Blockchain and copyright
Beyond the buzzword?

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Introduction

1. A 'blockchain' or, in other words, a chain of blocks. The idea appears simple enough, but the term has taken the world by storm in the past few years. The buzz of blockchain technology has now also reached the legal sector. In the past, the traditionally cautious legal profession has been reticent in adopting the use of new technologies. However, the ever-increasing pace of technological innovation forces us out of our comfort zone – filled with law books and paper documents – into the world of legal tech. Lawyers cannot lag behind any longer and need to dive headfirst into the opportunities that 21st century science is crafting for us.

2. For this purpose, this paper investigates the opportunities and challenges posed by and for blockchain technology in intellectual property law, with a focus on copyright law. Our aim is not to be exhaustive nor to pursue an in-depth analysis of all relevant legal issues. Instead, the aim is to provide a bird's-eye view that may serve as a starting point for further research.

3. While the technology behind blockchain has been around for some time, most legislators across the globe have not yet found a way to fit blockchain issues into their legal framework. Considering the many uncertainties surrounding the potential of this technology, their reluctance to put legal norms in place is understandable. In the EU, small preparatory steps are being taken, but only on a soft law level.[2] As the exception proves the rule, we note that certain new or existing laws have been made applicable to cryptocurrencies based on blockchain technology.[3]

4. This paper consists of three chapters. First, we will provide a layman's overview of blockchain technology, describing the basics of how this technology works and what the main current challenges of blockchain technology are. The second chapter focuses on the interplay between blockchain and copyright law. We first discuss how blockchain may play a role in establishing and tracking copyright ownership. Then, we will review blockchain's promise of transparency, disintermediation and decentralisation in the field of copyright exploitation and management. Before concluding this paper, we provide a first glimpse regarding how blockchain might impact other intellectual property rights, such as trademarks and patents.

I. Basics of blockchain technology

I.1. Summary of the working of a blockchain

5. To establish whether or not the buzz surrounding blockchain has a firm basis in reality, a grasp of the basics of this technology is required. Therefore, we will first present the essential characteristics of blockchain technology, without aiming to be exhaustive. For further details, we refer to the countless (news) articles and videos describing the 'magic' of the block-

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2 See e.g. the Declaration of 10 April 2018 creating the European Blockchain Partnership (EBP), available online at https://ec.europa.eu/digital-single-market/en/news/european-countries-join-blockchain-partnership and the recent launch of the EU Blockchain Observatory and Forum by the European Commission, as described at https://ec.europa.eu/digital-single-market/en/eu-blockchain-observatory-and-forum.

3 See more details in N. Vandezande, *Virtual Currencies. A Legal Framework*, Cambridge – Antwerp – Portland, Intersentia, 2018, 499 p.

chain[4], i.e. a distributed system that stores information using cryptographic techniques.

6. At the outset, we emphasise that many aspects of blockchain technology are not all that novel and groundbreaking as one might think.[5] Already in 1979, computer scientist Ralph MERKLE invented a method of providing digital signatures using so-called 'hash trees'.[6] Further, for almost 25 years, the company Surety Technologies Inc.[7] has been collecting hashes of electronic files, aggregating them in single hashes using hash trees and combining these hashes with timestamps.[8] Thus, they created a chain of secured hashes that is very similar to what is labelled as 'blockchain technology' today. Finally, we refer to the Belgian 'TIMESEC' project which concluded in 1999 and was *i.a.* aimed at the development of a digital timestamping system.[9]

– *Blockchain is not Bitcoin is not blockchain*

7. Blockchain technology rose to virtual fame as the system behind cryptocurrencies, the most (in)famous of which being 'Bitcoin'.[10] Bitcoin was first proposed in 2008 by a man, woman or group of people (?) writing under the pseudonym 'Satoshi NAKAMOTO' and introduced as a new form of digital money whereby transactions are based on cryptographic proof rendered in a peer-to-peer environment (hence the terminology "crypto-currencies") and whereby the need for a central legal controlling entity is eliminated.[11] In other words, there is no central Bitcoin bank; in theory, every participant can play a part in the production of Bitcoin and verify transactions.

