

COPYRIGHT BLOCKCHAINED: EXPLORING THE POSSIBILITIES AND CHALLENGES OF BLOCKCHAIN IMPLEMENTATION IN THE COPYRIGHT REALM

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ABSTRACT

The rapid advancement of information and technology has posed some serious challenges to intellectual property rights. Copyright is one such right which is facing difficulty in coping with the rapid rise and evolution of the internet. In this Internet era, copyrightable works are being extensively made and transformed into various digital platforms which has on the one hand opened up a significant market for a wide variety of artists to showcase their artistic talent to the world. On the other hand, it has posed some serious challenges in terms of copyright infringement and digital piracy that results in loss to the owners of the copyright, both in terms of money and reputation. Lack of control over the internet, difficulty in locating the source of infringement and ease of replication and modification of the content makes it difficult for the copyright holders to enforce their rights. The Digital Rights Management has failed to provide satisfactory protection to copyright holders in the online world. However, the advent of blockchain technology has certainly raised hopes of getting an effective solution to check copyright infringement in cyberspace. Blockchain is a software protocol which helps in storing information within digital blocks which are tamper proof and time stamped, making them immutable from backdating. Blockchain technology has gained widespread recognition with the introduction of cryptocurrency. Application of smart contracts to Blockchain further strengthens its reliability and security. This article aims to present a descriptive analysis of the concept of blockchain, its functioning and how its unique features including smart contracts could help in securing copyright content, creating more transparent licensing procedures through smart contracts and enforcing the rights of the owner of the copyright in the digital arena. The article shall also look into instances where

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blockchain technology is being used to secure copyright protected works on the internet and discuss the challenges in implementing this technology in respect of copyrightable works.

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INTRODUCTION

The information technology revolution has stirred the copyright system throughout the globe. These technologies have paved the way for digitisation of tangible artistic works. Any form of work could be converted into binary language which requires minimum skill and expertise to do so and then can be stored in computer systems. Once digitized, they can be easily replicated with minimal cost and error. The advent of the Internet has further complicated the issue by providing a platform where a digitized work could be shared throughout the globe to innumerable persons at the same point of time without any loss of quality with regard to the original work. The use of the internet and computer systems has, on one hand, opened an ocean of opportunities for content providers consisting of artists, academicians and people from film and music industries to expand their potential markets. On the other hand, it has also posed some serious challenges on the copyright front in the form of unauthorized digital reproduction of works, dissemination of it on the internet, which is popularly known as “Online Piracy”, and difficulty in restricting the distortion of the digital works¹. Since the internet is not a closed group but an open-access network, it is extremely difficult to pinpoint the exact source from where the infringement of copyright originated. The ability to act anonymously helps pirates to perform copyright infringements without leaving any trace of evidence and any risk of loss². Once a work is available on the digital platform, the current technology has made it possible for pirates to distort the information attached with the work regarding the identification of the creator or the copyright owner and share it on the internet. Once the identity of the work is altered, it becomes extremely difficult to trace the infringing copies since the internet is an open network and the owner of the work has almost no control over the issue of copies being made available online.

In order to cope up with these copyright issues posed by the cyberworld, the World Intellectual Property Organization (WIPO) introduced the WIPO Copyright Treaty (WCT) and the WIPO Performances and Phonograms Treaty (WPPT), collectively known as the ‘Internet Treaties’. These treaties not only recognized the rights of the copyright holders in the digital environment, but more importantly it obliged the contracting parties to provide effective legal remedies against the circumvention of those technological measures adopted by the copyright holder which restricts unauthorized and unlawful acts in connection with their works and provides

¹ Zakir Thomas, *Digital Copies and Emerging Copyright Scenario*, 8 J. INTELL. PROP. RTS. 276, 277 (2003).

² Eric Schlachter, *IPR Renaissance in Cyberspace: Why Copyright Law Could Be Unimportant on the Internet*, 12 BERKELEY TECH. L.J. 15, 20 (1997).

adequate legal remedies against any action of altering and removing electronic rights management information that has been attached to the works of the rights holders under the treaty³. These rights are known as Digital Rights Management (DRM) and the technologies used to enforce these rights are known as DRM technologies. They provide protection to the rights of copyright holders by restricting access to digital content only to authorized consumers. Access to online content only after payment and encryption of digital contents to restrict its usability to certain platforms are some of the examples of DRM technologies used to prevent piracy breach and other misuses of the digital content. The DRM technology facilitates secured distribution of the digital content on the internet by giving more security to the owner of the content and more choices to the consumers⁴.

