* note 2.
[7] *Id.*

regulations, and the way in which authorities impose taxes or safety requirements, related, for example, to identity verification. As a matter of fact, the new visioned system would have allowed users to interact anonymously, while maintaining high level of security.
The reason why Nakamoto's idea worked in the first place is, as mentioned before, the introduction of a financial incentive through the process of mining (see section 1.1.4), which allows users to contribute to making the system decentralized, while obtaining a monetary reward, the bitcoin[8].

1.1.3 Difference between public and private blockchains

Blockchain can either be private or public, depending on whether the admission to the network is permissioned or permissionless.
The former has some main features that distinguish it from the latter. First, the access to the chain is limited and can be regulated in different ways. For example, the existing participants may decide who to admit, or authorities may provide licenses to access the chain[9] . Moreover, participants of private blockchains do not have knowledge of a transaction happening in the network, unless they are directly involved in it. Another important distinction is that private blockchain usually does not allow anonymity of participants, since they are usually used by financial institutions or in the corporate world, contexts in which knowing the identity of participants is crucial.
Of course, these features imply that decentralization is limited in this case, since a certain level of control is involved. Additionally, there are two main disadvantages in private blockchains. First, since the authorized nodes are those who validate the transactions, they need to be trustworthy. This implies a problem of trust, which is difficult to guarantee and measure. Second, since private blockchains have usually fewer nodes than public ones, they may be more easily hacked.
Advantages of these blockchains are, instead, the speed and scalability, which are enabled by the small number of nodes. In fact, if only a few nodes are responsible for the validation of information, consensus is reached quickly, and a huge number of transactions can be executed.

On the contrary, public blockchains are completely open, meaning that anyone can join the network and there is no central authority supervising it. Moreover, as explained in [1.1.1], the chain relies on P2P networks and on cryptography, allowing it to present four major features.
First, it has a market-based and game theory consensus mechanisms, since it relies on a protocol stating that all the network participants must agree on, or approve, each transaction. In other words, this means that whenever a transaction is executed, each node must record the change occurring on the ledger. Second, it is

[8] On Consensus in Public Blockchains | Proceedings of the 2019 International Conference on Blockchain Technology [Internet]. ACM Other conferences. 2019 [cited 2022 Mar 26]. Available from: https://dl.acm.org/doi/10.1145/3320154.3320162
[9] See *supra* note 3

"append-only", since information regarding transactions can only be added, but it can't be either modified or deleted. Third, it is disintermediated, because there is not an intermediary supervising over the transactions. Fourth, it is transnational, because since there is no controlling authority, the functioning of the blockchain protocols is not limited geographically[10].

On one hand, one big advantage of public blockchain is that, contrary to private ones, they do not have issues related to trust and security, which are ensured by the decentralization and by the distribution of information over the chain, which makes it almost impossible for hackers to modify each node of the network.

On the other hand, a downside of the system is that it is way slower than the private one and it is hardly scalable, since the more nodes are added to the chain, the more effort is required to reach consensus.

1.1.4 Blockchain verification and authentication

Of course, the lack of centralization and control on public blockchains implies that there must be a mechanism, which guarantees trust and security in the execution of transactions. This is provided by (1) P2P networks, allowing to implement consensus protocols, and (2) public-private encryption keys.

(1) A protocol is nothing else than an algorithm, a set of procedures executed by each node of the network, which grants that all the participants of the blockchain agree on the status of the ledger or, more specifically, on the information stored on it. Since such consensus must be reached collectively by each node, it is implied that each node must participate in the execution of this process.

There exist different types of consensus algorithms, such as "Proof of Work" (PoW), "Proof of Stake" (PoS), Proof of Activity (PoA), Proof of Elapsed Time (PoET)[11]. I will only focus on the two most popular methods.

- Proof of Work is based on the process of mining, introduced by Nakamoto together with Bitcoin. Its functioning is very similar to a lottery involving all the nodes of the network. Mining consists in keeping the record of transaction updated, i.e., adding a new block to the chain. Upon request of a new transaction, the members of the network, or miners, compete to create to a CPU-bound puzzle, which is nothing else than a complex mathematical problem based on records already stored on the chain and requiring large computational power[12]. Generally, the node that has more computational power will be the first to solve the puzzle and it will provide a "proof of work", showing that a solution is compliant with the previously solved puzzle. Then, only after all the other users have approved the solution, a new transaction block can be added.

  The problem solver is also the winner of the lottery and, as such, is compensated with an award in the form of Bitcoins, ensuring that there is high engagement from all users in maintaining the ledger

[10] See *supra* note 2

[11] Dr. Stefan Beyer. Blockchain Before Bitcoin: A History - Block Telegraph [Internet]. Block Telegraph. 2018 [cited 2022 Mar 26]. Available from: https://blocktelegraph.io/blockchain-before-bitcoin-history/

[12] *Id.*

up to date. Initially, winners were rewarded with 50 Bitcoins, but this quantity is halved according to specific time intervals. This mechanism is aimed at regulating the total amount of Bitcoins in circulations, set at 21 million coins. When the limit will be reached, there will not be remuneration anymore and the mining process will stop[13].

PoW has a main drawback, since it requires a huge consumption and waste of energy. This results from the fact that, for example, if there are 1000 nodes involved and only one wins, it means that the remaining 999 will have wasted computational power uselessly[14].

- Proof of Stake is a protocol mainly used for cryptocurrencies such as Ethereum and it partially solves the energy consumption issue. The goal is the same as that of PoW, but the process is different. The users are no longer miners, but "validators". To become such, users must have met a specific threshold of coins owned and must place some of these coins at stake in the chain. Then they can bet on the blocks they believe will be validated. Afterwards, several validators are selected randomly, and all together verify the new block. Lastly, validators that had bet on the approved block, and not the actual validators, receive a compensation that is proportional to their stake[15].

(2) Public-private encryption allows to create a pair of keys to secure transactions. An easy way to explain public and private keys is to compare them to, respectively, a bank account number and to a bank account password[16]. The former is public, meaning that anyone can access it, but the latter should be kept secret, since it represents the only mean to encrypt a message addressed to a specific user. If a transaction from one account to another account has been encrypted with a public key, only a private key can decrypt it and authorize the execution of it.

For example, let examine a transaction involving the exchange of Bitcoin. Suppose that user A want to send 1 Bitcoin to user B. It will issue a message in the network communicating the transfer and containing a proof of a previously executed transaction in which user A had effectively received 1 Bitcoin, showing that user A has enough funds for the payment to be executed. Additionally, the message will be

shown in the network with user B's public key, which represents its account number, but it will also be partially encrypted with user A's private key as a proof that the message was sent by that user. Finally, user B will decrypt the message using her private key[17].

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[13] See *supra* note 3.

[14] See *supra* note 11.

[15] Banerjee S. Difference between private and public blockchain - iPleaders [Internet]. iPleaders. 2021 [cited 2022 Mar 26]. Available from: https://blog.ipleaders.in/difference-between-private-and-public-blockchain/#:~:text=The%20private%20blockchains%20have%20an,when%20it%20comes%20to%20participation.

[16] See *supra* note 2.

[17] *Bitcoin: Economics, Technology, and Governance on JSTOR*. (2015). Jstor.org. https://www.jstor.org/stable/24292130?Search=yes&resultItemClick=true&searchText=mining+bitcoin&searchUri=%2Faction%2FdoBasicSearch%3FQuery%3Dmining%2Bbitcoin%26so%3Drel&ab_segments=0%2Fbasic_search_gsv2%2Fcontrol&refreqid=fastly-default%3A4ccc2f02ec15a9f8760560f1cf97dbd4&seq=1#metadata_info_tab_contents

1.1.5 Applications of Blockchains

Given the features of this system, blockchain has currently several applications in different sectors. Thanks to its distributed nature and to its immutability, all users of the network can have access to transparent and trustworthy information, providing large benefits to all the parties involved. For example, IBM, a multinational company providing software, computers, and consulting services in the IT sector, has showed that many of its clients started to rely on blockchain technology to increase the scalability, trust, and efficiency of their processes[18].

In the food sector IBM entered a collaboration with many food producers and retailers, such as Walmart of Nestlé, and it offers them blockchain-based platform services to monitor the agri-food supply chain. *IBM Food Trust* allows all the parties involved along the chain to have access to information about the origin and quality of products and to keep track of the packing and shipping, so that it is extremely easy to detect the reasons of eventual bottlenecks[19].

IBM also provided an efficient blockchain-based solution to Maersk, a Dutch international shipping company. In fact, shipping industry faces several challenges related to the expensive and complicated communication between the firms involved in the shipping process, to the limited access to information regarding the status of goods (particularly when goods go through custom), and to the paper-based documentation, which facilitates frauds and delays[20].

Another main application of blockchain is represented by smart contracts. A smart contract is a software embedding a contract's terms and conditions in the form of *if-then* functions. If the conditions are met, the transaction is executed automatically. This technology guarantees, for example, that a party engaged in a transaction involving the periodical transmission of currency (Bitcoin), will meet the terms of the agreement.

The instantaneous and automatic execution of a transaction represent a revolutionary improvement for many industries, including the ones of trading, insurance, financial services, and government services. As a matter of fact, travelling companies could rely on smart contracts to automatically activate insurance cover when a flight is cancelled[21], or trading companies could harness this automation to speed up the transfer of assets.

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[18] Bilotta, N., & Botti, F. (2018). *Libra and the Others: The Future of Digital Money*. Istituto Affari Internazionali (IAI). http://www.jstor.org/stable/resrep19691

What is Blockchain for Business? – IBM Blockchain | IBM [Internet].

[19] What is Blockchain for Business? – IBM Blockchain | IBM [Internet]. Ibm.com. 2022 [cited 2022 Apr 1]. Available from: https://www.ibm.com/topics/blockchain-for-business

[20] Blockchainizing Food Law on JSTOR [Internet]. Jstor.org. 2019 [cited 2022 Apr 1]. Available from: https://www.jstor.org/stable/27007714?seq=1

[**] Turing-complete programming language is any programming language that, supplied with the right procedural instructions, can provide a solution to any computational problem for which a solution exists.

One of the main platforms for the implementation of smart contracts is Ethereum, which I will discuss furtherly in the following sections.

1.2 Altcoins and Ethereum

As already explained above, Bitcoins represented the first application of blockchain technology and the first cryptocurrency. The revolutionizing, decentralized finance system that was created by Nakamoto raised the interest of many programmers. Thus, a few years after the introduction of Bitcoins, many new projects funded on the same technology started to take shape. However, while Bitcoins network only works as a distributed ledger for the record of exchange and transfer of (digital) currency, these new projects aimed at introducing new capabilities and new features, so that blockchain could be exploited for many other different purposes. These are known as "*altcoins*", literally alternative coins[22]. Some of the main intended uses of altcoins are, for example, the registration of ownership of a physical asset, the representation of non-fungible assets, or the implementation of software that manage digital assets (smart contracts). The main, and most important for this discussion, alternative cryptocurrency is Ethereum, or Ether (ETH), which is based on the Ethereum Network. Ethereum was launched officially in 2015, but the idea was developed in 2013 by Vitalik Buterin, who published at that time a White Paper to explain all about the network's features, objectives, and applications[23]. Buterin's purpose was to create a new, open-source platform enabling a community of programmers to collaborate in the provision of several different applications relying on a blockchain technology. To do so, Buterin introduced a new Turing-complete[23**] programming language, known as "Solidity", which allows contributors to write smart contracts and to create the above-mentioned applications and many others[24]. Thus, Ethereum is not only a cryptocurrency, sharing the same features of Bitcoins, but it is also a network or marketplace for apps, games, products, and services, using ETH as a cryptocurrency. One of the main features and advantages of the network is that it is completely open, meaning that not only anyone can contribute to the provision of new applications, but also that anyone can use such services if they have an internet connection. Moreover, the platform just requires a user to set up a wallet account, thanks to which she will be able to manage her ETH and to access the services available[25]. To better understand Ethereum network, is fundamental

[21] Maersk: Betting on Blockchain - Case - Faculty & Research - Harvard Business School [Internet]. Hbs.edu. 2018 [cited 2022 Apr 1]. Available from: https://www.hbs.edu/faculty/Pages/item.aspx?num=54373

[22] Blockchain and Beyond on JSTOR [Internet]. Jstor.org. 2017 [cited 2022 Apr 20]. Available from: https://www.jstor.org/stable/27031184?seq=1

[23] Ethereum Whitepaper | ethereum.org [Internet]. ethereum.org. 2022 [cited 2022 Apr 20]. Available from: https://ethereum.org/en/whitepaper/

[24] *Id.*

[25] *Id.*

to focus on three main aspects, (1) the features of the underlying cryptocurrency, (2) the features of the network itself, and (3) the main fields in which the platform's apps operate.

Since ETH is founded on blockchain technology, it is a decentralized currency. Thus, it is not possible for an authority, such as a central bank, to decide to issue more coins. Moreover, this cryptocurrency is easily accessible by anyone, since not only it is "available in flexible amounts"[26], meaning that any individual can decide to acquire a small, decimal portion of an ETH, but also anyone desiring to buy ETH and execute transactions with it only requires internet connection to have access to a wallet, where belongings can be easily managed without the intervention of a bank. Cryptographic functions, additionally, grant the security of transactions.

The decentralization of the whole network also implies that users can have access to the services offered on the platform without constraints imposed by authorities and it also reduces the possibility for users to be subject to surveillance. As a matter of fact, differently from any other platform controlled by an institution or central body, applications on Ethereum require very limited information to its users.

Since decentralization is the key feature of Ethereum, of course, is also the main characteristic of its applications, decentralized apps or "*dapps*"[27].

Lastly, it is not possible to understand the revolutionizing character of Ethereum network without analyzing the three main fields for which products and services have been designed: Decentralized Finance (DeFi), Decentralized Autonomous Organizations (DAOs) and Non-Fungible-Tokens (NFTs).

DeFi is an infrastructure that relies on smart contracts protocols for the provision of financial services in a transparent and open way. The reason why decentralized finance was conceived is due to the several problems existing in traditional finance services. Individuals store their money on bank accounts owned by financial institutions, which not only act as guarantors, but they are also responsible for limiting the availability and efficiency of such services. For example, markets can be closed at the government's will, or money transfers may require several days since they are manually handled by humans. Additionally, trust is a great concern in finance since, for example, any individual deciding to deposit her asset on a bank account is required to trust blindly the institution in charge of managing her money. All these issues and concerns can be eliminated on Ethereum, since DeFi allows users to totally own the control over their money, to have access to continuously operating markets and to execute transactions in a faster and more transparent manner. Ethereum is a revolutionizing platform also because it is different from its source model, Bitcoin. In fact, they are very similar in terms of features of the underlying technology, but the main distinction is that the former grants the access

[26] *Id.*

[27] *Id.*

to many functionalities that are not available on bitcoin's network, such as investing, lending, and borrowing using cryptocurrencies[28].

Some examples of DeFi dapps are Oasis, allowing to borrow and trade Dai, a cryptocurrency based on Ethereum, Matcha, which allows to find the best prices to conduct exchanges on cryptocurrencies, and Aave, which allows users to earn interest on tokens lending.

DAOs allow to implement alternative, decentralized regulatory solutions for businesses. Traditionally, corporate governance relies on a hierarchical structure, in which members of a board of directors, such as main leaders, CEOs and managers, are responsible for enforcing decisions that are taken during shareholders meeting through a collective, voting mechanism. However, this system gives rise to several issues, due to conflicts of interest between the stakeholders of an organization or due to information asymmetries, as shown by the common principal-agency problem[29]. Since most of the time shareholders' objectives differ from those of managers, the latter will very likely exploit the power in their hands to act in a way that prioritizes their own interests and damages those of the organization's investors.

Such hindrances in corporate governance can be overcome with DAOs, thanks to smart contracts' efficacy. In fact, DAOs can be considered as internet-native business[30] in which no hierarchical structure exists, since the corporate is managed collectively by its members. In a DAO each decision is taken only whenever a consensus of voting participants is reached, and changes in the structure of the business are embedded in a smart contracts code, which is public, transparent, and unmodifiable even by its creators. This implies that opportunistic behavior and agency problems can be overcome, since the clauses of a contractual performance are executed exactly as they are designed[31].

As any other business a DAO requires funding, which is gathered collectively by the members participating. Membership can be obtained through the purchase of tokens, which are either ETH or other cryptocurrencies created specifically for a DAO. With the acquisition of tokens, participants also gain voting power, which is usually proportional to their contribution to capital. Such capital is then used to sustain the projects for which a DAO is funded, which are usually of two main kinds. Those that act as typical venture capitalists, and those that collect blockchain-based assets to grant the access to new investment strategies[32].