8. "The" blockchain does not exist either. Instead, there are several blockchain networks, with different purposes and various protocols. In this regard, it should be noted that blockchain is the technology behind Bitcoin and not *vice versa*. The technology as such has indeed a much broader field of application than Bitcoin or the whole world of 'fintech'[12] (financial technology).[13] In fact, Bitcoin is only one of several hundred applications that use blockchain technology today.[14] Some authors even describe Bitcoin as a 'bubble'[15] and blockchain as the underlying technological design that will survive, even in case Bitcoin should collapse.[16]

9. Over the last few years, this concept has grown into a fully-fledged blockchain ecosystem. A special mention in this regard should be made of *Ethereum*, an open software platform based on blockchain technology that has played an important role in the thrive of blockchain.[17] Ethereum, created by Vitalik BUTERIN, enables developers to build and deploy decentralised blockchain *applications*[18] by introducing ultimate abstraction through Turing complete code.[19] While the Bitcoin blockchain is used to *store* transactions in digital currency (Bitcoin), the Ethereum blockchain allows for the storage of any type of information and focuses on running the programming code of any de-

4 A useful beginner's guide to blockchain technology is freely available online at https://www.coindesk.com/information/. For a more in-depth study of the technical aspects, we refer to *i.a.* I. BASHIR, *Mastering Blockchain. Distributed Ledger, Technology, Decentralization, and Smart Contracts Explained*, Birmingham (UK), Packt Publishing, 2017, 199 p; J. BACON, J. MICHELS, Ch. MILLARD and J. SINGH, *Blockchain Demystified*, Queen Mary School of Law Legal Studies Research Paper No 268/2017, 21 December 2017, available on ssrn; D. GERARD, *Attack of the 50 Foot Blockchain. Bitcoin, Blockchain, Ethereum & Smart Contracts*, Createspace Independent Publishing Platform, 2017, 182 p.; D. PUTHAL, N. MALIK, S. MOHANTY, E. KOUGIANOS, G. DAS, *Everything You Wanted to Know About the Blockchain: Its Promise, Components, Processes, and Problems*, IEEE Consumer Electronics Magazine, Vol. 7 (4), 2018, also available on ResearchGate; M. SWAN, *Blockchain – Blueprint for a New Economy*, Beijing-Cambridge, O-Reilly, 2015, 130 p. and D. YAGA, P. MELL, N. ROBY & K. SCARFONE, *Blockchain Technology Overview*, NIST Internal Report 8202, January 2018 (available on NIST website) (hereafter 'NIST report').

5 For this paragraph, the authors thank Dr. Bart PRENEEL, professor at the Engineering Department of the KU Leuven, for pointing out the "older" technologies mentioned below during the seminar re blockchain technology that took place at the Law Faculty of the KU Leuven on 20 June 2018.

6 See US Patent no. 4,309,569, filed on 5 September 1979 and listing R.C. MERKLE as inventor. Hash trees are also called 'Merkle trees'. In computer science, the term 'tree' is used to indicate a mathematical model that takes the shape of a hierarchical tree structure, with linked parent and children nodes. The lowest nodes or "leaf" nodes contain the hash of a data block and all of the nodes above contain the cryptographic hash of the labels of their child nodes. The top node also contains the top hash. A hash tree allows for a verification of large data structures that is not only efficient, but also secure. Indeed, if – e.g. following a transfer of the data structure – the hash of the top node remains exactly the same, the integrity of the data is assured.

7 Established in 1994. See website: http://www.surety.com/.

8 See for more information regarding the process used by Surety Technologies: http://www.surety.com/digital-copyright-protection/prove-ownership.