However, these technologies suffer from certain limitations that have become a spot of bother for both the content owners and the consumers. The technology restricts interoperability which means that files bought from a service supporting one technology might not work on the devices which run on another technology⁵. Apart from interoperability, regional restrictions coded in the digital content also makes it difficult for consumers to access the content, no matter what they are willing to pay⁶. These technologies also suffer from single point failure as they have a centralized operating structure, making them vulnerable to cyber-attacks. In the event of failure of DRM system, they negatively impact both the content owners and the consumers in terms of revenue and reduction in the availability of purchased content⁷. Additionally, DRM technologies have certain privacy and security issues, where these technologies have been found snooping around the user's system. For example, Adobe's Digital Editions DRM used to keep track of the books downloaded by the user, progress made by the user in the book and where the user is sending the books⁸.

³ See World Intellectual Property Organization Copyright Treaty art. 11, 12, Dec. 20, 1996, 2186 U.N.T.S. 121; See also World Intellectual Property Organization Performances and Phonograms Treaty art. 18, 19, Dec. 20, 1996, 2186 U.N.T.S. 203.

⁴ Centre For Democracy & Technology, *Evaluating DRM: Building a Market Place for the Convergent World*, YUMPU, <https://www.yumpu.com/en/document/read/18155402/evaluating-drm-center-for-democracy-and-technology> (last visited Mar. 13, 2020).

⁵ Nicholas Sheppard, *Digital Copyright Protection- some success but mostly failure*, THE CONVERSATION (Aug. 12, 2014, 6:24 AM), <https://theconversation.com/digital-copyright-protection-some-success-but-mostly-failure-30215>.

⁶ Fredrick W. Dingley & Alex Berrio Matamoros, *What Is Digital Rights Management?*, in DIGITAL RIGHTS MANAGEMENT: THE LIBRARIANS GUIDE 16-17 (Catherine Lemmer & Carla Wale eds., 2016).

⁷ James Rinaldi, *Peer to Peer Digital Rights Management Using Blockchain* 9-10 (Jun. 5, 2018) (Thesis, University of the Pacific), https://scholarlycommons.pacific.edu/uop_etds/3136.

⁸ Dingley & Matamoros, *supra* note 6, at 19.

Blockchain technology promises to afford a secure and decentralized platform for digital contents where supervising and controlling of content would be more effective and transparent as compared to present DRM services. Apart from strengthening DRM, blockchain could provide a robust copyright ownership registry, which is tamper resistant. Blockchain removes the need for an intermediary, giving more power in the hands of content creators and provides a direct link with the consumers. This article examines the underlying technology of the blockchain and its features which underlines its potential for the copyright system. The article shall further examine the possibilities of implementation of this technology within the copyright realm with the help of certain marketplace examples which are using this technology in managing copyright and the issues which hinder its implementation in the copyright realm.

I. UNDERSTANDING BLOCKCHAIN TECHNOLOGY

Blockchain is a decentralized, time-stamped, peer to peer network-based public, encrypted and immutable digital federated ledger system⁹. In other words, it is a distributed ledger system in which information of any kind is stored in the form of blocks and are joined together chronologically with time stamping and cryptographic security. Since the system is decentralized, every person attached to the blockchain network through their computer devices called nodes, has the access and exact replica of each and every block present in the chain. This makes it difficult for anyone to make any changes in the block without getting noticed.

The credit for getting this technology widely known to the world goes to a paper titled “Bitcoin: A Peer-to-Peer Electronic Cash System”¹⁰, published under the pseudonym of Satoshi Nakamoto in the year 2008. Till date, the identity of Satoshi Nakamoto is still a mystery but his ground-breaking paper introduced the world to a peer-to-peer based payment system in which the transactions shall be recorded in blocks that are cryptographically protected with digital time stamping. Additional blocks shall be added on the blockchain only when it is verified by the majority of the users attached to the blockchain network, creating an open trust-based model without the involvement of any intermediary. Although the core ideas on which the Blockchain system is based are not new and the methods like the time stamping¹¹ has been discussed in the past by also to secure digital files and do away with the requirement of a central

⁹ B.P Singh & Anand Kumar Tripathi, *Blockchain Technology and Intellectual Property Rights*, 24 J. INTEL. PROP. RTS. 41, 42 (2019).

¹⁰ SATOSHI NAKAMOTO, BITCOIN: A PEER-TO-PEER ELECTRONIC CASH SYSTEM, <https://bitcoin.org/bitcoin.pdf>.

¹¹ DAVE BAYER ET AL., *Improving the Efficiency and Reliability of Digital Time Stamping*, In SEQUENCES II METHODS IN COMMUNICATION, SECURITY, AND COMPUTER SCIENCE 329-334 (R. Capocelli et. al., 1993).

administrator¹², the credit for combining all these technologies and applying it to digital payments goes to Nakamoto. The blockchain system can be categorized into public blockchain or private blockchain based on the nature of the users using it. In public blockchain, anyone can join the network and can access all of the transaction history recorded on the blockchain. In private blockchain, the access to the network is determined by rules created by a single organization. Only few of the users have the authority to access the transactions and trust is centralized to the owner¹³.