The third main field of Ethereum *dapps* is that of NFTs, which will be better explained in the following section.

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[28] *Id.*

[29] Decentralized Finance: On Blockchain- and Smart Contract-Based Financial Ma...: EBSCOhost [Internet]. Ebscohost.com. 2021 [cited 2022 Apr 20]. Available from: https://web.p.ebscohost.com/ehost/detail/detail?vid=0&sid=2a95fe4a-44dc-45cb-babe-86b9c0b31c9c%40redis&bdata=JnNpdGU9ZWhvc3QtbGl2ZQ%3d%3d#AN=1918494&db=eoh

[30] See *supra* note 23.

[31] See *supra* note 29.

[32] 1School T. Blockchain-Based Corporate Governance [Internet]. Stanford Journal of Blockchain Law & Policy. 2021 [cited 2022 Apr 26]. Available from: https://stanford-jblp.pubpub.org/pub/blockchain-corporate-governance/release/1

1.3 Non-Fungible Tokens

Considering what has been said about blockchain, this technology represents a huge revolution because of its disrupting impact on the role of authorities, because of the changes brought in business administration and in the world of finance. However, it is necessary to highlight that the significant underlying novelty introduced by this technology is the possibility to create new kinds of digital assets, that facilitate the execution of transactions on the chain.

Such assets, or tokens, can be created on any blockchain network that allows the implementation of smart contracts, but this study will focus primarily on tokens created on Ethereum.

In general, tokens can be obtained from any digital asset (files, videos, audios, etc.) or information through a process known as tokenization and, once they are created, they are recorded on the blockchain[33]. However, they can be classified in to two categories, according to the main features that characterizes a digital asset, i.e., fungibility. On one hand, fungible assets are those assets that can be interchanged and replaced with one another, since they are basically identical and hold the same value[34]. A simple example is represented by any cryptocurrency. 10 ETH can be exchanged with ten units of 1 ETH as the clearly have the same value[35]. On the other hand, non-fungible assets (NFTs) are unique assets, that cannot be copied and cannot be exchanged or interchanged with any other token.

Each blockchain network has its own process of tokenization. Ethereum has a specific set of instructions, known as Ethereum Request for Comments (ERC), to guide programmers in the creation of tokens, and to ensure that these assets are compatible and transferable with and on the Ethereum network. There exist different protocols for different kinds of assets. Specifically, ERC-20 defines the standards for fungible tokens[36], while ERC-721 sets the standards for protocols of non-fungible tokens' smart contracts. Thus, technically speaking, an NFT is just the execution of software that is cryptographed and that includes both a hash, or unique code, and metadata[37] that allows to distinguish this piece of code from any other. This means that one and only one asset can be represented with a specific hash function through a process known as "minting". Any digital asset can be minted, for example a video, a photo, a voice record and so on. However, this procedure, which terminates with the permanent and immutable registration of the NFT on a blockchain, must and can be

[33] Wang G, Nixon M. SoK. Proceedings of the 14th IEEE/ACM International Conference on Utility and Cloud Computing Companion [Internet]. 2021 Dec 6 [cited 2022 Apr 26]; Available from: https://dl.acm.org/doi/epdf/10.1145/3492323.3495577

[34] Fungible Things [Internet]. LII / Legal Information Institute. 2021 [cited 2022 Apr 26]. Available from: https://www.law.cornell.edu/wex/fungible_things

[35] What's All the Fuss About… Non-fungible tokens.: EBSCOhost [Internet]. Ebscohost.com. 2021 [cited 2022 Apr 26]. Available from: https://web.s.ebscohost.com/ehost/pdfviewer/pdfviewer?vid=7&sid=4388149c-9646-4a8c-ad91-0e1c7f52845e%40redis

[36] See *supra* note 2

[37] Non-Fungible Tokens and Potential Federal Income Tax Characterization Issue...: EBSCOhost [Internet]. Ebscohost.com. 2021 [cited 2022 Apr 26]. Available from: https://web.p.ebscohost.com/ehost/detail/detail?vid=0&sid=22e02e7a-20f9-47de-90c7-77442ae88b07%40redis&bdata=JnNpdGU9ZWhvc3QtbGl2ZQ%3d%3d#AN=153331590&db=bsu

implemented only if a P2P mechanism is used to reach common consensus of the all the nodes. An example will make the process of minting clearer.

The creator of a video can mint an NFT of that video by running a smart contract. The resulting hash code will have to be approved by the other nodes and then the NFT can and must be added on the wallet of its creator. This transaction must be inserted in the chain in the form of a block, which again, must be approved collectively. This is because the blockchain will maintain a record of ownership of such asset. Of course, there can be only one owner of an NFT at a time and only Ethereum's accounts' owners can own an NFT, since without an account they would not be part of the chain and would not own a wallet. Ownership can be transferred, with the security of transactions and authenticity of the asset granted thanks to the private and public keys of the users[38].

The concept behind NFTs may be difficult to grasp since it introduces an astonishing and completely different way of defining ownership and origin of digital assets. Digital media can be copied, modified, sent, and received. This implies that, first, non-tokenized digital media cannot be scarce, and second, that is extremely difficult or even impossible to determine and grant their authenticity. It may be difficult to understand how NFTs are different from traditional digital media, since, theoretically, a tokenized picture can be screen captured and, in this way, NFTs would not hold any additional intrinsic value compared to any other digital picture. However, the real astonishing difference stands in the fact that property of NFTs can be proved, verified, and cannot (theoretically) be faked.

I will discuss the issues around this claim in Chapter 3, but for now it is important to understand the theory behind NFTs. Hence, tokens can be seen as "digital serial numbers"[39], certifying the authenticity and the history of ownership of the asset. The fact that there can only be an owner at the time, ensures the scarcity of these assets and their value. To better understand why, I will give an example.

Pictures turned in NFTs can be compared to original painting of famous artists, such as Picasso[40]. Anyone can reproduce one of its works, but independently from the similarity of the copy, it can be proved that there is only one original Picasso's painting and only one owner. Additionally, there is of course a limited number of original Picasso's paintings, and this contributes to the definition of their value. The same idea holds for NFTs. In fact, a blockchain user can mint only one token or a set of tokens, with a predefined and unmodifiable number of items. This limited availability (scarcity) is what partially defines the value of an NFT. Indeed, everything that concerns the market of NFTs, and their value is a much broader topic, that I will discuss in the next chapter. Nevertheless, even if this example fits especially for tokens of digital art, it is very useful to understand the fundamental underlying concept of these assets.

[38] Non-fungible tokens (NFT) | ethereum.org [Internet]. ethereum.org. 2020 [cited 2022 Apr 26]. Available from: https://ethereum.org/en/nft/#internet-of-assets

[39] See *supra* note 37

[40] Kugler L. Non-fungible tokens and the future of art. Communications of the ACM [Internet]. 2021 Sep [cited 2022 Apr 26];64(9):19–20. Available from: https://dl.acm.org/doi/epdf/10.1145/3474355

1.4 Intellectual property rights

This section is aimed at introducing the concept of intellectual property rights since these topics are becoming particularly important with respect to the escalation and increasing popularity of NFTs. As I will explain in more details, authors of any copyright protected asset enjoy specific rights, such as the right of excluding others from reproducing or distributing the asset. Since the appearance of NFTs, new challenges emerged in the field of intellectual property law, because this technology has introduced a new paradigm to define property. As discussed in the previous section, ownership of NFTs can be transferred, but transfer of ownership does not necessarily coincide with transfer of copyrights or any other intellectual property right[41], and the specific rights obtained depend on the single contracts of acquisition between buyer and seller. To understand all the problems related to these rights, it is necessary to provide an overview of intellectual property law.

1.4.1 Intellectual property law

Intellectual property law defines all those rights that are aimed at safeguarding creators of any scientific or artistic works, as well as authors of new inventions and discoveries. Such rights allow them to control the use of their works and are aimed at protecting their economic interests, as to enhance their productivity, and at promoting the dissemination of their works. As a matter of fact, ensuring the distribution of works to the public and ensuring their authors a monetary compensation is the key to foster their creativity, and to enrich a country's national cultural heritage[42].

According to the type of work under protection, intellectual property law can be divided into two branches, one related to industrial property, and the other related to copyrights. Fall under the industrial property domain all the inventions and industrial designs, as well as trademarks. While all scientific, literary, and artistic works are protected by copyrights.

1.4.2 Copyrights

As said, copyrights are granted to any work deriving from the intellectual creativity of the authors and they are granted upon the only condition of originality not of the underlying idea, but of the expression of such idea.

Copyrights grant two types of rights, i.e., moral and economic rights. The first ones allow authors to claim authorship and to protect their work against any kind of misrepresentation or modification that could negatively affect their reputation. The second ones are also known as *"ius excludendi alios"* or "*rights to exclude others*", and comprise the right of reproduction, communication or making available to the public, distribution, rental,

[41] See *supra* note 37.

[42] World. WIPO intellectual property handbook : policy, law and use [Internet]. Geneva: World Intellectual Property Organization; 2008 [cited 2022 Apr 26]. Available from: https://www.wipo.int/publications/en/details.jsp?id=275&plang=EN

lending, and resale. What this category of rights grants to the authors is quite clear, and it is, as the name suggests, the right to authorize or prohibit others to reproduce, share, rent, lend or resale their work.
NFTs introduce new challenges in the field of intellectual property law, not only because institutions must deal with a new phenomenon and must apply existing law to unprecedented cases, but also because the underlying features of NFTs and of its technology open the doors to new opportunities for frauds and illegal activities. For example, the anonymity of blockchain or the immutability of records makes it hard for authorities to enforce intellectual property rights as for any other kind of asset[43].

1.4.2 Trademarks

Trademarks are "*any visible sign capable of distinguishing the goods or services of an enterprise from those of other enterprises"*[44] and, as such, their main purpose is to allow customers to individualize the source of the product, enabling them to make a well-reasoned choice among similar products of different brands. To reach this purpose, several categories of signs can be considered suitable as trademarks. For example, words, colors, letters, numbers, audible signs, or any other sign enabling the distinctive function and being representable on the register of trademarks. In fact, following the Paris Convention[45], most countries have provided a register, serving as a confirmation of the protection granted to the trademarks' owners, who have recorded their sign.
The main right granted by this kind of protection is the right to exclude others from using the mark in such a way that may mislead or deceive consumers into believing that a product has been produced by a specific company, when, indeed, it was not. This kind of activity is prohibited since the infringer aims at taking advantage of the popularity and recognition of the trademark's brand, a practice known as "free riding", which it may cause the brand's reputation to be negatively affected. Of course, there exist some exceptional cases that do not classify as infringement, such as the case in which the use is not likely to cause any confusion in the potential buyer.
With respect to NFTs trademarks, just as copyrights, pose several questions and doubts regarding the enforceability of existing rules.

I will focus more deeply on these issues (Chapter 3), but before I can do that, I will devote the next chapter to the analysis of the market of NFTs, to the possible applications of these new assets in several different industries and to a few case studies to better illustrate the phenomenon.

[43] Arvindan, K. (n.d.). *Non-Fungible Tokens -An Overlap between Blockchain Technology and Intellectual Property Rights*. Retrieved March 10, 2022, from https://www.juscorpus.com/wp-content/uploads/2021/07/69.-K.-Parikshith-Arvindan.pdf
[44] See *supra* note 42.
[45] *Id.*

Chapter 2

2.1 What can I do with an NFT?

To answer the question of why people would want to buy and own NFTs and of what people can do with NFTs, I will explore all the possible fields or sectors in which these assets are currently being used. This is because, even though their main purpose is to guarantee property and authenticity of digital assets, the advantages brought to an NFT owner, and thus the drivers that lead to purchases, depend on the type of asset associated to the NFT.

2.1.1 Digital Artwork Sector

The most popular transactions of NFTs are those that involve digital artwork. These consists of the sale and purchase of digitally created piece of art, that are minted into NFTs through tools that anyone can find and use on NFTs marketplaces[46]. The reason why they are so revolutionizing is that they basically changed the world of art, introducing several advantages and opportunities for both creators and purchasers. Before the existence of NFTs it was already possible for artists to express themselves through digital artwork. However, given the extremely easiness with which a digital asset can be modified, duplicated, and reproduced online, it was hard for artists to safeguard their economic interests. Preventing any possible duplications and second-market illegal sales of their works was extremely hard, and ownership of such works could not be defined in any ways, as any copy was identical to the original one. Moreover, it was hardly impossible to even determine which of the many available copies of a digital artwork was the original[47].

Now, instead, NFTs allow to safely transfer ownership, to preserve the originality of works and guarantee their authenticity. These changes represent an incredible chance for art collectors as well. Art auctions and art galleries constitute a market that has lived until recently only around material goods. Now that technology has taken over every aspect of our life, it is understandable that art collectors find immense benefits in expanding their collections and investment in the digital world. In the past, it would have not made much sense to invest on digital artworks if it was impossible to obtain a reliable certificate of authenticity, or if anyone else could just duplicate your collectable and own it as well. Today, instead, NFTs should grant art collectors a mean to profitably own digital art. First, they are allured by the satisfactory feeling of owning a certainly unique and inimitable piece of art. Again, I will challenge this claim later in the paper, but I need to mention it to explain

[46] Dimitrios Gourtzilidis. What's All the Fuss About Non-Fungible Tokens (NFTs)? [Internet]. Medium. DataDrivenInvestor; 2021 [cited 2022 Mar 12]. Available from: https://medium.datadriveninvestor.com/whats-all-the-fuss-about-non-fungible-tokens-nfts-1b3aa47a2282

[47] Kugler L. Non-fungible tokens and the future of art. Communications of the ACM [Internet]. 2021 Sep [cited 2022 Apr 26];64(9):19–20. Available from: https://dl.acm.org/doi/epdf/10.1145/3474355

the prevalent opinions that drive NFTs acquirors. Second, the possibility of earning profits on their investment is nearly certain. I will discuss more in detail in the next sections what determines the value of an NFT, but for now it is important to understand that scarcity of these works allows to easily re-sell NFTs on second markets. The latter point represents an incredible upgrade for artists as well. As a matter of fact, while in the past they could only get paid for the initial sale of their artwork, now they can potentially earn money from one artwork for a lifetime[48]. NFTs marketplaces allow artists to set terms on the smart contracts regulating the sale of their works and, thus, give them the opportunity to set royalties on resales prices. As stated by the contemporary art specialist Leighanne Murray, artists are very well interested in NFTs, since they are faster, more democratic, and more appealing than the traditional art world model[49].

Evidence of the prosperity and popularity of this market can be found in the sale of "*The first 500 days*", a compilation of digital images created by an artist named Mike Winkleman (alias Beeple) and sold during an auction for $69.3 million, making it the most expensive NFT ever sold.

2.1.2 Music Sector

As for the digital art sector, NFTs are revolutionizing the music sector both for artists and for music lovers. Coherently with the main purpose behind cryptocurrencies and blockchain, NFTs in this sector provide an opportunity for artists to get rid of all the actors playing the role of middlemen in the industry, such as music labels enterprises and streaming platforms. Musicians would benefit considerably if they could rely less on these companies since they set how much each artist is paid. Usually, artists would only get a small percentage (below 50%) of total revenues deriving from music sale and shows[50]. The scenario is even worse for artists distributing their music on streaming platforms since the average compensation is of $0.0032 per stream[51]. This is because the dynamics of music distribution have changed substantially in the last decades and music streaming platforms, such as Spotify, YouTube and Apple Music have gained extensive power and took advantage of new monetization opportunities. Even if they had a decisive role for the growth of independent artists, who could distribute their music on to these platforms, these giants are now undermining decentralization in the industry and, in the end, affecting artists' revenues[52].

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[48] *Id.*

[49] *Id.*

[50] What are NFTs and what do they mean for the music industry? - Blog | Splice [Internet]. Splice.com. 2021 [cited 2022 Mar 13]. Available from: https://splice.com/blog/what-nfts-mean-for-music-industry/?utm_source=google&utm_medium=cpc&utm_campaign=Google_Search_Acquisition_Sounds_Nonbrand_DSA_ROW&utm_content=sounds&utm_term=&campaignid=13577111017&adgroupid=123041963239&adid=528665014304&gclid=Cj0KCQiAybaRBhDtARIsAIEG3kmUnurvX5To-1V6qBnb7j8xY2fxclB9ChwPIuLUsIFMOfKgPlFKmaQaAvSIEALw_wcB

[51] *Id.*

[52] Mattias Tengblad, Angervall E. The Power of NFTs in Music Distribution [Internet]. Cryptonews.com. Cryptonews; 2021 [cited 2022 Mar 13]. Available from: https://cryptonews.com/exclusives/the-power-of-nfts-in-music-distribution.htm

NFTs in the music sector propose to solve this issue and to empower artists, giving them the chance to sell their works directly to fans, without relying on intermediaries.