9 The final report of this project dates back to December 1999 and is available online at http://www.belspo.be/belspo/organisation/publ/pub_ostc/NO/rNOb007_en.pdf.

10 Website: http://www.bitcoin.org.

11 S. NAKAMOTO, "Bitcoin: a peer-to-peer electronic cash system", November 2008, 1, available online at https://bitcoin.org/bitcoin.pdf.

12 See *i.a.* World Economic Forum and Deloitte, "The future of financial infrastructure: An ambitious look at how blockchain can reshape financial services", August 2016, 129 p., available online at http://www3.weforum.org/docs/WEF_The_future_of_financial_infrastructure.pdf and X, "Distributed Ledger Technology in payment, clearing and settlement – an analytic framework", Committee on Payment and Market Infrastructures, Basel, February 2017, 29 p., http://www.bis.org/cpmi/publ/d157.pdf. See for a more critical approach D. ZETZSCHE, R. BUCKLEY, D. ARNER, "The Distributed Liability of Distributed Ledgers: Legal Risks of Blockchain", *UNSWLRS* 2017, 43 p.

13 On 27 november 2018, the website *coinmarketcap.com* listed specifics (like value, market share, etc.) for over 2000 different cryptocurrencies, with Bitcoin, Ethereum and XRP in the top 3.

14 See more details in the NIST report (*supra*, n. 4).

15 See, e.g. N. ROUBINI, "Bitcoin biggest bubble in history, says economist who predicted 2008 crash", *The Guardian* 2 February 2018, available at www.theguardian.com.

16 S. BERMAN, "Bitcoin and Blockchain: What Will Survive If the Bubble Bursts?", *Corporate Counsel* 16 February 2018, available at www.law.com.

17 See in more detail https://www.ethereum.org/.

18 See in more detail M. SWAN, *Blockchain – Blueprint for a New Economy*, Beijing-Cambridge, O-Reilly, 2015, 21-22. SWAN describes Ethereum as a "Turing-complete virtual machine". This means that "*it can run any coin, script, or cryptocurrency project*".

19 According to Wikipedia, a system of data-manipulation rules (such as a computer's instruction set, a programming language, or a cellular automaton) is said to be Turing complete or computationally universal if it can be used to simulate any Turing machine. In the context of blockchain, it essentially means that you can write programs (contracts) that can (for the most part) solve any reasonable computational problem.

centralised application[20], including so-called 'smart contracts'. [21] Ethereum has therefore proven to be especially useful beyond the realm of cryptocurrencies, such as in relation to copyright-related applications.

10. Blockchain technology is coming to the foreground in many different sectors. Next to the banking sector, blockchains are *i.a.* used in supply chain management[22], public administration[23] and the sectors of insurance and healthcare (health care records, personal medicine).[24]

Blockchain technology is indeed capable to record any kinds of data and store transactions of all kinds of tokens[25], including domain names, trade secrets[26], identity records[27] (*e.g.* driving licences), ownership deeds[28], public records (such as land titles[29]), social welfare payments, bank accounts and electricity use.[30]

11. As a result, the blockchain ecosystem has recently been 'buzzing' in several areas of the law.[31] We note in particular blockchain's intriguing interface with privacy and data protection law[32] and the possible application of blockchain in the competition law sector[33]. Finally, a recent PhD thesis provides a detailed and insightful overview of the legal framework surrounding virtual currencies on the blockchain, such as Bitcoin and Ether.[34] That blockchain technology may play a role in the area of copyright and other sectors of intellectual property rights is therefore no longer a purely hypothetical assumption. Different relevant elements may be represented by cryptographic tokens, including "works, ownership metadata, licencing terms and remuneration".[35]

– *Core concepts*

12. While blockchains exist in many shapes and forms, most of them share a number of core concepts.[36] We describe the essence of these concepts below.

13. A "blockchain" is an open[37] ledger of information that serves as a tool to record and track certain transactions, which are then distributed and verified on a peer-to-peer network. This explains the qualification of blockchain as a "distributed ledger technology" or DLT in short.