The underlying concepts of blockchain technology are highly complex and technical. Therefore, we shall restrict ourselves to only those features which are relevant for copyright, and through these features we shall understand the functioning of blockchain in a more practical manner. The first distinctive feature is its decentralized structure where each person attached with the blockchain network can independently verify information¹⁴. It is easier to steal an object from a secluded place than from a public place where it is visible to everyone. Every node attached to the network has a copy of the network stored in its computer and any change happening on the network gets reflected on their computers, making it difficult for a malicious attacker to change any block. It is similar to record keeping in the real world but with complete transparency with respect to making entries and changes in it.

The second important feature of blockchain technology is that it is tamper-resistant. Once information is embedded in the block, it is very difficult to change it. The blockchain technology takes help of a cryptographic hash function to secure the information present in the block. The hash function or simply hashing, is a mathematical function that transforms an input of any length into a unique fixed-length output¹⁵. In other words, if we put any information of any length through a hash function, it will produce a unique alphanumeric series of fixed output¹⁶. There can be no two inputs of data that will give the same result after going through the hashing function. Every block in the blockchain not only contains the hash function of its own block but also the hash result of the previous block making a reference to the previous block. This leads to a chain of blocks in which each one has the reference of the hash of the

¹² Amy Whitaker, *Art and Blockchain: A Primer, History and Taxonomy of Blockchain Use Cases in the Arts*, 8 ARTIVATE 21, 25 (2019).

¹³ V. DEDEOGLU ET. AL., *Blockchain Technologies for IoT*, in *ADVANCED APPLICATIONS OF BLOCKCHAIN TECHNOLOGY* 60-61 (Shiho Kim & Ganesh Chandra Deka eds., 2020).

¹⁴ DELOITTE, *BLOCKCHAIN @MEDIA: A NEW GAME CHANGER FOR THE MEDIA INDUSTRY?* (2017), <https://www2.deloitte.com/content/dam/Deloitte/tr/Documents/technology-media-telecommunications/deloitte-PoV-blockchain-media.pdf>.

¹⁵ ARVIND NARAYANAN, JOSEPH BONNEU, ET. AL., *BITCOIN AND CRYPTOCURRENCY TECHNOLOGIES* 34 (2016).

¹⁶ Whitaker, *supra* note 12, at 29.

previous block, making it easy to verify the source and increasing its trustworthiness. In this way two blocks cannot connect together unless the hash value of one block and the hash value in the header of the subsequent block is the same. This method helps in detecting any data tampering, and even if an attacker changes data in a block, it will be immediately detected by the other nodes on the network and will be rejected by them¹⁷.

A change in the blockchain can be introduced only through a new block after it is validated by the majority of the users present on the network. This is known as the ‘consensus-based trust model’. For adding a new block to the chain, a user has to solve a cryptographic puzzle using the ‘Nonce’ given in the header of a block. A ‘Nonce’ is a random cryptographic number that is only used once¹⁸. The nodes on the network constantly hash the nonce to get the desired result which will allow the block to be added to the network. This calculation is nothing but a trial-and-error test done by the brute force of the computational power of the computer¹⁹. The solution of the cryptographic puzzle depends upon the nature of the network. For instance, in the Bitcoin network, the calculated value of the hash must have a certain number of leading zeroes. This consensus-based model is known as the “Proof of Work” (PoW) model where the node who is claiming to generate a new block must prove that he has done some work to solve that cryptographic puzzle. Once a node successfully solves this puzzle, it broadcasts it on the network and all other nodes must mutually validate the correctness of the hash value. This model does not require any central authority or any intermediary to validate the authenticity of the block.

The third important feature of this technology is its time-stamping method which works as a proof of the existence of the hash in the block. Once a hash is created, it is attached with the time and date of the creation and is published publicly on the blockchain network. The timestamp proves that the data must have existed at the time, obviously, in order to get into the hash. Each timestamp comprises the previous timestamp in its hash, forming a chain, with each additional timestamp supporting the ones before it²⁰.

Since the blockchain network does not contain a central enforcement authority, it uses self-executing programming codes, which automatically comes into effect once the required conditions are fulfilled. This takes us to the fourth important feature of this technology which

¹⁷ Tom W. Bell, *Copyrights, Privacy and the Blockchain*, 42 OHIO N.U. L. REV. 439, 463 (2016).

¹⁸ NATIONAL INSTITUTE OF STANDARDS AND TECHNOLOGY, NISTIR 8202, BLOCKCHAIN TECHNOLOGY OVERVIEW (2018), <https://nvlpubs.nist.gov/nistpubs/ir/2018/NIST.IR.8202.pdf>.

¹⁹ Whitaker, *supra* note 12, at 30.