Moreover, dealing with NFTs in the music sector, it is important to underline that NFTs not only can be songs recorded in audio files, but also any other asset related to the music world, such as music videos, album covers, concert tickets and merchandise. Both this direct interaction between artists and fans, and the possibility to not only sell digital goods, but also experiences, generates several advantages for both musicians and fans. First it creates incentives for fans to invest in their favourite artists' careers. The opportunity to profit from the sale of the purchased NFT following an increase in its value also represent an incentive for fans to actively promote the artist to make their investment worth. This is true especially for emerging artists, since fans willing to invest a considerable amount of money in an NFT will be willing to put an effort in making the artist grow, so that their investment will have higher value. In return, increasing the value will attract new NFTs buyer and start a positive loop for the artists, who could also use the earnings obtained from the sale of NFTs to fund new projects, such as album releases[53]. Thus, NFTs give the chance to build an active fanbase.

Because of the importance of securing fans loyalty, artists often include exclusive extras in sold NFTs. For example, Snoop Dogg sold the possibility for the purchaser to virtually meet the artist[54], while the band Kings of Leon sold their new album as an NFT together with front-row tickets for any of the band's concerts during the time the purchaser holds the token[55]. Second, since NFTs are traded on marketplaces without the intervention of intermediaries, artists obtain full price of the asset, but they can also earn royalties as a percentage of resale price for any subsequent resale, thanks to the record of ownership transfer. Of course, the profit depends on the value of the NFT, but surely this direct sale potentially provides way higher returns to the artists, compared to what they traditionally earn on streaming platforms.

NFTs in this sector started to thrive in 2021, during the pandemic, when the music industry was facing immense losses due to the impossibility to hold concerts. Thus, artists had to reinvent to find a way to recover from such crisis and identified NFTs as a viable source of income. The music event organizer company Live Nation found a way to leverage the old-fashioned activity of collecting concert tickets stubs by bringing it into the NFT world. In October 2021 the company posted a tweet, announcing the introduction of "*Live Stubs*", collectible NFT ticket stubs, which fans can obtain for free with the purchase of concert tickets. Soon, many artists recognized in this initiative a great opportunity to strengthen the relationship with their fanbase and many joined the project, starting from the dance music band Swedish House Mafia[56].

[53] See *supra* note 50

[54] Lielacher A. How Music NFTs Could Disrupt the Music Industry [Internet]. Cryptonews.com. Cryptonews; 2022 [cited 2022 Mar 13]. Available from: https://cryptonews.com/exclusives/how-music-nfts-could-disrupt-music-industry.htm

[55] See *supra* note 50

[56] See *supra* note 52.

2.1.3 Sport and Fashion Industry

As understood from the two previous paragraphs, NFTs represent a new opportunity to transfer into the digital world a well-popular and old hobby as collecting items is. However, NFTs introduced the possibility of collecting not only typical items, such as paintings and tickets stubs, but also "moments" and fashion items.

In June 2020 the National Basketball Association (NBA) launched a new NFT marketplace named "NBA Top Shot", where users can buy, sell, and collect the most memorable NBA moments in the form of videoclips. Moments are bought in packs, and only after opening one, users find out what they got. An activity that closely resembles collecting cards[57].

Then, another industry in which NFTs are becoming increasingly popular is the fashion one. Many different brands and stylists are introducing and experimenting NFTs in their activities in many ways. For example, stylists Rebecca Minkoff believes that NFTs represent a logical step in the development of the collaboration between fashion and technology, especially because of the recent advances in technologies of augmented realities (see paragraph 2.1.5). In fact, given the increasingly popular trend of consumers trying garments through their digital avatars, the stylist realized that designing the brand's own collection of digital garments, would have represented not only an opportunity to increase the brand's competitiveness, but also an occasion to strengthen the relationship between designer and consumers. Thus, the brand sold four hundred digital garments on the OpenSea marketplace[58]. Minkoff's beliefs seem to be confirmed by Yahoo's president Joanna Lambert, who affirms that there are incredible opportunities for fashion in the digital world, because new technologies have the power of reimagining and revolutionizing the customer's journey, enabling a complete immersion in the fashion world[59]. The choice to dive into the NFTs world was explained by Minkoff as a way to improve customers' experiences and as a possibility to introduce a new profitable source of revenues. The enthusiasm that has been growing around NFTs in the last years is undeniable, and famous, luxury brands took advantage of it, foreseeing that as people are willing to spend thousands of euros on luxury items in the real world, they would have been willing to spend similar amounts, or even more, for digital goods just to be part of a trend of exhibitionism and ostentation of wealth. They had also foreseen that thanks to NFTs, they could have reached a new segment of customers, namely those belonging to crypto-assets market. As a matter of fact, Gucci released an exclusive version of its Dionysius bag for $4,115, a price higher than the one of its physical versions[60]. Similarly, Hermès sold a NFT version of its most famous and exclusive handbag "Birkin" for

[57] NBA Top Shot: The Ultimate Guide [Internet]. nft now. 351Studios; 2021 [cited 2022 Mar 17]. Available from: https://nftnow.com/guides/nba-top-shot-guide/#:~:text=Top%20Shot%20is%20essentially%20an,and%20see%20what%20you%20get.

[58] How fashion brands are navigating NFTs and what's next for the metaverse [Internet]. Glossy. 2021 [cited 2022 Mar 17]. Available from: https://www.glossy.co/fashion/how-fashion-brands-are-navigating-nfts-and-whats-next-for-the-metaverse/

[59] *Id.*

[60] 2021, The Year Of Fashion NFTs - The Interline [Internet]. The Interline. 2021 [cited 2022 Mar 17]. Available from: https://www.theinterline.com/10/2021/2021-the-year-of-fashion-nfts/

$23,500, compared to the $15,000 of a physical one[61]. It could be important to understand whether these new kinds of assets truly represent a revolutionizing utility, for example considering the expected future developments in metaverses, or if they will only serve as an additional mean for a small elite of rich people to show-off their wealth.

Non-luxury brands such as Nike and Adidas decided to take advantage of such enthusiasm as well, and created their own NFTs, including not only digital garments, but also access to unique digital and physical experiences, selling them at prices that hardly resemble the real-life's items' ones[62]. These experiences for purchasers can include, for example, exclusive access to events, sales, or the possibility to dress their in-games avatars with brand-signed garments. Of course, Adidas and Nike are not the first brands to combine the gaming and the fashion world, as many others did it before, such as Louis Vuitton or Burberry.

To understand properly why NFTs have an enormous potential in fashion, I will explain in more details the gaming industry, what it means to own an NFT as an in-game item and how this is correlated to the metaverse.

2.1.4 In-Game Items

NFTs became incredibly popular in the gaming world, where the activity of collecting digital items has been existing already for a long time. As a matter of fact, most games allow its players to purchase in-game items to upgrade the functionalities and levels of the game or to personalize their avatars. Some of these assets can be bought with fictitious in-game money, but many others can be purchased not only with real money, but also with immense amounts of it. If spending thousands of dollars to buy luxury firms' clothes in real life might be considered as senseless to many people, spending the same amount of money for items that one does not even possess is certainly more absurd. Moreover, the absurdity of this industry stands in the fact that any asset purchased is platform-dependent[63], meaning that if a discontinuation of the game or a hack happens, the users might lose their very expensive items. Focusing on this aspect, the introduction of NFTs makes spending real-life money sensible, or at least slightly more acceptable. In fact, a game owner would never be able to deprive purchasers of their NFTs, simply because ownership cannot be erased on a blockchain! In other words, transforming in-game items into NFTs means that purchasers truly own these assets, and ownership also means to have control over them and to be able to sell them for a profit at any time, or to use them in different games[64].

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[61] The "Baby Birkin" NFT Just Sold for More Than the Real Thing [Internet]. Highsnobiety. Highsnobiety; 2021 [cited 2022 Mar 17]. Available from: https://www.highsnobiety.com/p/baby-birkin-nft-basic-space/

[62] *Id.*

[63] McIntosh R. NFTs Are Creating Robust Economies in Online Gaming: Here's How [Internet]. Financial and Business News | Finance Magnates. Finance Magnates; 2021 [cited 2022 Mar 24]. Available from: https://www.financemagnates.com/cryptocurrency/news/nfts-are-creating-robust-economies-in-online-gaming-heres-how/

[64] Snider M. Everyone wants to own the metaverse including Facebook and Microsoft. But what exactly is it? [Internet]. USA TODAY. USA TODAY; 2021 [cited 2022 Mar 25]. Available from: https://eu.usatoday.com/story/tech/2021/11/10/metaverse-what-is-it-explained-facebook-microsoft-meta-vr/6337635001/

Whether one's agrees or not on why owning an in-game NFT item makes more sense than owning a "traditional" in-game item, the industry has thrived incredibly, especially after the launch of the first blockchain-based game "*Cryptokitties*" (see paragraph 2.4). Afterwards, as mentioned above, many fashion companies started to create their own NFTs garments, that can be purchased as in-game items. In this way the fashion industry found a way to expand its business, entering both the gaming and metaverse industry.

2.1.5 Metaverse

The metaverse is likely the industry in which NFTs are and will be the most profitable in the future. What is the metaverse, exactly? Even though it does not exist a unique definition, the term was coined in 1992 by the writer Neal Stephenson, who mentioned it in one of his novels and pictured how in the future humans would have been able to interact and live through their avatars in a 3D virtual environment. Currently, the metaverse is still developing and expanding, but it comprehends, generally, all those platforms that allow the creation of immersive, interactive, virtual worlds, through different technologies, such as augmented reality (AR), virtual reality (VR), or 3D holographic avatars[65]. Thus, video games resemble and are, somehow, included in the concept of metaverse. Additionally, most of these platforms, just as any video game, can be easily accessed through a smartphone, while others require a laptop with more sophisticated features, or gaming consoles such as the Xbox, together with, for example, AR glasses[66].

All these platforms basically aim at reproducing our every-day real life, allowing us to be represented by life like avatars, who can buy assets and items, attend events, build 3D virtual environments[67], visit virtual places and interact with others. Video games reproducing real life, such as The Sims or Minecraft, have been existing for many years now, but it is probably with the invention of NFTs that many companies recognized the opportunity in developing the already existing video games into proper virtual worlds, in which data, locations and activities are connected and easily accessible. Moreover, after Facebook's CEO Mark Zuckerberg announced that the company would have changed its name into Meta and would have invested money in the creation of its own metaverse, many companies realized that they had to guarantee themselves a spot in the virtual world as well. Companies started seeing the metaverse as a branding tool, as an e-commerce place and as an opportunity to expand their business[68]. The reason is that the possibility for purchasers to truly own the assets in digital worlds in the form of NFTs, enables users to show them off or trade them, to live in the virtual world in the same way as the live in the real one. As the enthusiasm around the metaverse increased, it started to be clear that just as people wear Nike's extremely expensive Air Yeezy in the real world, they would want their avatars to wear the same shoes in the virtual world, if that was possible.

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[65] *Id.*

[66] Why Wall Street Loves the Metaverse.: EBSCOhost [Internet]. Ebscohost.com. 2022 [cited 2022 Mar 24]. Available from: https://web.s.ebscohost.com/ehost/pdfviewer/pdfviewer?vid=16&sid=f6c0979d-c65d-4c93-b4a9-01807131ba01%40redis

[67] *Id.*

[68] *Id.*

Thus, in 2021 Nike announced the acquisition of RTFKT (pronounced "artifact"), a company founded to build virtual sneakers that can be sold in the metaverse[69] [38], Dolce & Gabbana created NFTs on the blockchain platform Polygon to make their NFTs portable and transferrable across many virtual worlds, and Adidas announced the launch of a new collection of NFTs collectibles called "*Into the Metaverse*", offering the holders the opportunity to join a community with exclusive advantages both in the physical and in the digital world[70].
Of course, not only fashion garments can be acquired as NFTs in the metaverse, but also any other asset that one needs for living, including real estate assets. Acquiring virtual lands has become very popular lately because people believe they will become more valuable in the future when the metaverse will be broadly known. These visionaries may not be wrong, since the price of a piece of land on Sandbox or Decentraland, the two biggest metaverse platforms, increased by $12,000 in just one year[71]. Owners would, then, be able to resell the land or to build houses in which to live their virtual life.

2.2 NFTs Market

Until now I explained what NFTs are, their main features and main uses. I presented the industries and sectors in which they find ground for application, mentioning that more and more people are spending real, considerable amount of money on these assets. However, I did not explain exactly how to buy them, how to resell them, and, most importantly, what determines the value of NFTs. Why there exists tokens valued thousands of dollars, while others only cost a few dollars? Will the price of NFTs keep increasing in the future? Or will they be forgotten by the majority in just a few years?
I will reply to all these questions in the next paragraphs.

2.2.1 How to trade NFTs?

NFTs are traded on specific online marketplaces, such as OpenSea or Rarible. These work as any other online marketplace, where sellers post their products and set the price or open an auction.
On one hand, anyone desiring to become a NFT artist would find that relatively easy, since generally there are just a few steps to be taken to become a seller on these marketplaces. There exist a few platforms, such as Nifty Gateway, that may require creators to apply to sell their works and to be selected by the platforms'

[69] RTFKT is selling NFT cybersneakers to the metaverse.: EBSCOhost [Internet]. Ebscohost.com. 2021 [cited 2022 Mar 25]. Available from: https://web.s.ebscohost.com/ehost/pdfviewer/pdfviewer?vid=5&sid=2e0be9e1-013e-4da7-b7f8-27cad6831914%40redis
[70] See *supra* note 58.
[71] Marr B. How To Buy Land & Real Estate In The Metaverse. Forbes [Internet]. 2022 Mar 25 [cited 2022 Mar 25]; Available from: https://www.forbes.com/sites/bernardmarr/2022/03/23/how-to-buy-land--real-estate-in-the-metaverse/?sh=35b5287b546e

owners[72]. However, most of the platforms only need creators to have a computerized wallet to store cryptocurrencies (typically Eth, since the most famous NFTs are minted on Ethereum blockchain), needed to mint, sell and purchase NFTs. On platforms like OpenSea, after setting up a wallet, and making sure is funded, creators can simply use a "create" button to upload their work and mint the NFT. Before it is published on the marketplace, creators may also add a name, a description, and features of the work. Additionally, creators may decide to set a fixed price or to sell it for an auction, and to set a percentage of return for any secondary sale[73]. The last step consists in the payment of a sort of transaction fee, called "*gas fee*". Gas is a unit of measure for the computational power required to mint NFTs or to execute any other transaction on the Ethereum network, and it is received by miners as a reward for their verification work. The fee can vary from $10 to $45, and it depends on the amount of transactions that are taking place on the platform in a specific moment. Thus, theoretically creators can decide to mint their NFTs in moments of "low traffic". For example, if a collection with a lot of hype is to be released in a specific moment, a creator might decide to mint the NFT in another moment, when a smaller number of transactions will take place, thus reducing the gas fee. Once the fee payment is completed, the NFT will be posted on the platform and ready to be purchased. The marketplace also requires receiving a percentage of the sale price, which varies from the 2% to 10% of full price and it changes according to the type of the item.
Buying NFTs is incredibly easy as well. There not exist any fees to be paid on the purchaser side, and the only requirement is to own a crypto wallet funded with Eth and connected to the marketplace.

In the previous paragraphs I only mentioned cases of NFTs sold for thousands of dollars. Clearly, not every NFT has the same value, and the fact that anyone can easily mint and sell an NFT does not mean that everyone will become incredibly rich out of it just because these assets are madly popular now. In fact, not only different factors determine the price and value, but these are also extremely volatile, meaning that they are up to swift changes. In the next paragraph I will explore in more details which factors play a role in determining NFTs prices.

2.2.2 What determines the value of NFTs?

In this paragraph, I will provide a detailed explanation of the three main determining factors of NFT's price: utility, reputation, and future value.
Taken as they are NFTs could be quite useless, so very few people would have, at least in their early stages of development, been willing to purchase these assets without any added value. Thus, the main way to make a

[72] Non-Fungible Tokens and Potential Federal Income Tax Characterization Issue...: EBSCOhost [Internet]. Ebscohost.com. 2021 [cited 2022 Apr 26]. Available from: https://web.p.ebscohost.com/ehost/detail/detail?vid=0&sid=22e02e7a-20f9-47de-90c7-77442ae88b07%40redis&bdata=JnNpdGU9ZWhvc3QtbGl2ZQ%3d%3d#AN=153331590&db=bsu
[73] *Id.*

NFTs collection extremely valuable is to embed utility for its purchasers. In most cases such utility is translated into a kind of membership, a right to be part of a community or club, to join dedicated social events, to get access to exclusive opportunities of any kind, both in the physical and digital world. Providing these advantages to purchasers, creators aim at developing a group of loyal, highly engaged community, contributing to the establishment of a true active ecosystem[74]. In fact, creators collect revenues form NFTs sales, and use such revenues to finance the brand and all the activities around the project, which in turn increase the value of the collectibles. In other words, members become a sort of shareholders of the brand and contribute to its development. The most striking example of NFT community is the Bored Ape Yacht Club (see paragraph 2.4), which has become a truly exclusive community formed by a small elite of wealthy people and celebrities, owners of the famous "*bored ape*" NFTs.