DLTs are decentralised, which means that there is no central authority with full control (as opposed to what is the case in *e.g.* the current banking system).[38] Instead, the system consists of connected 'nodes' (data storage points) between which information is circulated. Together, the nodes constitute a distributed ledger, whereby every participant has a simultane-

20 https://blockgeeks.com/guides/ethereum/.
21 The possible uses of smart contracts will be discussed below; see paragraphs 50 *et seq.*
22 Recording the transfer of physical goods from a producer, to a shipping terminal, to a ship, to a cargo train, to a delivery truck and to a store is an appealing application of blockchain technology.
23 See *e.g.* M. Pomp and R. Verhaert, *Blockchain in de praktijk. Meer dan vijftig use cases in Nederland en België*, Brugge, Vanden Broele, 2018, 39-45, with 8 use cases from Belgium, see 113-131; R. Verhaert, *Blockchain. De overheid aan of in de ketting? Hoe blockchain de werking van de overheid kan veranderen*, Brugge, Vanden Broele, 2016, 66 p. and in particular 47-53.
24 EPO, *Patents and the Fourth Industrial Revolution. The inventions behind digital transformation*, December 2017, 74 ("Blockchain technology unites the different system languages of health records and decentralises their use. Important information is often scattered over several sites and sometimes not accessible when it is most needed. Unlike a health card, a blockchain can be viewed from anywhere, so that the potential for telemedicine is increased. A sick person can contact a doctor by smartphone. The doctor can then access the patient's medical data, which are recorded by the sensors of the smartphone or other wearable devices. He or she also has access to the patient's entire medical history, which is logged in the blockchain").
25 B. Bodó, D. Gervais, J.J. Quintais, "Blockchain and smart contracts: the missing link in copyright licensing?", *International Journal of Law and Information Technology*, eay014, September 2018, 2 and 4.
26 M. Loney, "How blockchain will change intellectual property – trade secrets", *Managing Intellectual Property* 2018 (27 March 2018); Y. Poullet and H. Jacquemin, "Blockchain: une revolution pour le droit?", *JT* 2018, 805 and 807.
27 See the platform *Juru* that allows you "to own, manage and control" your own identity, including personal attributes, such as e-mail, blood type, curriculum vitae; see https://juru.io/.
28 See in this regard in particular B. Verheye, "Blockchaintechnologie en het notariaat bij vastgoedtransacties: Damocles' zwaard of opportuniteit?", *T.Not.* 2018, 212-238 and B. Verheye, "Real estate publicity in a blockchain world: a critical assessment", *EPLJ* 2017, 441-477.
29 See e.g. J. Vos, "Blockchain-based land registry: Panacea, illusion or something in between?", www.elra.eu/wp-content/uploads/2017/02/10.-Jacques-Vos-Blockchain-based-Land-Registry.pdf, 2016, 26 p.
30 See for more examples the NIST report (*supra*, n. 5), p. 37 ff; M. Swan, *Blockchain – Blueprint for a New Economy*, Beijing-Cambridge, O-Reilly, 2015, 10-11 and D. Tapscott en A. Tapscott, *Blockchain Revolution: How the Technology Behind Bitcoin Is Changing Money, Business, and the World*, Portfolio published on 10 May 2016, update on 12 June 2018.
31 Literature dealing with legal topics includes *i.a.* J. Linneman, "Juridische aspecten van (toepassingen van) blockchain", *Computerrecht* 2016, 319 and P. De Filippi and A. Wright, *Blockchain and the law*, Cambridge, Harvard Univ. Press, 2018.
32 There is a growing amount of legal doctrine on this particular topic. We note in particular the work of M. Finck, in particular M. Finck, "Blockchains and Data Protection in the European Union", *MPI Research Paper* 2018-01, 31 p. and M. Finck, "Blockchain Regulation", *MPI Research Paper* 2017, n° 13, 30 p. See also Commission Nationale Informatique & Libertés, "Blockchain. Premiers éléments d'analyse de la CNIL", September 2018, 11 p., available online at https://www.cnil.fr/sites/default/files/atoms/files/la_blockchain.pdf; V.I. Laan, "Privacy en blockchain: wanneer is er voor wie privacywerk aan de winkel?", *Tijdschrift voor Internetrecht* 2017, n° 1, 4-11; S. Marien, "De privacyparadox: 'Blockchain en GDPR zijn elkaars tegenbeeld' ", *Data News* 29 June 2018, 32- 35; Y. Poullet and H. Jacquemin, "Blockchain: une revolution pour le droit?", *JT* 2018, 808-810 and E.W. Verhelst, "Blockchain aan de ketting van de Algemene Verordeningen Gegevensbescherming?", *Privacy & Informatie* 2017, 17-23.
33 See *e.g.* OECD, "Blockchain Technology and Competition Policy – Issues paper by the Secretariat", DAF/COMP/WD (2018) 47, 2018, 10 p.
34 N. Vandezande, *Virtual Currencies. A Legal Framework*, Cambridge – Antwerpen – Portland, Intersentia, 2018, 499 p.
35 B. Bodó, D. Gervais, J.J. Quintais, "Blockchain and smart contracts: the missing link in copyright licensing?", *International Journal of Law and Information Technology*, eay014, September 2018, 2.
36 See more details in X. Xu *et al.*, "A Taxonomy of Blockchain-Based Systems for Architecture Design", Conference Paper for ICSA'17: IEEE International Conference on Software Architecture, April 2017, available on ResearchGate.
37 In this context, we clarify that the word 'open' refers to the transparency of a blockchain and the decentralised nature thereof. It does not necessarily mean 'open to the public', since this is really only true in relation to public (and not private) blockchains.
38 D. Zetzsche, R. Buckley and D. Arner, "The Distributed Liability of Distributed Ledgers: Legal Risks of Blockchain", *UNSWLRS* 2017, 10.