²⁰ Nakamoto, *supra* note 10, at 2.

are self-executing codes called “Smart Contracts”. Nick Szabo introduced the concept of smart contract as “A computerised transaction protocol that executes the terms of the contract. The general objective of the smart contract design is to satisfy common contractual conditions, minimise exceptions both malicious and accidental and minimise the need for trusted intermediaries”²¹. In rather simple words, smart contracts are based on an *if and then* scenario which is validated and enforced automatically by the computer codes. A basic example of smart contract in action would be of a vending machine where it is programmed to dispense items once the money is inserted in it. The most attractive part about these smart contracts is there is no need for a middleman with regard to enforcement and thus, saves the cost of fees charged by them. It is tamper-proof and permanent where the blockchain network acts as the intermediary and enforcer²². Suppose, a group of farmers pool some money as an insurance against the rising temperature above fifty degree Celsius for three consecutive days and put it on a blockchain network where the smart contract is linked with the local weather website. If the website shows temperature above fifty for three consecutive days, then the smart contract will automatically enforce the payment of the insured money according to the specified shares of the farmers which is also being encoded in the smart contract. Its hassle free and paper less functionality has created a lot of buzz in the copyright realm which will be discussed in the next section.

II. POSSIBLE IMPLEMENTATIONS IN THE COPYRIGHT REALM

The above prominent features of blockchain technology certainly open a new door of opportunities for copyright management in the cyber world. The technology can possibly help to solve certain glaring issues faced by the copyright owner. Some of the issues in which blockchain technology can certainly provide a strong alternative are:

A. Secured and Transparent Digital Rights Management

One of the pressing issues which the copyright owners face in the digital world is lack of transparency regarding the ownership of copyrightable work and the ease of manipulation of information of the copyrightable works in the digital arena, which makes it further difficult to ascertain the authenticity of the copyrightable work. The information regarding copyright

²¹ Nick Szabo, *Smart Contracts: Building Blocks For Digital Markets*, PHONETIC SCIENCES, AMSTERDAM (1996), https://www.fon.hum.uva.nl/rob/Courses/InformationInSpeech/CDROM/Literature/LOTwinterschool2006/szabo.best.vwh.net/smart_contracts_2.html.

²² TIANA LAWRENCE, *BLOCKCHAIN FOR DUMMIES* 30 (John Wiley & Sons. Inc., 2017).

ownership is currently distributed across different databases and even companies²³. The lack of a central repository regarding the information about copyrightable works makes it difficult for both owners and the users to get benefit from each other. Since copyright belongs to the category of unregistered Intellectual Property rights, the proof of ownership of the work becomes really difficult especially in the digital world. The DRM technologies do help to some extent in protecting the work, but due to its centralized nature, they have certain limitations which we have discussed briefly in the beginning of this article. The use of third-party services for storage and security of digital works adds to the cost of both the owner of the work and the potential user.

Blockchain can resolve these issues to some extent by providing a decentralized database of verified public timestamps which could help in providing evidence of the conception, ownership of the works, especially in case of unregistered copyright works²⁴. No single computer or organization is responsible for blockchain. This feature of no central storage makes it almost impossible to change the data present in the block²⁵. Blockchain can serve as a common asset registry, making a global registry for copyright and neighbouring rights a possibility²⁶. Timestamps can further help in creating a presumption of ownership and possibility for anyone on the network to state publicly that the certain event happened at a certain time²⁷. Time stamping provides proof that a certain thing existed at a given point of time like a notary service. Platforms based on the blockchain technology generally store the hash of a block together with the timestamp so the author can prove that he or she created the document and that document existed at a given time²⁸. The authenticity of the time stamp is further strengthened by the help of a cryptographic hash function combined with it. If any person on the network wants to confirm whether the contents of the block have been manipulated or not, he simply has to run the hash function on the data on his computer and

²³ Asim Vehbi, *Core Issues of Copyright Law in the Digital Environment: The Promise of Blockchain*, 13 INT. J. APPL. ENG. RES. 14510, 14511 (2018).

²⁴ Birgit Clark, *Blockchain and IP Law: A Match Made in Crypto Heaven*, 1 WIPO MAGAZINE 1, 31-32 (2018), https://www.wipo.int/wipo_magazine/en/2018/01/article_0005.html.

²⁵ Wubing Chen et. al., *A survey of Blockchain Applications in Different Domains*, INTERNATIONAL CONFERENCE ON BLOCKCHAIN TECHNOLOGY AND APPLICATIONS 17, 19 (2018), <https://arxiv.org/ftp/arxiv/papers/1911/1911.02013.pdf>.

²⁶ Michele Finck & Valentina Moscon, *Copyright Laws on Blockchains: Between New Forms of Rights Administration and Digital Rights Management 2.0*, 50 INTERNATIONAL REVIEW OF INTELLECTUAL PROPERTY AND COMPETITION LAW 77-108 (2018).

²⁷ Alexander Savelyev, *Copyright in the Blockchain Era: Promises and Challenges* 8 (NATIONAL RESEARCH UNIVERSITY HIGHER SCHOOL OF ECONOMICS, Working Paper No. WP BRP 77/LAW/2017).