However, these clubs should not be an end in themselves, but should, theoretically, be built around a value proposition, an identity and purpose that should be expressed clearly since the beginning of each project to attract not only the right community, but also to develop engagement of members[75]. Having a valid value proposition may not be enough for a project to success, thus the identity of creators of a project might also be fundamental to create a community. Well established brands can leverage their reputation in the physical world and be sure that this will be enough to thrive, at least in the short run, even without a well-defined objective. Unknown artists, instead, must rely on their own marketing skills, to brand their vision and values hoping to attract influential purchasers, such as celebrities, who will in the end create excitement around the project. In fact, it is not a surprise that ownership history[76] of NFTs, as a component of the reputation factor, plays a role in the determination of value. Just as in the real world the demand for a generic pair of shoes can rocket just because a celebrity wore it, the same can happen with an NFT collection.

The third determinant factor is the future value, which is dependent on scarcity and speculation. Just as gold and diamonds derive their price and value from their scarcity, the same rule holds for NFTs. In the moment of minting, creators specify immediately the number of collectibles included in their collections and this number cannot be modified in the future. Thus, collections formed by a small number of works will be obviously more tempting than others with thousands of items. It is common to see collectibles on marketplaces classified into different categories according to their scarcity. For example, NBA Top Shot moments are grouped into three tiers, common, rare, and legendary[77]. On OpenSea, instead, each NFT is presented with a tag of properties, each of which shows a percentage indicating the rarity of that feature in the whole collection. Of course, this factor only makes sense for projects that already possess some intrinsic value thanks to the two previous factors.

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[74] How NFTs Create Value [Internet]. Harvard Business Review. 2021 [cited 2022 Mar 26]. Available from: https://hbr.org/2021/11/how-nfts-create-value

[75] *Id.*

[76] *Id.*

[77] See *supra* note 57.

[78] Yearly NFT Market Report 2021 [Internet]. nonfungible.com. 2022 [cited 2022 Mar 27]; Available from: http://nonfungible.com/reports/2021/en/yearly-nft-market-report

In fact, for example, if I were to mint a collection of ten items tomorrow, without efficient branding, surely no one would buy it for considerable amount of money.

Additionally, it is important to keep in mind that, first, there does not exist a clear methodology, as for another property, to determine the value of an NFT, because each has different properties and utilities that influence the price. Second, NFTs' market is extremely subject to the hype phenomenon, and it is sensitive to trend changes, which may have rapid, dramatic effect on the price of the asset[78].

Third, it is not said that the market price reflects the actual value of an asset, because seller and buyer may have different perceptions. Sellers want to close the deal with the highest possible gain, setting prices that might be above fair valuation. Similarly, buyers may make a low bid offer that may not reflect the true asset value.

In conclusion, given the information above, I believe that there seems to exist three different kinds of NFTs purchasers that contribute to the value creation. First, there exists those that only consider NFTs as an investment and buy items with the hope that they will be able to make a profit once the value will increase. Second, there exists trends enthusiasts and fanatic celebrity supporters, who use NFTs as a tool to show-off their wealth, or to feel closer to their idols. Third, there exists another group of enthusiasts, who truly believe in the values proposed by the communities they join and develop a feeling of belongingness, and build their personal identity around their membership, as shown from the fact that many people use their NFT as profile pictures online[79].

Once I have illustrated the main value determinants, the next step in the analysis of NFTs' market is a brief overview of the volume of exchanges that have been taking place in the last years. Hence, I will devote the next section to this topic.

2.2.2 Volume of exchanges

NFT was nominated word of the year in 2021 by Collins Dictionary[80], and it is not a surprise considering the incredible speed with which this market expanded last year. The market started six years ago, but it is only in 2020 that the volume of exchanges really started to increase. In fact, there has been a 236% increase in the volume of dollars traded from 2019 to 2020, and a 21.350% increase from 2019 to 2021, when the figure reached almost $18 billion. This huge change reflects the variation in the average price per NFT, which went from $15 in 2019 to $807 in 2021[81]. The latter figures correspond to a yearly average, so it would be premature to compare these with the most recent data of 2022. However, just looking at the average price in January 2022,

[79] See *supra* note 74.
[80] See *supra* note 78.
[81] *Id.*

when the total value of NFTs sold reached $4 billion[82], it is possible to get an idea on how the market has been growing abruptly since 2020. This is $3200, compared to the $350 in January 2021.

Even though the market expanded considerably in 2020, the real change happened in 2021, specifically in the last two quarters of the year. Focusing only on exchanges on OpenSea, the most popular marketplace, the number of NFTs sold reached the peak of 1.7 million in September 2021, compared to the 200,000 of March 2021[83]. One of the reasons of this abrupt changes must be connected to the spread of trends around many NFTs project, that basically transformed into brands and attracted many buyers.

Then, looking inside the different fragments of the market, it results that the collectibles market has had the fastest growth among the digital markets. Even though there have been several fluctuations throughout 2021, these assets have been quite profitable last year, with an average price between $5,000 and $10,000. Moreover, there are two important considerations to make as an example that shows both the great volatility of NFTs and the role of speculation in determination of prices. First, there has been a decline in the average price of a collectible asset from May to June 2021, due to a drop in liquidity of some unpromising collections. This plummet was followed, however, by a rise in the average price between October and December 2021 due to the speculation developed around the launch of some new, most valued collections such as the Mutant Ape Yacht Club projects. Second, the secondary market largely outweighs the primary market for what concerns the volume of dollars traded[84], showing that assets tend to appreciate in the former following the development of trends and the influence of ownership history.

The metaverse segment largely increased in the last quarter of 2021 as well, surely thanks to Zuckerberg's announcement that Facebook would have become "META". Regardless of the reason, the surge is evident since the price of a metaverse plot rose from $500 in January 2021 to $10,000 in December 2021.

Given these large figures, it is not surprising that the prices of many of the most famous projects and artworks reach millions and billions of dollars. Here a short summary of the main collections and single assets in terms of prices[85]:

- "*The merge*", a dynamic work costing $91.8 million. The NFT is a mass, dynamically composed of 312,686 units owned by almost 29 thousand users.
- The already introduced "*Everydays: the First 500 Days*" by Beeple, costing $69.3 million.
- "*CryptoPunk 7523*", sold for $11.8 million. The NFT is part of the CryptoPunk collection and portraits a blue alien wearing a beanie, a golden earring, and a medical mask.
- The before mentioned Bored Ape Yacht Club collection, having a market capitalization value $2.95 billion and the newest Mutant Ape Yacht Club, valued $1.14 billion.

[82] Caporal J. The NFT Market: Average NFT Prices, Largest Marketplaces, and More [Internet]. The Motley Fool. The Ascent by The Motley Fool; 2022 [cited 2022 Mar 27]. Available from: https://www.fool.com/the-ascent/research/nft-market/

[83] *Id.*

[84] *Id.*

[85] *Id.*

- "*Cool Cats*" collection, valued $376.31 million, comprising 9,999 portraits of cats, each with different features, outfits, and faces.
- "*Clone X*", valued $801,87 million. It is a collection of randomly generated 20,000 3D avatars, and it was ideated with the intension to sell the NFT as avatars for the metaverse, or for online conferences.

NFT market had evident success in the last years, but what will happen in the future? The next paragraphs will be devoted to discussing different point of views about the potential of these assets.

2.3 Future of NFTs

It is always difficult to predict how and if a market will grow in the future, but in the case of NFTs the forecast appears even more challenging due to the existence of opposing evidence.

On one hand, the high volatility of NFTs value, which is also strictly related to cryptocurrencies trends, makes it look very unlikely that the enthusiasm around these assets will last long.

I explained above the determinants of value, but the real question here is not how variable the value is, but whether there actually exist a value of NFTs. To better explain my point of view I will report an example from Deeksha Gupta, finance professor at CMU, that I find particularly explicative[86]. Why do people enjoy visiting museums? Why don't they go the souvenirs shop on the same street to look at the same identical painting, avoiding eventual hours-long lines? Well, the reason is that they regard the experience of seeing an original painting more valuable than seeing a replica. This is quite reasonable, since the original artwork is infused with the charm of the history behind it, the charm of something that is hundreds of years old, making the two versions completely different. However, the same cannot be said about digital assets. From the point of view of the experience provided, a digital artwork is just the same as any other of its versions, whether it is connected to an NFT or not. Hence, the value now is only defined by enthusiasm for the phenomenon, by the power of trend and celebrities' appeal that create excitement about a new item. But what if community members loose engagement about a project? Then, the value of their collectibles would plummet because there is no intrinsic utility in their assets. This is defined as the "*last mile*" problem[87], which shows that the value of digital assets depends on their relationship with the physical world. This is just as true for cryptocurrencies since, in the long run, we must make sure that these are useful not only in the digital world, but also in the physical one. People are already tackling the issue, and they are introducing new ways to, for example, conduct every-day transactions with Bitcoin such that it is now common to buy physical items using Bitcoin or to encounter a Bitcoins ATMs in the street, allowing to buy cryptos with a credit card. What might happen in the future is

[86] Kugler L. Non-fungible tokens and the future of art. Communications of the ACM [Internet]. 2021 Sep [cited 2022 Apr 26];64(9):19–20. Available from: https://dl.acm.org/doi/epdf/10.1145/3474355

[87] *Id.*

that, similarly, it will be possible to use NFTs as a paying method and to buy other items with them as in a sort of barter to make them more useful than just collectibles.
In the mid time, to contrast this instability, more and more actors are trying to enter the market of NFTs and to establish a solid position creating new, long-lasting functionalities, which could accomplish to revolutionize many existing industries and provide NFTs with intrinsic value and utility. In the next paragraph I will investigate all those industries in which the application of NFTs has been until now only hypothesized or barely developed.

2.3.1 Possible future applications of NFTs

As introduced in the previous paragraph, the current and main goal of many companies is to establish their position as players in the NFTs market. Such goal started to be shared by many companies after Zuckerberg's announcement of Meta, because businesses all around the globe perceived the potential impact that this market could have had on their operations if more and more companies had followed the tech giant. Thus, the most forward-looking companies understood that they should have not stayed behind. However, not only they started wishing to join the market, but they also realized that they need to be the first to offer innovative functionalities and new kind of experiences to guarantee a long-lasting success in the market.
A good example is represented by the social network Twitter, which in response to the requests from its users, decided to introduce the possibility for iOS users to connect their crypto wallet to their Twitter account and to set their NFTs as profile pictures, framed in a new hexagonal frame, instead of the classical circular one[88]. This is certainly a good start for the social network, even though, to grant a solid position in the market it would probably need to implement a few changes and improvements of its NFTs feature. In fact, the functionality is exclusively offered to iOS users located in specific locations, to owners of Ethereum-based NFTs and, most importantly, to Twitter Blue's members, a company that offers an upgraded version of the social network under subscription[89]. Moreover, this feature still has one main flaw, that is the impossibility to prevent frauds from minting a visually identical NFT on a marketplace and have it validated on Twitter to show it in the hexagonal shape. This is one of the many regulatory issues that the NFTs world still need to tackle (see section 3.3.3).
The latter example only shows the introduction of a new component in a product, which has not been drastically modified. However, introducing avant-guard functionalities implies also introducing new products and services that may disrupt and completely revolutionize many sectors.
A rampant example is that of the financial sector. As explained in Chapter 1, the financial sector has already been revolutionized by the rise of the newest DeFi's services and products, but it has the potential to be evolved

[88] Alper T. Twitter Introduces Verified NFT Profile Pics, Sets up Foundation Account [Internet]. Cryptonews.com. Cryptonews; 2022 [cited 2022 Apr 5]. Available from: https://cryptonews.com/news/twitter-introduces-verified-nft-profile-pics-sets-up-foundation-account.htm

[89] *Id.*

further thanks to the combination of DeFi and NFTs. The way in which these two elements come together is not only related to the fact that they are both based on blockchain technology, but to the fact that they complement each other. In fact, on one hand, the NFTs are means to store value, while on the other hand, DeFi allows to unlock their value through any financial operation just as NFTs were an asset in the DeFi portfolio. The reason why this combination is particularly useful is that, not only it has made possible to trade and commercialize digital product and services thanks to the proof of ownership provided by NFTs, but it also allowed to introduce innovative features and possibilities in conducting traditional financial services.

First, thanks to this association, the system for collateralization can be changed. Collateralizations is a practice that guarantees a safeguard on a loan because in case of default, the lender is entitled to seize an asset from the borrower. In traditional finance the collateralization amount is set by the bank, but NFTs allow the lender to determine it. The loan would be requested not to a bank, but directly to a lender through one of the several available platforms; then, the lender would perform an evaluation of the NFT offered as collateral, taking into consideration the actual price, but also the potential price of resale on a secondary market[90]. Second, just as NFTs can become collateral assets, they can become insurance policies. In this way, the insurance sector would be significantly improved. In fact, while most of traditional insurance policies have an expiry date and require the insured to file several documents and to go through laborious procedure, NFTs don't expire and can be easily transferred, sold, or bought[91].

Third, expensive NFTs are much more liquid than another traditional finance asset. In fact, as a token can be fractionalized, it is possible to sell only a part of the asset, making it easier for sellers to find potential buyers[92].

Another example of sector in which the use of NFTs is likely to evolve is the education sector. First, it would provide considerable advantages in the process of application to schools. In fact, to complete the application students are asked to submit several documentations, such high-school diplomas, language certificates and grade transcripts. However, most of the time quite expensive fees need to be paid for official versions of these papers to be received by the institutions. Such fees could be avoided if certificates were to be transformed into NFTs, also granting admission committees and employers to easily verify their authenticity and increasing the credibility of candidates' resumes[93].

A third example is that of the ticketing industry. I already explained how many artists are offering concerts' tickets in the form of NFTs to allow their supporters to maintain the pleasure of preserving them as they were elements of a collection. As a matter of fact, since the ticketing industry started to substitute paper tickets with

[90] Iredale G. How Can NFTs Be Used in DeFi (Decentralized finance)? [Internet]. 101 Blockchains. 101 Blockchains; 2021 [cited 2022 Apr 8]. Available from: https://101blockchains.com/nft-and-defi/

[91] Team P. How Are NFTs Reforming the DeFi Sector? [Internet]. PixelPlex. PixelPlex; 2022 [cited 2022 Apr 8]. Available from: https://pixelplex.io/blog/nft-defi-transformation/

[92] *Id.*

[93] NFTs and Higher Education: Part 1 [Internet]. nonfungible.com. 2022 [cited 2022 Mar 27]; Available from: http://nonfungible.com/news/opinions/nfts-and-higher-education-part-1

digital ones, this has become hardly possible, depriving attenders of an activity that is a fundamental part of the overall experience of attending an event. Surely, digital tickets brought several advantages and allowed to streamline the whole process of tickets distribution and production, but it the combination of "digital and NFTs" that truly allows the industry to solve some of its main problems. First, tickets exchanges on black markets have always been a major issue, since purchasers are usually asked to pay for incredibly high prices that largely exceed the original ones, but they also face a considerable risk of buying fake tickets. Moreover, because of resales, event organizers, who usually ask purchasers for their identification information, are unaware of who is going to attend the event[94], causing a safety issue as well. All of this happens mainly because it is impossible to impose an efficient regulatory framework on tickets sales outside the network of a certified supplier. In the last years, many tickets providers, such as Ticket One, tried to introduce some rules to control exchanges of tickets imposing both named tickets and the change of the holder's name through the payment of a small fee in case of resale, claiming that identity checks will be executed at the event's venue. However, it is common knowledge that identity checks rarely happen, especially in venues hosting thousands of attendees. Thus, people keep relying on black markets. Transforming tickets into NFTs and transferring them on the blockchain, would potentially prevent all of this. The benefits that both tickets' purchasers and organizers would obtain are several. On the guests' side, authenticity of tickets would be always granted since the initial sale from the official provider to the first purchasers would be registered on the ledger, resale of tickets would be made much easier since there would be more trust among guests, and it would be possible to store tickets in memory of the attended event or make a profit selling them to collectors. On the organizers' side, instead, it would be possible to significantly reduce the costs and time of producing tickets since minting NFTs is both cheaper and faster than printing[95], it would be possible to gain revenues imposing royalties on the resale of tickets both prior the event and after the event when they are sold in the form of collectibles, and they would always be able to verify the tickets' holders[96].