ous copy of all the data.[39] Decisions are made by consensus of the nodes[40], which verify all transactions and determine which information is entered into the ledger. No single party can make such a determination or change the information that was entered at a later stage. The quantity of nodes provides the security that is necessary in this system driven by and dependent on trust.[41] Indeed, in order to hack a blockchain, one would need to strike the copies on the node computers (almost) all at once. We do note that the use of the term 'trust' is debated and that it is argued that the concept of 'trustless trust' is a better fit since trust is not placed in actual people but rather in the technology that enables consensus between participants in a certain blockchain.[42]

14. The name 'blockchain' refers to the way in which data are stored on the distributed ledger, i.e. not individually, but stored in a 'block' together with other data in 'hash' form, arranged in a specific, timestamped order (the 'chain').[43]

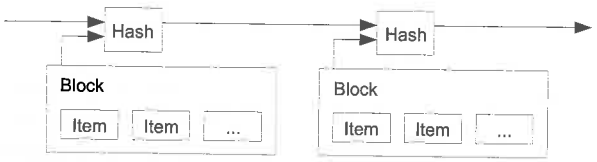


Figure 1 (source: https://bitcoin.org/bitcoin.pdf)

15. A 'hash' is a mathematical function that transforms content, such as the content of a block of data, into a large number of letters and numbers. Under the Bitcoin protocol[44], a hash is obtained by combining the following four elements:

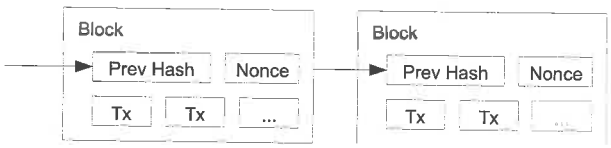


Figure 2 (source: https://bitcoin.org/bitcoin.pdf)