²⁸ VALENTINA GATTESCHI ET. AL., *Blockchain Technology Use Cases*, in ADVANCED APPLICATIONS OF BLOCKCHAIN TECHNOLOGY 96 (Shiho Kim & Ganesh Chandra Deka eds., 2020).

match it with the hash signature embedded on the blockchain network. *Poex.io* is a blockchain based service provider that allows the user to upload any kind of document on it and generate a unique hash with the timestamp and save it on the website's public blockchain. The user now has a proof of the existence of the document which could help in establishing the ownership²⁹. Similarly, *Binded* is another blockchain-based platform which provides a unique hash for image uploaded on it and gives a timestamped digital certificate to prove the ownership³⁰.

B. Tracking of Digital Copies

Blockchain network allows the creator of the work to keep a control over digital copies used on the network. The hashing function allows the creator of the work to produce a unique hash identity of each digital copy of a copyrighted work. By making minor changes in the data, the creator can generate a unique hash for every digital copy made which would help in keeping track of the copies. The hash function can be used to self-issue new and unique identifiers of each copy which may have very minor differences in them³¹. The generation of new hashes assigns every copy a unique serial number³². Since each block is connected with the previous block by way of hashing, it would be easy for the users to identify the owner of the copyright and similarly it would help authors and artists to track when and who is using their work and to specify the royalty fees³³. For instance, assume that a person has uploaded an academic paper on a blockchain network and gets a unique hash of the paper along with the time stamp. Since every block of a blockchain contains the hash of the previous block, one can easily trace back the paper's rightful owner with the help of the hash identity and the timestamp could provide the evidence of existence of the paper. *Copytrack* is a blockchain-based copyright enforcement service provider which helps in tracking illegal usage of digital content³⁴. *Verisart* is a start-up

²⁹ George Kiknadze, *What is Proof of Existence and how it will help to protect intellectual or private property*, MEDIUM (Nov. 3, 2017), <https://medium.com/@kiknaio/what-is-proof-of-existence-and-how-will-it-help-to-protect-intellectual-or-private-property-77aa97a3fbb1>.

³⁰ Nadja Bester, *Binded: Copyright, The Blockchain Way*, INVEST IN BLOCKCHAIN (Nov. 21, 2017), <https://www.investinblockchain.com/binded-copyright-blockchain>.

³¹ Savelyev, *supra* note 27, at 10.

³² Vehbi, *supra* note 23, at 14512.

³³ NASCIMENTO ER. AL., *BLOCKCHAIN NOW AND TOMORROW: ASSESSING MULTIDIMENSIONAL IMPACTS OF DISTRIBUTED LEDGER TECHNOLOGIES* 78 (2019).

³⁴ Tom Kulik, *How Blockchain May Just Transform Online Copyright Protection*, ABOVE THE LAW (Feb. 12, 2018, 5:47 PM), <https://abovethelaw.com/2018/02/how-blockchain-just-may-transform-online-copyright-protection/>.

that provides tamper proof certificates for art and collectibles that use blockchain technology for that purpose³⁵.

C. Simplified Licensing and Revenue Sharing using Smart Contract

The presence of intermediaries in the value chain between the artists and the audience often leads to unfair distribution of revenue between the intermediaries and the artists. A common issue which the artists face is that these intermediaries, often due to their high bargaining power force artists enter into economically disadvantageous contracts where the intermediaries capture the larger share of the revenue and the artist gets paid at last³⁶. On the online music streaming platform *Spotify*, it would take between 120 to 170 streams for a rights holder to receive their first penny³⁷. The artists have very little say in deciding the prices and terms of license of their works as these aspects are largely determined by the intermediaries like publishing houses, record labels and more recent entrants to this category, the online streaming platforms. Another issue with these intermediaries, especially on the online platform is that due to scattered databases all around the globe, it becomes really difficult for them to identify the real and legitimate right holders and whether they are affiliated to any collective societies, further complicating the payment of royalty. In 2016, *Spotify* faced a lawsuit filed by the National Music Publishers Association (NMPA) in the US for failing to obtain licenses for many of the songs available on its online music streaming service. *Spotify* claimed that it was unable to maintain a data to legitimize artist's claims and was unable to track the parties even if it was aware of the artists who had legitimate claim over the royalties and attribution³⁸.

Blockchain technology can change the above situation by giving artists increased control over their work and a direct connection with their audience without the need for any intermediary. Blockchain coupled with smart contracts, can certainly help in providing transparency and cost efficiency in the area of payment of royalties between the user and the artist. Smart contracts will allow automatic and immediate payments to selected parties and automatic termination of

³⁵ MARCUS O'DAIR, DISTRIBUTED CREATIVITY: HOW BLOCKCHAIN TECHNOLOGY WILL TRANSFORM THE CREATIVE ECONOMY 33 (2019).

³⁶ Don Tapscott & Alex Tapscott, *The Impact of the Blockchain Goes Beyond the Financial Services*, HARV. BUS. REV. (May 10, 2016), <https://hbr.org/2016/05/the-impact-of-the-blockchain-goes-beyond-financial-services>.