The restaurant industry may find the use NFTs useful as well. First, a common problem is represented by non-honored reservations, which cause considerable revenue losses. If table reservations were to be transformed into NFTs and secured through the payment of a small deposit, restaurant would not lose any money, and guests would be still able to cancel their booking simply by selling it for the same amount[97]. Second, fake reviews represent another big issue, since it is very frequent for competitors to pretend to be customers and to provide negative feedbacks ruining restaurants' reputation. Relying on the blockchain could provide a solution, since it would be possible to certify that the reviewer had actually been to the place.

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[94] How can NFT Ticketing disrupt the ticketing industry? [Internet]. LeewayHertz - Software Development Company. 2021 [cited 2022 Apr 8]. Available from: https://www.leewayhertz.com/how-nft-ticketing-works/

[95] *Id.*

[96] *Id.*

[97] Uptick Network. Uptick App | The Maya Story - Uptick Network [Internet]. Medium. Uptick Network; 2021 [cited 2022 Apr 8]. Available from: https://blog.uptickproject.com/uptick-app-the-maya-story-a13fc1b23e87

In conclusion, the NFTs market has a potential to grow as more and more applications are defined. Nonetheless, it is necessary to solve the many existing regulatory issues to ensure the utility of NFTs in the long term. The next chapters will be devoted to the investigation of such issues.

2.4 Case-studies

In the last paragraphs I mentioned some of the most famous NFTs or projects that have been created or sold. Hence, I will dig deeper in the history behind these assets to satisfy the curiosity of how and why they were valued millions of dollars.

2.4.1 Cryptokitties

Cryptokitties is the first Ethereum-based game, and it was lunched in 2017 during the ETHWaterloo, an Ethereum Hackaton. The game was developed by Roham Gharegozlou and Dieter Shirley as a mean to get people closer to blockchain technology. In fact, when Gharegozlou recognized in blockchain, cryptocurrencies and NFTs the solution to get rid of the monopolies imposed by tech giants such as Amazon and Facebook, he realized that he had to do his part to contribute to the proliferation of these instruments[98]. However, he also understood that it would have been a hard goal to try to explain the complicated rules and features of blockchain technology to the public. Thus, he needed a simpler way to make it accessible for everyone and thought about developing a game that would have engaged people and at the same time showed them the functioning of blockchain and Ethereum network. Cryptokitties resulted as the best solution for Gharegozlou's goal, as the adorable cartoon cats immediately attracted many users and generated the first NFTs mania wave. The game itself is incredibly simple, as users can only buy or sell kitties and breed them to obtain new kittens having a combination of its parents' features, but it effectively illustrates the concept of scarcity and the functioning of smart contracts. In fact, each of these crypotkitties has a unique 256-bit genome and can be bred with any other cryptokitty, allowing to obtain a maximum of 4 million unique cats, each with a different set of "*cattributes*"[99]. Obviously, since the game is based on Ethereum, users need to have a wallet to buy kitties. Players can either purchase kitties on sale or make an offer for other users' kitties. Then, they can decide to breed their own cats, or to breed them with "*public sires*" offered by other users.

Contrary to many other games built around an objective to pursue, Cryptokitties does not have any storyline or final goal. Only the three actions buying, selling, and breeding are possible. It may be that users find satisfying buying and breeding cats until they have completed a collection sharing a particular cattribute. More

[98] GOODKIND N, HACKETT R. All Work and All Play. Fortune [Internet]. 2021 Aug [cited 2022 Apr 9];184(1):72–5. Available from: https://search.ebscohost.com/login.aspx?direct=true&db=bsu&AN=151656060&site=ehost-live

[99] CryptoKitties. CryptoKitties | Collect and breed digital cats! [Internet]. CryptoKitties. 2022 [cited 2022 Apr 9]. Available from: https://www.cryptokitties.co/guide/cattributes

likely, it may be inferred that the reason why the game had engaged people so effectively is that it resembles gambling[100]. When breeding new kitties, users do not know what genome combination they will obtain, and they just pay the breeding fee hoping that the "newborn" will have scarce features so that it can be sold for a price that overcomes the transaction fee. Now, the prices of kitties vary extensively ranging from $20 to a maximum of $120,000[101].

2.4.2 The Bored Ape Yacht Club

The Bored Ape Yacht Club (BAYC) was funded in April 2021 by the Yuga Labs, a group formed by four thirty-years-old developers with the intention to provide crypto-savvy and NFT collectors with a space to gather and share latest news and inside jokes. They created 10,000 NFTs depicting shabby apes, each with different features in terms of fur types, accessories, expressions etc., derived from the causal combination of 170 traits which determine the portraits' scarcity. When the project was lunched, each bored ape cost 0.08 ETH, or around $190, and they all went sold out within a month[102]. The NFTs were perceived as a digital identity by their owners, who started using the portraits as profile pictures on social networks. However, creators aimed at creating additional utility for their followers, and wanted to build a community around the project, providing bored ape owners with exclusive rights. For example, purchasers earned the right of selling any spin-off products of the NFT hold and the right to access special games for earning cryptocurrencies or real-life events, as if the NFT was a sort of identity card[103]. Recently, several community's meetups were held in different cities all around the world, together with a whole weekend of dedicated events, including a yacht party held in New York, which was attended by different celebrities participated as well[104]. Celebrities played a fundamental role in increasing the value of these NFTs, and as characters such as the singer Eminem and the businesswoman Paris Hilton purchased the bored ape, the cost of all the elements of the collection rocketed, such that now the floor price is about $300,000. Moreover, given the popularity of the project, the BAYC has become a proper brand, doing business outside the blockchain, and collaborating with other established brands, such as Adidas. As of today, the record price of bored ape was $3 million, and the project has become extremely popular, uselessly expensive, and undeniably elitist. The incredible amount of money circulating around the project fairly triggered a strong reaction from Ethereum creator Vitalik Buterin. In fact, during an interview with the

[100] Serada A. Why Is CryptoKitties (Not) Gambling? [Internet]. Acm.org. 2020 [cited 2022 Apr 9]. Available from: https://dl.acm.org/doi/fullHtml/10.1145/3402942.3402985

[101] News B. CryptoKitties craze slows down transactions on Ethereum [Internet]. BBC News. BBC News; 2017 [cited 2022 Apr 9]. Available from: https://www.bbc.com/news/technology-42237162

[102] Cos'è il Bored Ape Yacht Club, guida agli NFT [Internet]. Youngplatform.com. 2022 [cited 2022 Apr 9]. Available from: https://youngplatform.com/blog/news/cos-e-bored-ape-yacht-club-guida-nft/

[103] Hissong S. How Bored Ape Yacht Club Created a Billion-Dollar Ecosystem of NFTs [Internet]. Rolling Stone. Rolling Stone; 2021 [cited 2022 Apr 9]. Available from: https://www.rollingstone.com/culture/culture-news/bayc-bored-ape-yacht-club-nft-interview-1250461/

[104] Daniel Van Boom. Bored Ape Yacht Club NFTs: Everything you need to know [Internet]. CNET. CNET; 2022 [cited 2022 Apr 9]. Available from: https://www.cnet.com/culture/internet/bored-ape-yacht-club-nfts-everything-you-need-to-know/

Time magazine, he asserted that he is not against the project, however he does not see how it can provide any positive return for the crypto community[105]. He wishes that this money was not an end in itself, but an asset to make public good in the crypto world, for example to finance new infrastructure investments. As a matter of fact, contrary to the Cryptokitties project, it is hard to find a clear objective and mission of the BAYC project beyond the lucrative one.

[105] Hayward A. Ethereum Creator Vitalik Buterin: I Don't Hate Bored Ape Yacht Club NFTs [Internet]. Decrypt. Decrypt; 2022 [cited 2022 Apr 9]. Available from: https://decrypt.co/95683/ethereum-vitalik-buterin-dont-hate-bored-ape-nfts

Chapter 3

3.1 Introduction

NFTs are a very recent phenomenon, and as such it still lacks a comprehensive and clear regulatory framework. The uncertainty regarding how they fit in the existing frameworks governing the finance and technology sectors rouse questions and doubts, showing that there a still many challenges to be faced and issues to be solved to guarantee that NFTs can be efficiently used and adopted in daily life.

In this chapter, I will focus on the main issues and challenges of legal nature posing particular attention on intellectual property rights.

3.2 Copyrights

3.2.1 Main advantages of blockchain in copyright law

Copyrights law and intellectual property law in general were introduced with the main aim of fostering the creativity and intellectual creations of authors and artists. In fact, even though copyrights include a set of different rights, the economic ones are the most important as they grant authors a sort of monopoly[106]. The latter allows authors to prevent third parties from copying or disseminating their work for lucrative purposes. Thus, it provides them with an economic incentive to continue to invest in their time and creativity. However, as I already mentioned in the previous paragraphs, nowadays there are two main problems that affect and diminish this economic interest, and which blockchain and NFTs can solve. First, in the past artists used to legitimately rely on intermediaries to a greater extent, since it was harder to distribute their works and make it known to the public. Obviously, the two parties shared and still share the derived profits, but in this era, intermediaries such as streaming platforms, enjoy a privileged position, collecting most of the revenues and leaving small percentages to the artists. Second, the technologies adopted in the last decades make it extremely easy to share and disseminate copies of copyrighted works, preventing basically the authors of their monopoly. Blockchain promoters claim to solve these issues by minting copyrighted works as NFTs. Nevertheless, there exist very convincing opposite point of views shared by many, who claim that considerable doubts can be cast on the capability of NFTs to preserve authors. Indeed, the next paragraphs will show how NFTs provide large possibilities for copyrights infringement.

[106] Tonya M. Evans, Cryptokitties, Cryptography, and Copyright, 47 AIPLA Q. J. 219 (2019). [cited 2022 Feb 15]. Available from: https://heinonline.org/HOL/P?h=hein.journals/aiplaqj47&i=227.

3.3.1 Rights granted with NFTs' ownership

The first important topic to deal with is determining what kind of rights are embedded in NFTs' ownership. To understand why there is an issue, I should first define what ownership means. Generally, ownership means to have control over a property, to enjoy it and to have the right to exclude others from enjoying it[107]. Obviously, this definition holds for real properties, but it also matches with the underlying concept of copyrights, protecting intellectual properties.

However, in the latter case, ownership of the property may or may not coincide with ownership of the copyrights. According to both the Unites States' Copyright Law and the European Union's legal framework (composed of eleven directives and regulations)[108], copyrights belong only to the author of the work, or exceptionally to whoever commissioned the work[109], and they can be transferred to others only if clearly stated from the rights' holder.

Thus, for example, buying a painting from an artist only implies the ownership of such painting for personal use. It may be exhibited in one's inhabitation, but it cannot be reproduced or exhibited in any other circumstance without the author's authorization.

The same holds with the purchase of an NFT. On a general basis, buyers of NFTs linked to a digital art only get the right to use the work as their profile pictures on social networks, to display it in game worlds[110] or on marketplaces to re-sell them; nothing more. All the intellectual property rights belong to the artist.

Hence, it seems like I already replied to the initial question of what one gets by buying an NFT, and the answer seems to be simply "ownership". Indeed, as I explained NFTs until now, they are essentially a certificate of ownership. Nevertheless, the matter is slightly more complicated than that. In fact, I must underline that there is an immense difference between the NFT and the work to which it is linked. They are not the same thing, because the NFT is only the metadata file containing a unique couple of token ID and blockchain address, a sort of pointer[111] to the link of the website where the actual work is stored, which can be any regular website. Thus, while many believe that purchasing an NFT means obtaining ownership of the work, what one gets is

[107] Vjayakumaran, Adarsh. NFTs and Copyright Quandary [Internet] Journal of Intellectual Property, Information Technology and Electronic Commerce Law, vol. 12, no. 5, 2021, pp. 402-413. 2022 [cited 2022 April 13]. Available from: https://heinonline.org/HOL/P?h=hein.journals/jipitec12&i=600

[108] Copyright legislation [Internet]. Shaping Europe's digital future. 2022 [cited 2022 Apr 13]. Available from: https://digital-strategy.ec.europa.eu/en/policies/copyright-legislation

[109] World. WIPO intellectual property handbook : policy, law and use [Internet]. Geneva: World Intellectual Property Organization; 2008 [cited 2022 Apr 26]. Available from: https://www.wipo.int/publications/en/details.jsp?id=275&plang=EN

[110] Kastrenakes J. Nyan Cat is being sold as a one-of-a-kind piece of crypto art [Internet]. The Verge. The Verge; 2021 [cited 2022 Apr 13]. Available from: https://www.theverge.com/2021/2/18/22287956/nyan-cat-crypto-art-foundation-nft-sale-chris-torres

[111] See *supra* note 107.

ownership of the metadata, a sort of "receipt"[112], which may even contain more information about the work, in addition to the tokenID and contract address, as illustrated in the figure below.


```
"symbol": "Mintable Gasless store",
"image": "https://d1iczm3wxxz9zd.cloudfront.net/8f3b45b2-5744-45e3-
b201-774f4adb0899/000000-0000000000
/56742968571651567842470476732289835256898763642165777827629012765324346003 39
/ITEM_PREVIEW1.png",
"animation_url": "",
"royalty_amount": 500,
"copyright_transfer": false,
"address": "0x8c5aCF6dBD24c66e6FD44d4A4C3d7a2D955AAad2",
"tokenId": "5674296857165156784247047673228983525689876364216577782762901276 53
"resellable": true,
"original_creator": "0x0C8B89C808c37f20547B75eF5b17ED8b8C97bb98",
"edition_number": 1,
"description": "<p>This charts my mouse during a day.</p>",
"auctionLength": "604800",
"title": "A day in the life",
"url": "https://metadata.mintable.app/mintable_gasless
/56742968571651567842470476732289835256898763642165777827629012765324346003 39",
"file_key": "",
"apiURL": "mintable_gasless/",
"subtitle": "Digital life is everything",
"name": "A day in the life",
"auctionType": "Auction",
"category": "Art",
"edition_total": 1,
"gasless": true
```


Figure 1. An example of NFT metadata[112]

I should point out the fact there exist another kind of NFTs, which are linked to works uploaded entirely on the blockchain, and they are known as *on-chain* works. These are extremely rare though, because they imply the uploading of much more data compared to the *off-chain* works and, thus, require very high transaction fees to be minted (approximately $71 410 per 1 MB)[113].

It seems hard to believe that people are spending enormous amounts of money to own, in the end, just a set of characters. It can sound just as senseless as buying a star, which gives nothing other than a bragging right[114], and, indeed, it is (at least for some categories of assets linked to the NFT).

[112] Guadamuz A. The treachery of images: non-fungible tokens and copyright. Journal of Intellectual Property Law & Practice [Internet]. 2021 Dec 1 [cited 2022 Apr 13];16(12):1367–85. Available from: https://academic.oup.com/jiplp/article/16/12/1367/6449489

[113] *Id.*

[114] See *supra* note 110.

To be more precise on the matter, I should mention that in some cases NFTs' purchasers win some rights on the connected work, but this should be clearly stated in the terms and conditions of the smart contract, as if it was a sort of transfer of rights from the copyrights' owner. This aspect will be explored in paragraph 3.4.
The discussion can be expanded further, considering that the fundamental distinction between work and NFT gives rise to two other questions. First, whether minting an NFT can be considered as part of either the right of communication or reproduction, inducing large possibilities for infringement. Second, if minting more than one NFT linked to the same work can be considered as an infringement of copyrights law. I will try to answer to these questions in the following paragraphs.

3.3.2 Criteria to determine the existence of infringement

In the previous paragraph I concluded that the NFT and the work related to it are not the same thing, but there is general uncertainty on whether minting an NFT without the author's authorization represents an infringement of copyrights. To better understand if this is the case, I should take into considerations three elements[115] that must be true for infringement to take place.
First, there must be a causal connection between the original and the alleged infringing work, the NFT. Indeed, even though the two items do not coincide, there exist a connection, since whoever mints the NFT must have access to the original work (or to a copy of it).
Second, the original must have been copied either in its entirety or in a substantial manner. In this case, the requirement is met depending on the type of NTF[116]. If it is an on-chain one, then it is a complete copy of the work, but if it is an off-chain NFT and, thus, simply a token, infringement may not be implied.
Third, it must be defined whether the minting of NFTs can be considered as a form of reproduction or communication to the public. In fact, Article 1 and Article 2 from Directive 2001/29/EC of the European Parliament cite the following regarding these two activities:

- "*Member States shall provide for the exclusive right to authorise or prohibit direct or indirect, temporary or permanent reproduction by any means and in any form, in whole or in part*".
- "*Member States shall provide authors with the exclusive right to authorise or prohibit any communication to the public of their works, by wire or wireless means, including the making available to the public of their works in such a way that members of the public may access them from a place and at a time individually chosen by them*"[117].