(i) The digital fingerprint of the previous block ('prev-hash') that interlocks the different blocks and ensures the **immutability** of the blockchain;

(ii) A record of a number of recent transactions that have been completed. This summary consists of a public key[45] and a private key[46]. Both are necessary in order to prevent fraud and ensure the **security** of the blockchain;

(iii) A timestamp that indicates when the block was created. The timestamp allows for verification and **traceability** of all transactions that have been made on the blockchain since its 'genesis';

(iv) The so-called **nonce** i.e. the resolution of a complex cryptographic puzzle that serves as the verification mechanism of the Bitcoin blockchain. This is how Bitcoin is managed and how it implements the idea of disintermediation. In simplified terms, a puzzle is made available every ten minutes and so-called 'miners' attempt to solve the puzzle.[47] The winner is financially rewarded in Bitcoins. The resolution of the puzzle is added to the block as its fourth element and validates the transaction. This 'proof of work' is said to assure the **integrity** of the blockchain, without there being any need for a centralised decision approving the finalisation of the hash.

The proof-of-work model used in the Bitcoin blockchain is met with criticism, *i.a.* in view of the high energy use of mining.[48] There are, however, other ways to achieve consensus between the blockchain nodes, such as a 'proof-of-stake' model whereby voting power is proportionate to share ownership in the blockchain network.[49] In such a model, trust depends on one's 'stake': those who own many coins in a particular blockchain network have a high interest in keeping the value of those coins high. Therefore, these stakeholders are trusted to maintain the system's integrity.[50]

The development of new and different consensus-achieving algorithms for blockchain applications is an ongoing and labour-intensive work, with proponents of both proof-of-stake and proof-of-work models advancing their case as best as possible.[51] However, it is safe to say that the 'ultimate' algorithm has not

39 *Ibid.*, at *11*.
40 See regarding the possible ways in which consensus may be reached below, paragraph 15.
41 In view of this element of security, DLT is said to provide an answer to the so-called 'Byzantine Generals Problem', as discussed in L. Lamport, R. Shostak and M. Pease, 'The Byzantine Generals Problem', *ACM Transactions on Programming Languages and Systems* 1982, n° 3, 382-401. See in this regard M. Swan, *Blockchain – Blueprint for a New Economy*, Beijing-Cambridge, O-Reilly, 2015, 2.
42 This term was coined by R. Hoffman, see "The Future of the Bitcoin Ecosystem and "Trustless Trust" – Why I Invested in Blockstream", 2014, available on LinkedIn. See also e.g. A. Wright and P. De Filippi, "Decentralized Blockchain Technology and the Rise of Lex Cryptographia", *Decentralized Blockchain Technology* 2015, 14 and 25, available online at https://papers.ssrn.com/sol3/papers.cfm?abstract_id=2580664.
43 D. Zetzsche, R. Buckley and D. Arner, "The Distributed Liability of Distributed Ledgers: Legal Risks of Blockchain", *UNSWLRS* 2017, 11.
44 S. Nakamoto, "Bitcoin: a peer-to-peer electronic cash system", November 2008, 9 p., available online at https://bitcoin.org/bitcoin.pdf.
45 This public key may be compared with an account number.
46 This private key may be compared with a PIN code.
47 We note that the cryptographic puzzle is meant to be solved in approximately 10 minutes. However, the computing power of miners has drastically increased over time. As a result, the puzzle has become much more difficult than in the early years of Bitcoin.
48 See in this regard *e.g.* the Bitcoin Energy Consumption Index at https://digiconomist.net/bitcoin-energy-consumption.
49 See on this topic *e.g.* https://blockgeeks.com/guides/proof-of-work-vs-proof-of-stake/.
50 See for a recent example of a proof of stake blockchain protocol: B. David *et al.*, "Ouroboros Praos: An adaptively-secure, semi-synchronous proof-of-stake blockchain", 2017, 37 p., available online at https://eprint.iacr.org/2017/573.pdf.
51 See *e.g.* BitFury Group, "Proof of Stake versus Proof of Work White Paper", 2015, 26 p., available online at https://bitfury.com/content/downloads/pos-vs-pow-1.0.2.pdf.

yet been found – at least, there is no consensus on this topic in the blockchain community.