³⁷ Ryo Takahashi, *How can Creative Industries Benefit from Blockchain*, MCKINSEY AND COMPANY (Aug. 8, 2017), <https://www.mckinsey.com/industries/technology-media-and-telecommunications/our-insights/how-can-creative-industries-benefit-from-blockchain>.

³⁸ Tyler Harttraft & Roberta Jacobs Meadway, *Where Does Blockchain Fit in the Digital Rights Management?* IP WATCHDOG (Feb. 6, 2018), <https://www.ipwatchdog.com/2018/02/06/blockchain-fit-digital-rights-management/id=93024/>.

a license after a certain amount of time³⁹. Since the blockchain is a decentralized network, authors shall have more control over their works and can discuss the licensing terms directly with the users without any need of an intermediary, leading to immediate remuneration for the artists⁴⁰. Once the sale of a digital asset is complete, the information related to the purchase is permanently embedded in the block in the form of a unique cryptographic hash and the already embedded smart contract codes will execute themselves, resulting in direct payment to the artist and allowing the usage of the work accordingly. Smart contracts could also help in the distribution of revenue in case of multiple authors or where multiple persons are involved, like in a song in which the singer, lyricist and the producer have an interest in the copyright generated. By adding their percentage of share in the smart contracts, it can automatically distribute the revenue generated by that work according to their share whenever the work is purchased or used⁴¹.

Recently, the online music industry has been showing a lot of interest in blockchain-based streaming platforms where the artists can directly connect with the users without any intervention of an intermediary. *Ujo* music is one such platform where smart contracts are used to facilitate the sale of digital music files and for the distribution of payments among various copyright holders. *Ujo* users can download the music by using cryptocurrencies which will be directed to the artist's wallet linked with the blockchain, thus eliminating the need of an intermediary in between⁴². In 2015, Grammy Award winner Imogen Heap released her new song 'Tiny Human' on a blockchain platform supported by *Ujo* music. Although from an economic point of view, the song could not fetch much money but it created a buzz in the industry regarding the potential of blockchain technology⁴³. *Peer Tracks* is another such platform where each song is associated with a smart contract that will automate sharing of earnings gained from the transaction between the user and the various rights holders based on their real-world agreement⁴⁴. Smart contracts could also help artists to individually decide the terms of the licensing of the work according to the nature of its usages. By simply putting the terms of license into self-executable smart contracts attached with the work, the artists could

³⁹ Savelyev, *supra* note 27 at 11.

⁴⁰ Annabel Tresise, Jake Goldenfein et. al., *What Blockchains Can and Can't Do for Copyright*, 28 AUSTL. INTELL. PROP. J. 144, 147 (2018).

⁴¹ Savelyev, *supra* note 27 at 12.

⁴² Gönenç Gürkaynak et. al., *Intellectual Property Law and the Practice in the Blockchain Realm*, 34 MARCUS COMPUTER L. & SEC. REV. 847, 859-860 (2018).

⁴³ Silvia A Carretta, *Blockchain Challenges to Copyright: Revamping the online Music industry* 42-43 (2018) (LLM Dissertation, Stockholm University), <https://www.diva-portal.org/smash/get/diva2:1351998/FULLTEXT01.pdf>.

⁴⁴ VINCENZO MORABETO, *BUSINESS INNOVATION THROUGH BLOCKCHAIN: THE B³ PERSPECTIVE* 106 (2017).

do away with the need for an intermediary to enforce the license as the smart contract will automatically start operating once the licensing terms are satisfied.

III. CHALLENGES IN IMPLEMENTATION OF BLOCKCHAIN TECHNOLOGY IN COPYRIGHT

There are no qualms about the possibilities that Blockchain technology may provide in revolutionizing copyright management in the digital arena. However, there are certain critical challenges in the implementation of this technology in the copyright realm. Firstly, it has to be kept in mind that the blocks only contain information regarding the usage or transfer of a copyrightable work, but it does not itself contain the work. The current state of blockchain technology puts a substantial constraint on putting the creative content directly on the blockchain⁴⁵. Since the content itself is stored offline, it is possible that two different people may have two different blocks for identical work, leading to a confusion in tracing the ownership of that particular work. Also, there is no method to determine whether the data given in the blockchain matches to the data existing outside the blockchain, leading to the issue of duality in the blockchain realm. A desynchronization of a blockchain may happen if the off-chain and on-chain information do not match or the data is not properly recorded on the blockchain, leading to an increase in uncertainty and loss of trust⁴⁶. Also, once the content goes off the blockchain, records in the ledger no longer provide a reliable certificate of ownership which is a serious limitation currently being faced by many blockchain-based projects. The *Ujo* music platform only keeps the record of the identity of the creator of the uploaded songs on the blockchain network but does not authenticate the originality of the music itself. Blockchain may provide a tamper-resistant ledger safeguarding the validity and history of the information already stored in the block, but cannot verify the authenticity of the information when it is put first in the system⁴⁷. This might lead to conflicting claims on the same work, and since the information once embedded in the blockchain is immutable, it would be difficult to reflect any change in the real world with regard to the ownership of the work immediately in the blockchain network which could lead to a diminishing of trust on the blockchain network.