[115] See *supra* note 112.
[116] *Id.*
[117] EUR-Lex - 32001L0029 - EN. Europaeu [Internet]. 2022 [cited 2022 Apr 14]; Available from: https://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CELEX:32001L0029:en:HTML

However, there are some limitations on the validity of these rights. These are all those cases defined as "fair uses" of the work, including the reproduction for personal use only, and deprived of any economic significance[118].

Whether minting an NFT falls under the activity of reproduction depends, again, on whether the NFT is on-chain or off-chain. In the first case, we deal with reproduction. Conversely, in the second case, the matter is just as the same as for the copying requirement explained above. If one were to be accused of reproduction right infringement, it could be argued that the NFT exists independently from the work because it is just a token, and it does not resemble the work in any way[119].

Infringement of communication right seems to be more likely and easily evincible. In fact, as shown in Figure1, among the information contained in most of the NFTs there is also an URL that links to the minted work, stored on some website over the internet. Since such link allows the public to reach the work, it can be argued that there is a copyright infringement. Nevertheless, there are some considerations to be made before jumping to such conclusion.

First, theoretically, anyone in addition to the NFT's owner can easily retrieve the link to where the work is stored, knowing an NFT's blockchain address and a tokenID. There exist several websites for this purpose, such as CheckMyNFT. However, some smart contracts are not public and do not allow to find such link.

Second, it is very common that, even if they are easily retrievable, links are broken, meaning that they do not lead anywhere (see paragraph 3.5). Hence, one could argue that rotten links or "private" links serve as means to circumvent copyright law, as a proof that the work was not actually made available to the public[120]. I agree that there is a possibility that the link will not, in the end, redirect the public to the work due to the just mentioned reasons. Nonetheless, minting an NFT without the author's authorization should be considered as a form of communication to the public, because that is the initial intention of any NFT creator, together with the ultimate purpose of selling it on marketplaces, which clearly does not fall within the scope of "fair uses".

There is another topic I should discuss. Let's assume that jurisdictions have agreed on considering unauthorized minting of NFTs as a copyright infringement. The next element that should be considered is the nature of the work to which the NFT is connected. As I illustrated in the previous chapter, NFTs can be minted from any kind of digital work, including digital art that is randomly created through an algorithm, as in the case of Cryptokitties, or Bored Apes.

Differently from other digital art created with digital tools by human artists, such as Beeple's works, this kind of artworks are not properly a product of human creativity. Indeed, they are a product of machine automation. According to several jurisdictions both across Europe and in the United States, the only requirement for a work to be protected by copyrights is that it must be a product of intellectual creativity of the authors, implying that

[118] See *supra* note 109.
[119] See *supra* note 112.
[120] *Id.*

the author must me human. Institutions can deal with this problem either by denying copyright protection to these works, or by granting protection to the authors of the computer program generating the works[121]. However, the latter case would require a much deeper analysis which is out of scope for this research. Thus, clearly, if such works are not protected by copyright laws, NFTs minting cannot even be condemned as copyright infringement. Surely there must be a legal framework that should be applied for unauthorized minting, but it seems like there is still uncertainty regarding how to govern this phenomenon.
Obviously, all the above discussions suggest that the vagueness of NFTs' regulatory framework provide plenty of possibilities for engaging in criminal and unethical activities and getting away with them.

3.3.3 Three types of infringement

Let's assume again that NFTs fall within the scope of copyright law. Then we should wonder how many and what kinds of infringement of intellectual property rights are possible. I identified several cases.
The first one is the one I discussed in the previous paragraph, and it consists in the minting of an NFT from an original work without the author's permission. Then, there are two more cases, which are particularly important because they undermine the concept of scarcity, which not only should be the outcome of intellectual property rights protection, but it is also the assumption for NFTs' success. It is true that blockchain aims at solving the problem of digital scarcity proving the authenticity of the original work. However, it is not true that this goal can always be reached. First, without careful governance, nothing can impede marketplaces' users from screenshotting an NFT, and uploading it on the same or another marketplace. This is exactly the problem that many have raised criticizing, for example, the new service offered by Twitter Blue, which I discussed in paragraph 2.3.1. Twitter declared that it is working on a solution to this problem, but at the current state of things, anyone can create their own, fake version of a Bored Ape NFT and have it validated as the so much desired hexagonal profile picture[122]. If verification was to be carried out, it would be easily revealed that the token is not original, but it means that marketplaces and artists should keep track of all the NFTs minted on every existing marketplace.
Moreover, given the high prices at which NFTs are sold, it is not excluded that artists themselves act in a way that mines their works' authenticity and uniqueness. No rule defined on the Ethereum network can stop them from minting several "unique" NFTs from the same original work and sell them on different marketplaces at different prices. In this way, they would be both protected from any price fluctuation affecting a marketplace

[121] Artificial intelligence and copyright [Internet]. Wipo.int. 2017 [cited 2022 Apr 14]. Available from: https://www.wipo.int/wipo_magazine/en/2017/05/article_0003.html

[122] Barrett E. Twitter will help users verify their NFT profile pictures—but only if they subscribe to its premium Blue service [Internet]. Fortune. Fortune; 2022 [cited 2022 Apr 15]. Available from: https://fortune.com/2022/01/21/twitter-blue-nft-profile-pic-hexagon-frame-feature-verification/

more than another[123], and they could sell their work at the highest offer on the market[124]. Obviously, the fact that there exist several versions of an NFT, independently from the fact they are "original", affects both the interests of the buyers and of the artists. Buyers would be disappointed discovering that there exist more copies of their "unique" asset, and potential acquirors would be less willing to spend a lot of money on something that is not unique, causing the value of the NFT to diminish, and impacting the artists' revenues.

Now we should wonder whether the marketplaces, where all the transactions take place, should be held liable for these illegal activities, given their role of intermediaries. Since, NFTs sales happen online, the legal framework that governs these transactions should be the Digital Millennium Copyright Act (DMCA) in the United Stated, and the E-Commerce Directive in the European Union. The first is composed of a set of provisions aimed at safeguarding online service providers from liability due to copyrights infringements carried out by their users[125]. The second, adopted to stimulate the development of online platforms in Europe and to protect its users, contains the description of "safe harbors", which were inspired from the DMCA[126]. These are a series of situations in which the online service providers cannot be held liable for law infringement taking place on their platforms. Basically, these provisions state that liability should not be presumed if the service providers acted expeditiously to take down or block the access to fraudulent items. Marketplaces are now enhancing new systems and policies to deal with this "counterfeiting" issue. The platform Foundation, for example, added a statement in its terms of use, inviting authors to send a notification, upon which an investigation to verify the infringement will take place and, eventually, the illegal content will be removed[127]. Other platforms, instead, implemented different approaches. SuperRare is now executing a manual verification of each item on the website. AtomicAsset, instead, introduced a sort of disclaimer for its user, suggesting making "their own research" before proceeding with the purchase to make sure they are buying "genuine works", since anyone can mint NFTs on their platform using another collection's name[128].

The next big question is whether copyright is actually enforced when it comes to the NFT world. Given the DMCA and the immediate action of many platforms for removing the allegedly illegal content, there was no need to take infringement cases to court. However, in June 2021 the first in-court case was opened. The legal action[129] took place because the producer Damon Dash, announced that he would have listed on Super Farm an NFT with Jay-Z's debut album "Reasonable Doubt". The album was released in 1996 by the music label

[123] See *supra* note 107.

[124] See *supra* note 112.

[125] Zimmerman M. Your DMCA Safe Harbor Questions Answered [Internet]. Available from: https://assets.fenwick.com/legacy/FenwickDocuments/DMCA-QA.pdf

[126] The e-commerce Directive as the cornerstone of the Internal Market Assessment and options for reform [Internet]. Available from: https://www.europarl.europa.eu/RegData/etudes/STUD/2020/648797/IPOL_STU(2020)648797_EN.pdf

[127] See *supra* note 112.

[128] Mahmood G. NFTs: What Are You Buying and What Do You Actually Own? - The Fashion Law [Internet]. The Fashion Law. 2021 [cited 2022 Apr 15]. Available from: https://www.thefashionlaw.com/nfts-what-are-you-buying-and-what-do-you-actually-own/

[***] An extension is an overlay to the artwork, that does not modify the artwork and that can be removed at any time. For example, a new garment such as a hat or a dress.

[129] See *supra* note 112.

RAF, cofounded by Dash. The latter claimed that, since he owned a small fraction of the company, he could sell the NFT together with the possibility of receiving any "future revenue generated by the album". Basically, he wanted to sell what he claimed to be his portion of copyrights, as a stakeholder of the company. However, he did not own what he wanted to sell. As stated in the lawsuit, it is the company itself and not the stakeholders to own all the company's assets[130]. Hence, the stakeholder could not in any way sell or transfer the asset.

The judge intervened immediately after the notification of alleged infringement and imposed to stop temporarily the sale on the marketplace. The verdict is yet to be defined. Given the uncertainty around the enforcement of existing laws and the lack of specific rules, it is difficult for authority to reach a conclusion, thus, the case has not been closed yet, and similarly all the other court cases opened recently.

In addition to the hesitation on rules to apply, another issue is that, sometimes, it is hard to even open a case. Due to the pseudo-anonymity on blockchain, it may be difficult to identify who the rightful creator is and to identify the infringers. Even though each user has a digital wallet address, it is not simple to link the address to the real identity. Anonymity is topic that deserves better investigation as it is related to another legal issue, the one of compliance with GDPR (see section 4.5).

3.4 License and Assignment

As explained, NFTs transactions are executed through blockchain-based smart contracts, which are simply lines of code. Hence, any type of agreement between parties can be embedded. It is now clear that the NFT itself is neither the artwork nor a license itself. It is just a token. Hence, given the uncertainties regarding the rights that come along with the purchase of an NFT, it is important for both creators and purchasers to have such rights, together with all the actions that one is allowed to do, clearly stated in the contract. Following the initial state of development and with the expansion of volume of exchanges, having realized the limitations of the system and the lack of clarity, more and more creators started to introduce a specific license in the sale of their NFTs, aiming at maintaining a greater control over their works. In fact, a license is simply an agreement between the parties, which allows the purchaser to perform some specified actions that would generally be prohibited by copyright protection.

There exist several standard licenses, the most famous being the NFT License 2.0, developed by Cryptokitties's producers, Dapper Labs[131]. This was born as a tool to protect their own projects, but also as a standard and opensource instrument to which any crypto enthusiast could collaborate to reach two main goals. First, helping all creators to gain major control over their work, and protect themselves and their works against their own ingenuity. Second, safeguard the purchasers and provide them with the freedom to enjoy the asset they buy

[130] Roc-a-fella records, inc. vs. Damon Dash. [2021]. Case 1:21-cv-05411. Available from: https://storage.courtlistener.com/recap/gov.uscourts.nysd.562168/gov.uscourts.nysd.562168.1.0.pdf

[****] Derivatives are new artworks inspired by the purchased NFT.

[131] See *supra* note 112.

without fear and uncertainty[132]. Just as Apple did with its Apple Store[133], Dapper Labs aimed at creating a framework for blockchain developers that would allow artists to protect and maintain their rights, spread, and monetize their work.

Obviously, the license is not mandatory. Neither its creators nor any of the marketplaces impose artists to include such license or any other in the terms of their sale, however, it is really recommended to avoid unpleasant inconvenience.

The NFT License 2.0 is clear and provide detailed descriptions of the actions authorized. These actions include: the right to use, copy and display the art or any extension*** that the purchaser may create for personal use only, for sale, provided that the marketplace can verify cryptographically that the users is the actual owner of the NFT, and on websites or games that allow the usage and display of NFTs; the right to commercialize the NFT, for example by creating merchandise that includes the art, with the only clause that the revenues must not be higher than $100,000 per year[134]. The latter is surely an important concession, but it may not be effective in the purpose of safeguarding the economic rights of creators. As a matter of fact, Dapper Labs itself admits that the clause is not verifiable in any way, and creators deciding to include this right in their license should understand that they must rely on an honor system and trust their buyers that they will not take advantage of this privilege. Despite being caught infringing this rule would translate in the termination of the license, the tiny probability of detection is very unlikely preventing purchasers to unlawfully monetize their NFT. Obviously, crime detection is not the only way in which the license terminates its effect, because, with ownership being the main requirement for the exercise of the mentioned actions, the terms must automatically be annulled when the purchaser resells the asset.

As I said, the NFT License 2.0 is a standard format that can be used by any creator on any platforms simply adding a link to it in the terms of sale. While many creators are relying on this standard, many are writing their own license terms as the BAYC's creators did. Like the standard license, the BAYC's one grants its purchasers both the right to display and the right to commercialize their NFT through the production and sale of merchandise, including t-shirts, prints etc. Additionally, BAYC's owners are also entitled to create derivatives**** and sell them, deciding freely and with no obligation whether to share or not royalties with the original work's artist[135]. This feature, together with the initial low floor price of all items of the collection, is

[132] NFT License [Internet]. NFT License. 2022 [cited 2022 Apr 19]. Available from: https://www.nftlicense.org/

[133] *Id.*

[134] See *supra* note 132.

[135] Bored Ape #6068 Royalty-Free Usage License + Source Files [Internet]. Rarible.com. 2022 [cited 2022 Apr 19]. Available from: https://rarible.com/token/0x495f947276749ce646f68ac8c248420045cb7b5e:115580012693954311385725909754056071395906630937317129648263429795014445729 44?tab=owners

certainly one of the main factors that determined the swift success of the project. BAYC's owners have indeed exploited their right, and there have been some successful cases of commercialization, which helped to promote the overall BAYC project. For example, one owner created a parody of a mayor's election campaign, reproduced it on a Times Square Billboard, and shared it on Twitter, where it received thousands of reactions. Another owner, instead, produced and launched their own line of beer titled "Bored Ape IPA"[136] .

Hence, a license gives the acquiror the permission to engage in an activity that should be prohibited. It does not coincide with the transfer of the creator's rights since the concession is limited by a time limit or bounded by ownership. There exist, instead, another kind of agreements that grants the complete and permanent transfer of copyrights to the purchaser. As I mentioned in the previous paragraph, copyrights can be transferred from the right holder to another party, and this is called "assignment". This procedure does not allow the transfer of moral rights, but it gives the possibility to transfer all the economic rights. According to several jurisdictions, included the United States', such agreement must be in a written from and it must include the right-holder signature[137] as proof of his given consent. This requirement give rise to a few aspects to consider when it comes to assignment in the NFT world. Many marketplaces are introducing the possibility to sell copyrights simply adding a tick-box allowing the NFT creator to sell its rights clicking on such box. Hence, the question here is: does this method match with the written-and-signed requirement? Generally, the interpretation of what can be defined as "written" has been very broad, and particularly the recent cases seemed to have accommodated the use of technology[138], but there should be deeper investigation on whether a computer code can be considered as a valid, written document. The "signed" requirement seems to be easier to accomplish. Electronic signatures are now broadly accepted; hence it would not be a surprise if cryptographic signatures used to complete NFT transactions were to be recognized as lawful. Additionally, one may argue that the tick-box may not seem the most legitimate and official method, but e-commerce purchases are concluded everyday thanks to a tick-box for the acceptance of terms and conditions[139]. There is no reason why a transfer of copyrights concluded in the same manner should not be considered just as authentic.

Even though the cases in which NFT sales coincided with transfer of copyrights are extremely limited (and probably inconvenient for creators), authorities should dedicate some time in establishing clear criteria to be applied for rights transfer on marketplaces.

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[136] economist. Bored Ape Yacht Club: The Case for Licensed Commercial Use Rights [Internet]. Medium. Medium; 2021 [cited 2022 Apr 19]. Available from: https://medium.com/@deconomist/bored-ape-yacht-club-the-case-for-licensed-commercial-use-rights-b1bbd463d189

[137] U.S. Copyright Office. Chapter 2 - Circular 92 | U.S. Copyright Office [Internet]. Copyright.gov. 2022 [cited 2022 Apr 19]. Available from: https://www.copyright.gov/title17/92chap2.html#:~:text=204.-,Execution%20of%20transfers%20of%20copyright%20ownership,such%20owner's%20duly%20authorized%20agent

[138] See *supra* note 112.