- *Public blockchain vs. private blockchain vs. database*

16. The 'traditional' concept of a blockchain is that of a network that is open and anonymous, *i.e.* '*permissionless*' or 'public'. Bitcoin and Ethereum are public blockchains: anybody who has downloaded the software, which is open source and open access, can participate.[52]

These types of blockchain must be distinguished from the so-called '*permissioned*' or 'private' blockchains, whereby the ledger can only be accessed in case the required authorisation is granted.[53] Such blockchains (*e.g. Ripple*[54]) are only available on private networks, such as an intranet or VPN, and often involve proprietary software. Private blockchain operators can control who is allowed to operate a node, as well as how the nodes are connected. In view of this higher degree of possible control, private blockchains could be considered more secure in a way.[55] Moreover, if something does go wrong, the question of accountability is much easier to answer. However, at the same time and in another way, private blockchains could be considered less secure too. Indeed, it could be argued that the flipside of having a (single) point of control is that it leads to a single point of failure – precisely what blockchain technology seeks to avoid.[56]

There is a spectrum of different technological architectures in between these extremes of public-private blockchains and permissionless-permissioned blockchains which we will not discuss any further.[57]

17. As mentioned above[58], blockchain technology uses distributed ledger technology. With the word 'ledger'[59] implying nothing more than the collection of data, a comparison can be made with the concept of a *database*. A blockchain – either public or private – can, however, not simply be equated with a traditional database. The main difference between these two concepts lies in the distributed, decentralised nature of a blockchain. Indeed, ownership and control are organised differently than in the case of a traditional database. Contrary to the latter, a blockchain is not 'owned' by a single undertaking or public entity and does not have a single 'master copy'.[60] Instead, all nodes of the blockchain system have a copy of the entire blockchain and, depending on whether the blockchain is permissioned or not, any number of users may access the ledger and participate in building it.[61] Thus, public blockchains are clearly further away from standard conceptions of traditional databases than private blockchains.

Another difference between a blockchain and a traditional database is the order in which the gathered data are stored. As explained above[62], a blockchain is, in essence, a well-defined structure of 'blocks' linked into a chronological 'chain', whereby each block contains data, its own hash and the hash of the previous block. This differs from the structure of a database, the working of which does not depend on the order in which the data were entered into the system.

18. A final interesting question is under which specific circumstances the use of a blockchain may actually provide added value over the use of more traditional means, such as a regular database. In this regard, we refer to the work of Wüst and Gervais, who argue that the choice between a database and a private or a public blockchain should depend on *i.a.* the level of trust required and the need for public verifiability of the data.[63]

II.2. Blockchain-related challenges

19. Before analysing the opportunities that blockchain technology may hold for copyright, we need to be aware of some challenges that this technology entails.[64] For this purpose, we will reflect on the main characteristics of a blockchain that we described