Secondly, there are structural challenges in the implementation of this technology in the copyright realm. Copyright is essentially a territorial right and therefore, the protection is based

⁴⁵ Savelyev, *supra* note 27 at 13.

⁴⁶ Baláza Bodó, Daniel Gervais et al., *Blockchain and smart contracts: the missing link in copyright licensing?*, 26 INT. J. LAW. INFO. TECH. 323 (2018).

⁴⁷ *Id.* at 328.

on the law of each jurisdiction, which makes it impossible to have a uniform licensing scheme on the blockchain especially in the case of international licensing. To comply with the domestic laws, the creator would have to incorporate all the relevant legal requirements in the form of codes in the smart contracts which is again a very complex process and as we have seen above, there are chances that the licensing agreement on the chain may not represent the essence of off-the-chain physical world licensing agreement, leading to conflict of interests. Even if the author is in direct contact with the potential user of its work, it is difficult to coordinate international exploitation of the work in multiple formats and markets⁴⁸. Also, the value of such a network will depend upon the number of users it is able to attract. As the number of users will increase, the value of the network shall also increase, leading to attracting a wider user base. Take the internet for instance, where the value of the service depends upon the number of users. Same goes for the copyright management system based on the blockchain network, which will become valuable to users and right owners only if it is able to attract a large number of people on it. The challenge here is to attract and bring enough people on the blockchain network to disrupt the existing offline copyright management solutions.

Thirdly, the legal issues surrounding smart contracts and blockchain also put some serious limitations in the implantation of this technology in the copyright realm. There are doubts with regard to treating smart contracts at par with the traditional contracts in the real world and whether the traditional legal principles could be applied to them. It can be argued that smart contracts are not promises in the legal sense but merely machine code or an automated mechanical process⁴⁹. Since they are simple machine codes, they do not take into consideration real-life circumstances and hence are not adaptable to events as they unfold, which is not with the case of real-world contracts that leaves a space to deal with unforeseen circumstances. Another problem with smart contracts is that it is impossible to discern the intentions of the parties to the contract. Since there is no human agency involved in the execution of the contract, once the consensus is obtained on the blockchain ledger, it will be enforced even if it was fraudulently induced. The blockchain does not have any context regarding why the parties signed the smart contract using their private keys, only that they did⁵⁰. In a traditional contract, law provides certain safeguards with respect to enforcement or non-enforceability of the contract which may not be incorporated in the contract itself but are recognized by the courts

⁴⁸ *Id.*

⁴⁹ Jean Bacon et. al., *Blockchain Demystified: A Technical and Legal Introduction to Distributed and Centralised Ledgers*, 25 Rich. J. L. & Tech. 3, 31 (2018).

⁵⁰ Kevin Werbach & Nicolas Cornell, *Contract Ex Machina*, 67 DUKE L. J. 314, 368 (2017).

as implied in it. In the case of smart contracts, enforcement is done through a technological framework, which could allow the private parties to bypass legal safeguards as any smart contract which is technologically sound will be enforced whether or not it fulfils the conditions of a valid contract⁵¹. Also, in case of faulty code or hacker attack, how would the court decide the liabilities of the parties and whether the smart contract would be able to include all the exemptions with respect to fair usage which varies in scope and by territory⁵² are some pressing questions which require some serious deliberations by law enforcing agencies.

The size of the blockchain network also puts a limitation on the workability of the smart contract on a decentralized network, and its ability to carry out a variety of transactions, and update and revise them is also highly overestimated⁵³. The significance of blockchain databases as evidence of ownership of work in a court of law is also questionable as most jurisdictions do not accept blockchain-based registries as evidence of ownership. Although some countries are slowly recognizing the value of blockchain-based registries but it is still in a very nascent stage⁵⁴. Despite many online platforms giving blockchain-based services with regard to registration of creative works, their database lacks the legal validity. This discourages the artists or the owners of creative work to join the network or upload their works on these blockchain-based networks.

Lastly, complete disintermediation may not be possibly achieved in the case of blockchain-based copyright systems. As most of the works reside outside the blockchain network, there is always a need for a third party to identify and authenticate those works and its authorship before entering the information on the network. The current blockchain based online platforms that provide copyright registrations are also nevertheless, functioning as intermediaries by providing their network facilities to the owners of the work, although the degree of control may be very minimal. Also, in case of change in the ownership of copyrights, it might be difficult to carry out changes in the blockchain network due to its immutable nature and consensus-based model. One possible solution is to make the government or its agency master user of the blockchain network so that it could carry out valid changes in the blocks with regard to

⁵¹ Primavera De Fillipi & Samer Hassan, *Blockchain Technology as a Regulatory Technology: From Code is Law to Law is Code*, 21 FIRST MONDAY 1, 11 (2016), https://www.researchgate.net/publication/311447869_Blockchain_Technology_as_a_Regulatory_Technology_From_Code_is_Law_to_Law_is_Code.