[139] *Id.*

3.5 Other flaws of NFTs

In the previous paragraphs I anticipated the main problem NFTs have, and that is the fact that they are uncorrelated and separated from the work they are related to. As long as this feature persists, there will always be three main flaws in NFTs. First, that more than one NFT can be minted from the same work. Second, that an NFT can be minted from anyone, including non-owners. Third, there is high risk of losing the work and be left with a unvaluable NFT. The first two belong to the problem of authenticity, which I already discussed previously. The last one is related to the issue of vulnerability of links and the easiness with which online content can be manipulated. The main situations an owner may face are that the link contained in the NFT metadata becomes rot (or broken), meaning that it redirects "nowhere", or that the link works but it redirects to deleted content or to content different from what was expected. Since there is not a binding connection between the two items, a creator may mint an NFT linked to an artwork stored on a website, and then the creator herself (or a hacker) may substitute the art with other content. Moreover, the web host may shut down the website where the work is stored for multiple reasons, or the owner of the work may have not paid a hosting bill causing its content to be removed[140]. In short, many things may happen, and this shows how there is high probability that NFTs' owners will be left with just a hash function in their crypto wallet and nothing more. It is true that blockchain provides for a secure solution to store file, but the issue is that this technology is not being used in the right way to really ensure a revolutionizing model of ownership. Blockchain does safely store the NFT, or better said the URL, but it does not provide for any protection on the original work, since it has nothing to do with the blockchain (at least, as long as most of the NFTs are off-chain).

Moreover, there exists another dangerous vulnerability in the system. Considering the high value that NFTs reached last year and being the NFTs stored on a crypto wallet, which exists and operats on the internet, it is not a surprise that they have become subject to hackers' attacks. Specifically, there have been already several cases of phishing, a kind of cyber fraud which consists in tricking internet user and induce to provide access credentials, or other personal data, including credit card numbers etc. At the beginning of 2021 there were two big attacks on two of the most famous marketplaces, Nifty Gateway and OpenSea. In the former, hackers stole artworks worth thousands of dollars from the users' wallet, and their credit card credentials to buy new NFTs. The platform itself confirmed the attack but did not admit the existence of any vulnerability of the platform itself, claiming that the damage was restricted to those users that were not using a two-factor authentication[141], a system of authentication that does not solely rely on username and password, but on an extra layer which could be either an identification number, a fingerprint, or other biometric patterns. Similarly, NFTs worth $1.7

[140] Kastrenakes J. Your million-dollar NFT can break tomorrow if you're not careful [Internet]. The Verge. The Verge; 2021 [cited 2022 Apr 19]. Available from: https://www.theverge.com/2021/3/25/22349242/nft-metadata-explained-art-crypto-urls-links-ipfs

[141] Peters J. Hackers stole NFTs from Nifty Gateway users [Internet]. The Verge. The Verge; 2021 [cited 2022 Apr 20]. Available from: https://www.theverge.com/2021/3/15/22331818/nifty-gateway-hack-steal-nfts-credit-card

million were stolen from 17 OpenSea's users' account[142]. Even though it may be argued that phishing attacks do not necessarily reflect a platform's vulnerability since they rely more on users' naivety than on technology's flaws, these episodes highlight another drawback in the world of NFTs.

3.6 NFTs and Trademarks infringement

To complete the discussion regarding intellectual property rights, I should talk about trademarks as well.
In the first chapter I introduced this as a type of intellectual property which serves as a distinctive sign, distinguishing a brand's product from its competitors' and allowing consumers to make informed decisions on their purchase. As I showed in the previous paragraph, in the case of copyrights there are plenty of opportunities of law circumvention because frauds can rely on the fundamental distinction between the protected work and the NFT. However, I conceive the matter concerning trademarks to be more straightforward as I have the impression that the just mentioned distinction does not create great confusion in determining the existence of infringement. To show why this is the case, I will report both the European Union and the United Stated legislations to explain the cases of infringement.
According to Section 43 of the Lanham Act "*Any person who, on or in connection with any goods or services, or any container for goods, uses in commerce any word, term, name, symbol, or device, or any combination thereof, or any false designation of origin, false or misleading description of fact, or false or misleading representation of fact, which:*
(A) is likely to cause confusion, or to cause mistake, or to deceive as to the affiliation, connection, or association of such person with another person, or as to the origin, sponsorship, or approval of his or her goods, services, or commercial activities by another person, or
(B) in commercial advertising or promotion, misrepresents the nature, characteristics, qualities, or geographic origin of his or her or another person's goods, services, or commercial activities, shall be liable in a civil action by any person who believes that he or she is or is likely to be damaged by such act"[143]. From the latter point it is implicit that the word damage refers also to all those actions that have the power to affect the well-established reputation of the brand to which the trademark is associated.
Similarly, according to the Article 10 of the European Union's Directive of 2015, which summarizes the rules applied in the Member States, the registration of a trademark allows " *the proprietor of that registered trade mark shall be entitled to prevent all third parties not having his consent from using in the course of trade, in relation to goods or services, any sign where: (…) the sign is identical with, or similar to, the trade mark irrespective of whether it is used in relation to goods or services which are identical with, similar to, or not*

[142] Brandom R. $1.7 million in NFTs stolen in apparent phishing attack on OpenSea users [Internet]. The Verge. The Verge; 2022 [cited 2022 Apr 20]. Available from: https://www.theverge.com/2022/2/20/22943228/opensea-phishing-hack-smart-contract-bug-stolen-nft
[143] 15 U.S.C. 1125 (Section 43 of the Lanham Act): False designations of origin, false descriptions, and dilution forbidden, Nov. 2015 (BitLaw) [Internet]. Bitlaw.com. 2015 [cited 2022 Apr 23]. Available from: https://www.bitlaw.com/source/15usc/1125.html

similar to, those for which the trade mark is registered, where the latter has a reputation in the Member State and where use of that sign without due cause takes unfair advantage of, or is detrimental to, the distinctive character or the repute of the trade mark"[144] . It should be specified that the mentioned term *to use* refers to, for example, affixing the sign to the goods or *use* the sign in advertising[145].

The latter punctuation was important to understand one of the first cases of lawsuit related to an alleged trademark infringement, which involves the clothing brand Nike and the reseller StockX.

StockX is an online marketplace which enables its users to resell sneakers, but also other clothing items, bags, and many more top-branded accessories. It serves as an intermediary between buyers and sellers, and it also provides a service of verification of authenticity for the items put on sale. Being an active intermediary, the marketplace is different from other traditional marketplaces, such as eBay. The seller sends the item to StockX, and only if authenticity is verified by a team of specialists, it is shipped to the acquiror[146]. The company has products of several different brands, but according to recent report Nike and its sub-brands (Jordan, Converse etc.) fall within the top five brands in terms of volume of sales, meaning that Nike has certainly a considerable appeal on the platform's users. Thus, StockX astutely (or maybe not) decided to take advantage of both the brand and the craze around NFTs to launch its own collection of NFTs, named "Vault NFTs". The idea behind the project is to associate to each piece of the collection a pair of shoes, stored it in a StockX warehouse and permit the NFT's purchaser to redeem it any moment paying an additional withdrawal fee[147]. In addition to the theoretical ownership of a pair of shoes, the digital item would also grant exclusive advantages on the marketplace, including discounts, rewards etc.[148]. All these benefits are lost in the moment in which the owner decides to redeem the physical item, since the StockX will also remove the NFT from the user's portfolio.

The problem with this initiative, and the reason why Nike comes into play is that eight out of nine of the collection's elements show Nike's trademark (see figure 2) and are associated to Nike's shoes. StockX has no right to display the trademark on its web page without the brand's authorization; furthermore, StockX has not been using it to sell Nike's products, since the NFTs are just the receipt, but not the pair of shoes itself. Since Nike has undoubtedly a well-established reputation, there should not be any hesitation in asserting that StockX has been violating trademark's regulation. Basically, what the company has been doing is selling a premium version of the marketplace with upgraded services tricking users by making them believe that Nike is involved in the project. Citing the above written regulations, StockX has been providing a false designation of origin

[144] EUR-Lex - 32015L2436 - EN - EUR-Lex [Internet]. Europa.eu. 2015 [cited 2022 Apr 23]. Available from: https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A32015L2436

[145] *Id.*

[146] UNITED STATES DISTRICT COURT FOR THE SOUTHERN DISTRICT OF NEW YORK [Internet]. [cited 2022 Apr 23]. Available from: https://storage.courtlistener.com/recap/gov.uscourts.nysd.574411/gov.uscourts.nysd.574411.1.0_1.pdf

[147] StockX Help [Internet]. Stockx.com. 2022 [cited 2022 Apr 24]. Available from: https://stockx.com/help/articles/How-do-I-withdraw-my-item-from-the-Vault

[148] See *supra* note 146..

and a misleading description of facts, depriving Nike's trademark of its distinctive function, in addition to using the trademark for dissimilar goods.

This designate an infringement also because since Nike has obviously no power over the NFTs associated to its products and its quality, placing Nike's goodwill is StockX's hands. Evidence of negative effects on the brand's reputation have already been identified on social networks[149], where users define Vault NFTs as a "scam for Nike to make money".

Even though StockX inserted a disclaimer on each NFT's webpage, stating that the digital item is not "sponsored by or connected to Nike"[150], the font is so small that is easily goes unnoticed and it can hardly represent a valid shield against the infringement accusation.

This case shows, again, how easy it is to infringe intellectual property rights with NFTs. As I anticipated at the beginning of the paragraph, while dealing with copyrights may raise doubts regarding the existence of infringement, with trademarks, clearly, the claim that the NFT and the work are not the same thing cannot work as a defense, and the case shows this point. In fact, infringement occurs also with the sale of goods that are completely different from the ones protected by the trademark.

[149] *Id.*

[150] *Id.*

Chapter 4

4.1 Introduction

The NFTs landscape is characterized by uncertainty not only on the matter of intellectual property rights, but also regarding many other legal aspects. This last chapter will be devoted to a brief analysis of other concerns that the authorities should address to guarantee a long-lasting, fair, and legalized utilization of these assets. These include, for example, income taxes regulations, circumvention of money laundering laws, or privacy-related issues. Lastly, I will conclude my study with final opinions regarding the themes I dealt with.

4.2 Regulations on income taxes

The first concern that should be considered regards the absence of a clear set of rules on taxation of income derived from the sale of NFTs. The problem arises because not only there does not exist a specific regulatory framework for this class of assets, but there is also great confusion on whether it is possible and how to apply already existing laws.

For example, federal tax law in the Unites States is regulated by the Internal Revenue Code (IRS), published in different volumes. The section of interest for the topic should be the "Digital Content Regulations" published in August 2019 on the Section 861 of the IRS[151]. Such regulations originally dealt only with transactions involving computer programs but was extended to any transactions involving any other digital content that is protected by copyrights. The application of such rules is very broad, but it is not clear whether NFTs should be considered falling within their jurisdiction. Reasonably, different rules apply to different categories and defining such boundaries should be necessary. For instance, capital gains on the sale of assets are usually subject to taxation. However, such obligation does not hold for artists of copyrights protected works, but it does for purchasers of such works[152]. As largely illustrated in the previous chapter, there does not exist a unique and shared opinion on whether NFTs, being links abstract from the underlying work, can be considered as copyrightable assets. Hence, if the application of such regulations is questioned, can authorities apply rules in place for computer programs? Or should NFTs be considered as falling under the category of digital content? Commentators think that either way, NFTs should be regulated with these rules, since even if copyrights are not granted to the NFT-link, it may be concluded that since NFTs can be defined as computer codes, they may fall within the definition of copyrighted "computer programs". Or, alternatively, the IRS may still be applied if the underlying work is protected by copyright.

[151] Non-Fungible Tokens and Potential Federal Income Tax Characterization Issue...: EBSCOhost [Internet]. Ebscohost.com. 2021 [cited 2022 Apr 26]. Available from: https://web.p.ebscohost.com/ehost/detail/detail?vid=0&sid=22e02e7a-20f9-47de-90c7-77442ae88b07%40redis&bdata=JnNpdGU9ZWhvc3QtbGl2ZQ%3d%3d#AN=153331590&db=bsu

[152] *Id.*

Another problem materializes from the fact that IRS regulations on collectibles taxation results to be extremely outdated since the list of taxable assets was stipulated well before the invention of the internet[153]. Thus, obviously, NFTs do not appear in such record, creating even more confusion.

4.3 Money laundering

Another potentially significant issue regards the possibility that NFTs provide in engaging in money laundering transactions. Money laundering consists in "*the process of disguising the proceeds of crime and moving value using trade transactions in an attempt tof4 legitimise their illicit origins. In practice, this can be achieved through the misrepresentation of the price, quantity or quality of imports or exports*."[154]. What criminals do is to hide revenues deriving from illegal activities, such as drug sale or terrorist funding, by generating other legitimate source of income. The purchase and sale of fine art is usually the preferred practice of money launderers, since paintings not only are a perfect mean to store and move value, but such value is also highly subjective[155], allowing these assets to be sold for incredibly large amount of money. NFTs appear as the perfect alternative to fine art collectables, in fact the massive advantage that money launderers derive from NFTs is that first, digital art NFTs are basically equivalent to fine art assets and, second, the price of NFTs is extremely volatile meaning that an asset bought for 1 EUR may be worth 1 million EUR the next day, perfectly matching the interests of fraudsters. Moreover, there is another feature favoring money launderers. As already mentioned in the previous chapter, NFTs transactions can happen in an anonymous (or pseudo anonymous, as we will see in paragraph 4.5) modality. Even though the record of transactions is safely stored on the blockchain, the identity of the actors involved can stay unknown. Fraudsters are highly facilitated from this, since they can easily create different accounts on the blockchain, sell and buy the same NFT transferring it from one account to another, thus creating a false history of legitimate transactions. Additionally, while sale and purchase of physical fine art may be complicated due to geographical boundaries and logistics issues to move the asset, money laundering through NFTs does not face all these hindrances and, thus, results very appealing to fraudsters. In fact, transfer of ownership of digital assets is immediate and, since it happens on the blockchain, it does not require any regulatory and financial cost[156] that may be involved in physical assets transactions.

[153] *Id.*

[154] Documents - Financial Action Task Force (FATF) [Internet]. Fatf-gafi.org. 2020 [cited 2022 May 11]. Available from: https://www.fatf-gafi.org/publications/methodsandtrends/documents/trade-basedmoneylaundering.html

[155] NFTs – the new art of Money Laundering? - IDnow [Internet]. IDnow. 2022 [cited 2022 May 11]. Available from: https://www.idnow.io/blog/nft-non-fungible-tokens-new-art-money-laundering/#:~:text=In%20sum%2C%20unfortunately%2C%20NFTs%20can,launder%20money%20without%20being%20detected

[156] Cassady D. NFT market is vulnerable to money laundering, according to US Treasury study of the art trade [Internet]. The Art Newspaper - International art news and events. The Art Newspaper - International art news and events; 2022 [cited 2022 May 11]. Available from: https://www.theartnewspaper.com/2022/02/08/us-treasury-study-art-market-money-laundering-nfts

4.4 Are NFTs commodities or securities?

Until now I have made clear that NFTs are such a recent phenomenon that institutions still have not a clear idea on how to classify and regulate them. There is one more case of such issue that I would like to discuss, and it regards the distinction between commodities and securities.

Commodities are any type of goods that can be bought or sold. Raw materials serving as inputs to produce other goods, such as agricultural products, metals, or natural gas, are the most common examples.

A security, instead, is a financial instrument, and it is defined as any asset that can be traded[157], such as bonds or stocks. Specific rules determining whether a class of assets can be considered a security depends on the different national jurisdictions. However, for the Unites State a more detailed definition of security has been provided in 1946 following the U.S. Supreme Court's case of SEC v. W.J. Howey C. According to the Court's final decision, a security is "*any investment of money (1) in a common enterprise (2) with a reasonable expectation of profits (3) to be derived from the effort of others (4)*"[158]. From this definition, the Howey test was outlined: a set of three questions verifying that the three requirements mentioned above are met. The reason why is important to be able to unequivocally classify NFTs is that, of course, different regulations apply to commodities and securities. Usually, more stringent rules apply to securities, in particular concerning transparency, reporting demands etc.[159].

The issue with classification of NFTs is that there exist different point of views leading to different conclusions. For instance, generally NFTs transactions involving a digital image should not be treated as securities. In fact, one of the requirements of the Howey Test is that the investment must be done in a common enterprise, where the effort made from others should guarantee a profit to the investor; clearly the purchase of a digital-image-NFT would not meet such requirement. The digital art would be complete at the time of the purchase and would not require any additional effort or work to be made for the NFT to be sold at a profit[160].

However, some commentators have different opinions, arguing that fractionalized NFTs, for example, can meet the Howey Test requirements. In fact, since fractionalization allows NFTs to be owned collectively, such investment can be compared to a common enterprise, in which all the shareholders must contribute to manage the entity collectively to guarantee that all the investors can make the expected profit selling the shared asset[161]. In such case, NFTs would exactly coincide with the Howey Test definition. Once again, it results obvious from this example that it should be unacceptable to have such uncertainty when dealing with assets involved in

[157] SoFi. Is Crypto a Commodity or Security? Why Does It Matter? | SoFi [Internet]. SoFi. 2021 [cited 2022 May 12]. Available from: https://www.sofi.com/blog/crypto-commodity-vs-security/

[158] PYMNTS. Can NFTs Be Securities? The SEC Says Yes [Internet]. Pymnts.com. PYMNTS.com; 2022 [cited 2022 May 12]. Available from: https://www.pymnts.com/nfts/2022/pymnts-nft-series-can-nfts-be-securities-the-sec-says-yes/

[159] See *supra* note 157.

[160] Are NFTs Securities? Analysis of the NBA Top Shot Litigation and Other NFT-Related Actions | JD Supra [Internet]. JD Supra. 2022 [cited 2022 May 12]. Available from: https://www.jdsupra.com/legalnews/are-nfts-securities-analysis-of-the-nba-2972108/#:~:text=%5B1%5D%20Based%20on%20the%20definition,market%20involving%20NFTs%20could%20develop.&text=Using%20the%20Howey%20definition%20and,transactions%20may%20not%20be%20securities

[161] See *supra* note 157.

exchanges of millions of euros, since the most immediate collateral effect is providing fraudster with the opportunity of freewheeling crimes.

4.5 Compliance with privacy regulations

In this paragraph I want to discuss a problem that may hardly come up in people's mind when thinking about NFTs and blockchain in general, since it regards the compliance of NFTs transactions with privacy law, such as the General Data Protection Regulation (GDPR), or the California Consumer Privacy Act (CCPA). In fact, considering the main features of NFTs underlying technology, the blockchain, it is reasonable to presume that privacy issues should not belong to the NFTs world. As described in paragraph 1.1, blockchain allows to execute transactions without the intervention of intermediaries and to keep a public, always-updated record of such transactions on a distributed ledger. Clearly, there is a considerable difference between participating in a transaction in the real world and on the blockchain. In the first case, all the different intermediaries involved, such as banks, online service providers, or shipping companies, would be able store our personal information, including name, address, phone number etc. In the second case, none of this would be required since no personal identification details are requested. However, differently from what one might think, the fact that users are not asked to provide their name or identification details does not mean that blockchain grants full anonymity. It grants, indeed, pseudo-anonymity[162]. The reason is that transactions between parties can be executed only if both users have a wallet, whose address is made visible on the public ledger, together with a public key once the operation has been executed.

It is true that wallet addresses consist, usually, of a 42-character string with little or none reference to the owner's identity, but with some effort and specific actions, it may be possible to retrieve one's identity[163]. Not to mention that many blockchain users now have an Ethereum Naming Service (ENS) domain associated to their wallet, and such domain can deliberately allow to identify either the users herself, or her online pseudonymous[164]. Anyhow, even without ENS, blockchain maintains a record of all the transactions in which users were involved, allowing anyone to know all the assets that a specific user has owned, sold, or purchased[165], but it still must be cleared out whether this can constitute as personal information under the protection of the current legal frameworks mentioned above. According to the CCPA *"(1) "Personal information" means information that identifies, relates to, describes, is reasonably capable of being associated with, or could reasonably be linked, directly or indirectly, with a particular consumer or household. Personal information includes, but is not limited to: […] (F) Internet or other electronic network activity information, including, but not limited to, browsing history, search history, and information regarding a consumer's*

[162] What do NFTs mean for privacy? [Internet]. Privacy & VPN Blog - Orchid. 2021 [cited 2022 May 13]. Available from: https://blog.orchid.com/what-do-nfts-mean-for-privacy-/

[163] Jacobs M, Murphy M. NFTs: Privacy Issues for Consideration [Internet]. JDSUPRA. 2022 [cited 2022 May 13]. Available from: https://www.jdsupra.com/legalnews/nfts-privacy-issues-for-consideration-7804114/

[164] *Id.*

[165] *Id.*

interaction with an internet website application, or advertisement[166]*"*. Considering the blockchain wallet as an electronic network activity information, then there would be no doubt of the applicability of such legislation. On the contrary, the GDPR appears not as clear since it does not explicitly mention the internet or any other online activity as example of personal information. However, the definition states that "*Personal data are any information which are related to an identified or identifiable natural person. The data subjects are identifiable if they can be directly or indirectly identified, especially by reference to an identifier […] which expresses the physical, physiological, genetic, mental, commercial, cultural or social identity of these natural persons. In practice, these also include all data which are or can be assigned to a person in any kind of way. […] Since the definition includes "any information," one must assume that the term "personal data" should be as broadly interpreted as possible*[167]." Here, the possibility of defining one's identity from a user's wallet would make blockchain transactions protected by the GDPR.

Even in this case, as for the discussion of the previous paragraph, is crucial to unequivocally determine whether personal information is involved and whether blockchain and NFTs should be considered under the privacy regulations frameworks. In fact, if this is not the case, there would not be any law regulating the transactions which, clearly, is unacceptable. On the contrary, if this is the case, there are some considerations to be made regarding the compliance with such rules. For instance, let's consider one of the rights granted to the data subjects according to the GDPR, the right of erasure or "right to be forgotten". The Art. 17 of the GDPR enunciates that *"The data subject shall have the right to obtain from the controller the erasure of personal data concerning him or her without undue delay and the controller shall have the obligation to erase personal data without undue delay where […] (a) the personal data are no longer necessary in relation to the purposes for which they were collected or otherwise processed; (b) the data subject withdraws consent on which the processing is based), and where there is no other legal ground for the processing; (c) the data subject objects to the processing) and there are no overriding legitimate grounds for the processing; […]*[168]*".* The matter is controversial. In fact, it seems that the immutability of the blockchain ledger is completely incompatible with the GDPR for the nature of such ledger itself. According to the point (a) of Art. 17, personal information should be deleted if no longer needed for the original purpose, i.e., the execution of a contract, but on the other hand transactions are recorded on the ledger permanently and should not be removed, otherwise the whole point of this technology would fail. The only clause blockchain could rely on to protect against GDPR violation claims is the one provided in section 3 of Art. 17, stating that the right to be forgotten cannot be exercised if

[166] 1798.140 – Definitions - BCLP California Consumer Protection Act Information [Internet]. BCLP California Consumer Protection Act Information. 2021 [cited 2022 May 13]. Available from: https://ccpa-info.com/home/1798-140-definitions/#:~:text=(1)%20%22Personal%20information%22,a%20particular%20consumer%20or%20household

[167] General Data Protection Regulation (GDPR) – Final text neatly arranged [Internet]. General Data Protection Regulation (GDPR). 2021 [cited 2022 May 14]. Available from: https://gdpr-info.eu/issues/personal-data/#:~:text=GDPR%20Personal%20Data&text=The%20term%20is%20defined%20in,identified%20or%20identifiable%20natural%20person

[168] *Id.*

the data are needed to achieve purposes of public interest in public health or scientific and historical research[169]. Even though it cannot be excluded that scientific researcher may use the blockchain and NFTs useful for their purposes, this would only represent a small portion of all the data stored on the ledger. Since it seems that the GDPR considerably limits the functioning of the blockchain, legislators could think about stipulating a whole new legal framework tailored specifically for the Web 3.0 and blockchain technology. Or, alternatively, they could evolve the existing regulation guaranteeing that not only the preservation of the data subjects' interests, but also the development and continuation of blockchain. Regarding this affirmation, one last consideration should be made. Notwithstanding the flaws and grey areas of the technology, blockchain can, if properly used, bring considerable benefits, and serve public interests. For example, it introduces an innovative digital infrastructure, new market opportunities and new modes of executing daily transactions[170]. For this reason, legislator should be careful to balance the goals of fostering blockchain innovation and growth while making sure that it is not harming the society in any way.

4.6 Environmental impact

In addition to the many legal controversies existing, one of the main concerns, if not the main one, regarding the NFTs craze is the environmental impact that they have, due to the extensive carbon dioxide emission each transaction causes. It is not completely correct to blame NFTs for this, since the real source of the emissions is the blockchain and, more specifically, the PoW consensus process necessary for mining cryptocurrencies, explained in paragraph 1.1.4. Since Ethereum, which is the most popular blockchain network and cryptocurrency used by NFTs marketplace, relies on PoW, clearly NFTs have an important problem to deal with. Mining cryptocurrency, exchanging them, and using them to buy assets is extremely compute intensive and it requires hundreds of computers running interruptedly to solve complex problems. To get better sense of the amount of energy needed, many researchers have engaged in studies finalized at estimating the average carbon emission footprint for different kind of transactions and comparing it to daily energy consumption. For example, transactions related to a single NFT, including the minting, bidding, sale, and transfer of ownership, have a total footprint of 340Wh, with emission of 211KgCO2, which is equivalent to a European Union resident total electric power consumption for a month, to a two-hour flight or to using a laptop for three years[171]. Considering that these are the numbers just for a single NFT transactions, thinking about the emission of all the yearly NFTs transactions is undoubtedly shocking.

What is even worse, according to the Danish PhD researcher on sustainable blockchain technologies Dr. Köhler, is that even if these machines are expected to become more efficient and be able to solve computational

[169] *Id.*

[170] NFTs: Privacy and Data Protection - Versteeg Wigman Sprey [Internet]. Versteeg Wigman Sprey. 2021 [cited 2022 May 14]. Available from: https://www.vwsadvocaten.nl/en/nfts-privacy-and-data-protection/

[171] Memo Akten. The Unreasonable Ecological Cost of #CryptoArt. Part 1 | Medium [Internet]. Medium. Medium; 2020 [cited 2022 May 14]. Available from: https://memoakten.medium.com/the-unreasonable-ecological-cost-of-cryptoart-2221d3eb2053

problems much faster, the increasing interest on blockchain and of number of NFTs transactions leads to much more complex puzzles to solve[172]. Hence, time does not bring consumption efficiency, indeed it leads to the opposite.

This does not mean that there does not exist a solution to avoid such a negative environmental impact, or one that could mitigate it. For example, the first step would be to switch to PoS consensus algorithm, which would allow to reduce energy consumption by 99%, since it does not involve mining[173], as explained in paragraph 1.1.4. Ethereum has, indeed, already announced its commitment in taking action in this direction, even though it has been already several years, and nothing has been done in practice, given than implementing a new model is not a change that "cannot be done overnight" and it involves several complexities[174]. However, it seems that many actors involved in the NFTs showed their awareness regarding the issue and took position against it. NBA Top Shot marketplace, for instance, decided to rely on Flow blockchain, instead of Ethereum, since it already uses PoS[175]. Elon Musk stood up as well and in May 2021 published a tweet declaring that Tesla would have no longer accepted Bitcoins for payments until a more sustainable process was adopted[176]. Even though there are still many people denying the environmental impact of blockchain, many other companies demonstrated their interest by taking much more conscious decisions, for example by installing mining facilities in areas where renewable energy can be utilized[177], while waiting for more advanced technological solutions to upgrade the current blockchain.

4.7 Conclusions

This analysis was aimed at exploring the world of non-fungible tokens, a new kind of assets whose existence has been enabled by the cutting-edge blockchain technology. In the recent years, blockchain and NFTs have been certainly among the most popular discussion topics all over the internet and social media, especially due to the astonishing sale prices that characterized some of the most famous NFTs, whose appeal has been fueled by the many celebrities who started to show their familiarity with these assets. And it is exactly this traffic on social media that aroused the curiosity of many people. Many started to wonder what NFTs were, and why they were valued so much money. Hence, some of them started digging deep and researching to study such

[172] NFTs Are Shaking Up the Art World. They May Be Warming the Planet, Too. (Published 2021). The New York Times [Internet]. 2022 [cited 2022 May 14]; Available from: https://www.nytimes.com/2021/04/13/climate/nft-climate-change.html

[173] Lewis S. NFTs may be the future of art — but are they threatening the future of the planet? [Internet]. Cbsnews.com. CBS News; 2021 [cited 2022 May 14]. Available from: https://www.cbsnews.com/news/nft-art-environmental-costs/

[174] See *supra* note 172.

[175] See *supra* note 173.

[176] *Id.*

[177] Bruner R. Environmental Concerns Have Cast Doubt on NFTs—But That's Changing [Internet]. Time. Time; 2021 [cited 2022 May 14]. Available from: https://time.com/6120237/nfts-environmental-impact/

new, peculiar trend; some tried to take advantage of the apparently inevitable fortune by investing both on cryptocurrencies and NFTs; some just passively observed the phenomenon. As the number of actors, the number of created projects and the size of the market increased, some of the most careful observer shed a light upon the first complications. No surprise that such significant, large-scale phenomenon would have had an impact on the rest of the world. Indeed, there must exist a reason for NFTs (and blockchain) being described as revolutionizing. Certainly, they introduced a completely unknown, brand-new system to represent property, they enabled the creation of a totally different revenue stream and, surely, present the potential to solve many drawbacks in many different markets, for example, the music or ticketing industry, as illustrated in the previous chapters. However, the obstacle that has been correctly identified with greater attention in the last months, stands in these assets themselves. Being based on blockchain technology, the intrinsic nature of non-fungible tokens is that of unregulated assets. The main feature of blockchain, indeed, is its decentralizations, its lack of authority's supervision, which of course is reflected on NFTs as well. This is probably the reason why up to this moment many grey areas have been identified; the relationship between NFTs and intellectual property rights, the compliance with privacy, money laundering and taxation rules are all instances of subject matters that have not been discussed enough until now, simply because authorities had not felt the need to emphasize them as, theoretically, the phenomenon should have been regulating itself. Then, when people started realizing that, as far as the absence of specific, articulated laws and autocratic body may be a paradisiacal situation, too many damages had already occurred.

As of today, NFTs (and blockchain) have been existing already for almost fifteen years, and still there are innumerable doubts on how to deal with them. I should clarify that I do not completely condemn authorities for this negligence as I acknowledge that creating a valid and effective regulatory framework is an activity that cannot be completed overnight, and surely the institutions are already trying to define the most appropriate rules possible.

There is the risk, however, that by the time that this is achieved, much of the current hype surrounding NFTs will be gone or faded. It would not even be that surprising, considering that the latest market trends have already shown signs of decline. For example, the average price per NFT dropped from $6,800 in January of this year to $2,000 in April[178]. Similarly, the total daily sales average was about $160 million in January, and plummeted to $26 million on March[179]. Obviously, as already mentioned, NFTs value is extremely volatile and follows the pattern of cryptocurrency markets. Thus, surely the recent events must have had their role in such abrupt decline, as the most evident changes were detected after Russia invaded Ukraine on February 24[180].

[178] Morris C. The NFT bubble is showing clear signs of bursting [Internet]. Fortune. Fortune; 2022 [cited 2022 May 16]. Available from: https://fortune.com/2022/03/04/nft-bubble-market-crash-price-value/

[179] Kharif O. NFT Mania Show Signs of Cooling as Average Price and Sales Decline [Internet]. Bloomberg.com. Bloomberg; 2022 [cited 2022 May 16]. Available from: https://www.bloomberg.com/news/articles/2022-03-03/nft-mania-show-signs-of-cooling-as-average-price-sales-decline

[180] *Id.*

However, even before the world was provided with prospects of a terrible war, a decay in the NFT market was already observable. This information can lead to two possible conclusions. The first one is that people started losing interest in this phenomenon, proving that all the engagement was dictated by the desire to be part of a trend, and to try a "toy" that was supposedly capable of turning everyone rich; when they realized that this was not the case, they got tired and turned the other way. The second one, which is not necessarily mutually exclusive, is that people had no idea about what NFTs were, they simply dove into this world and retired as they started noticing the flaws I highlighted in this research.

Either way, if we expect these market data to continue changing so abruptly, then it is very likely that we will not be hearing about NFTs anymore in the next years, or maybe not in the same terms as we do today. However, given the speed at which we are achieving technological progress and at which the world is getting more and more digitized, I am rather sure that the metaverse will evolve and become part of everyone's daily life. I cannot know when this will happen, but when it will happen, presumably NFTs will be in there as well. Hopefully, by that time, we will have overcome all the current obstacles hindering the application of these potentially revolutionizing, advantageous assets.

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