⁵² *Supra* note 46, at 333.

⁵³ George Howard, *Salzburg Hack: A 12 Hour Sprint to Build a Blockchain Music Product*, OPEN MUSIC (Feb. 20, 2020, 6:25 PM), <https://open-music.org/blog/2018/4/5/salzburg-hack-a-12-hour-sprint-to-build-a-blockchain-music-product>.

⁵⁴ Ledger Insights, *China Using Blockchain Evidence for Copyright Infringement*, LEDGER INSIGHTS (2018), <https://www.ledgerinsights.com/blockchain-intellectual-property-protection-china/>.

copyright. But giving full power to the government would go against the democratic and decentralized ideals of blockchain technology which are the main selling points of this technology. Even if the government does not take control of the network, the need of an intermediary cannot be completely discounted. Besides that, the inherent complexities in the technology make it difficult for a layman to understand its functioning and the initial implementation costs cannot be neglected⁵⁵.

IV. THE ROAD AHEAD

Blockchain technology has shown promising results in the area of digital currencies in the form of Bitcoin, and its potential use in the area of copyright has certainly piqued the interest of various stakeholders of copyrightable content throughout the globe. As the world is becoming more immersed in cyberspace, the security and transparency that the blockchain promises to provide in the online world would certainly democratize accessibility and distribution of content. Coupled with smart contracts, blockchain technology can surely give more control to the owners of the copyright, with respect to licensing of the work and revenue distribution, decreasing the dependency upon intermediaries which could further lead to cost saving. However, this technology also poses certain legal and technological issues which require a dynamic and all-inclusive approach. Standardisation of rules with regard to territoriality both at the international level and domestic level in the context of blockchain technology may be a good first step. Blockchain is essentially a network-based technology and therefore the rules of engagement with regard to copyright enforcement in extra territorial infringements require a uniform approach at the international level. Similarly, the domestic laws need to adapt to smart contracts and must provide solutions keeping in mind the uniqueness of these self-executing contracts. A hybrid approach where smart contract clauses are supplemented by real world traditional and legible contractual documents would be a desirable solution where in case of conflict between the two, the precedence should be given to the traditional documents⁵⁶. This could help in determining questions with regard to intentions of the parties and would serve as a backup in case of manipulation in smart contract software. Flexible approach by the administration and courts with respect to interpretation and application of legal provisions could also help in successfully tackling unforeseen scenarios which may come up in the context

⁵⁵ *Supra* note 35, at 27.

⁵⁶ NITI AAYOG, BLOCKCHAIN: THE INDIAN STRATEGY 29 (2020), https://niti.gov.in/sites/default/files/2020-01/Blockchain_The_India_Strategy_Part_I.pdf [https://web.archive.org/web/20201114233137/https://niti.gov.in/sites/default/files/2020-01/Blockchain_The_India_Strategy_Part_I.pdf].

of smart contracts and blockchain based copyrights⁵⁷. The issue of matching off-chain and on-chain claims with regard to artistic works could be resolved by appointing a central administrator of the government who could authenticate the ownership and verify that the online data matches with the offline works. Another way is to appoint individuals who are experts in their respective fields on the blockchain network who could verify the authorship and ownership of the works by consensus⁵⁸. Finally, the cost issues associated with the implementation and inherent complexities in the technology could be overcome by initiating pilot projects and surveys which could help in analysing the potential impact and response of the public to such technology, creating a foundation for future action. A good example here would be digitization of land records in Chandigarh carried out by NITI AAYOG in India⁵⁹. In this case, they developed a prototype of a digital land record system built upon blockchain through a user-friendly portal which captures transactions with respect to land on immutable blockchain making ownership records tamper resistant⁶⁰.

Like every other emerging technology, blockchain also would go through many advancements and changes which may make the above proposed solutions redundant. This is an ongoing process in which legal systems must base their actions on trial-and-error methods to cope up with such dynamic technology. The features of blockchain technology are captivating and promise a bright future in the long run for the copyright holders provided that the legal and operational issues are being dealt with effectively. This technology can certainly pave the way for a more transparent and more robust copyright regime and could impact other intellectual property rights also. Blockchain technology provides a greater degree of control and thus has the potential of becoming a potent tool for copyright owners in protecting their rights, especially in the digital environment.

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⁵⁷ MAXIMILIAN KIEMLE, BLOCKCHAIN AND COPYRIGHT ISSUES 14 (2018), https://www.4ipcouncil.com/application/files/9315/4876/6157/Blockchain_and_Copyright_Issues.pdf.

⁵⁸ *Id.* at 9.

⁵⁹ *Supra* note 56, at 33.

⁶⁰ *Id.*