52 K. Wüst and A. Gervais, "Do you need a Blockchain?", *Cryptology ePrint Archive* 2017/375, 1, available online at https://eprint.iacr.org/2017/375.pdf.
53 D. Zetzsche, R. Buckley, D. Arner, "The Distributed Liability of Distributed Ledgers: Legal Risks of Blockchain", *UNSWLRS* 2017, 11; https://www.coindesk.com/information/what-is-the-difference-between-open-and-permissioned-blockchains.
54 This platform connects banks and payment providers via RippleNet to provide services of sending and receiving money globally (https://ripple.com/).
55 A. Berke, "How safe are blockchains? It depends", *Harvard Business Review*, 7 March 2017, https://hbr.org/2017/03/how-safe-are-blockchains-it-depends.
56 Cf. B. Arruñada, "Blockchain's struggle to deliver impersonal exchange", *Minnesota Journal of Law, Science & Technology* 2018, n° 1, 70-71. See also European Union Agency For Network And Information Security (ENISA), "Distributed Ledger Technology & Cybersecurity. Improving information security in the financial sector", December 2016, 16 and 22, available online at www.enisa.europa.eu.
57 See for more details: X. Xu e.a., "A Taxonomy of Blockchain-Based Systems for Architecture Design", Conference Paper for ICSA'17: IEEE International Conference on Software Architecture, April 2017, available on ResearchGate, 3 ff.
58 See paragraph 13.
59 In Dutch: 'grootboek'.
60 See https://www.coindesk.com/information/what-is-the-difference-blockchain-and-database/.
61 See also above paragraph 13.
62 See paragraph 14.
63 See K. Wüst and A. Gervais, "Do you need a Blockchain?", 2017, *Cryptology ePrint Archive* 2017/375, 7 p., available online at https://eprint.iacr.org/2017/375.pdf. See also http://doyouneedablockchain.com/.
64 The below overview is not exhaustive. See in more detail D. Zetzsche, R. Buckley, D. Arner, "The Distributed Liability of Distributed Ledgers: Legal Risks of Blockchain", *UNSWLRS* 2017, 14-20.

above, namely its immutability, security, traceability and integrity.[65]

20. The **immutability**[66] of a blockchain and specifically of data stored on it is widely considered to be advantageous, but simultaneously leads to a considerable challenge, which has been referred to as the *garbage in, garbage out* dilemma.[67] Once data has been entered on the ledger, it is there to stay, whether this data is accurate or not and irrespective of whether grounds exist to either modify or delete the data at issue. As a result, a blockchain can be said to be not only immutable, but also inflexible.

21. In theory, it is possible to change the blockchain software, but this may lead to a whole range of other problems. Indeed, if the modification is not met with unanimity, changes to the software may lead to 'forking' of the blockchain, caused by a schism between the user group having accepted the change and the group that did not.[68] In an essentially leaderless community that is based on decentralisation and (trustless) trust instead of top-down rules and centralised authority, the risk of such 'forks' or split groups in case of proposed modifications is considerable. In this regard, we refer to the split in the Ethereum community that took place following a large hack in 2016, between the group that wanted to reverse the hack and prevent the hacker from cashing in and the group that did not want to relinquish the Ethereum blockchain's immutable nature.[69] This would not have happened to a regular database, where stored data may be modified easily and no impediments to general software updates exist.

22. The story of this hack brings us to another technical challenge, namely the **security** of the blockchain. Indeed, DLT technology – while certainly more secure than traditional centralised ledgers – is not at all immune to hacks as was already hinted to in the previous paragraph.[70]

23. Finally, the **traceability** and **integrity** of a blockchain are closely linked to the idea of total **transparency** and **decentralisation** that blockchain seeks to realise. By removing centralised management, blockchain technology eliminates errors and corruption that could be introduced by humans. However, at the same time, a new challenge emerges: how can a leaderless entity be governed or, indeed, controlled? We limit our contribution to this debate to the following general observations.

A first observation relates to the misconception that blockchains (and public blockchains in particular) are systems without any control or ownership. While indeed no user, government or country controls a blockchain, there is still a group of core developers that is responsible for the system's development. These developers may act in the interest of the community at large, but still maintain some level of control.[71] Clearly, there may be a thin line between supervising the satisfactory independent working of a blockchain and the risk of *de facto* recentralisation.[72]

Further, not all blockchains are as decentralised as they might seem. By way of example, the two largest Bitcoin mining pools[73] currently hold almost half of the mining power.[74] As a result, these pools solve many Bitcoin 'puzzles' and thus play an important role in the life of the Bitcoin blockchain. In other words, mining power translates into real power.[75] Moreover, concentration of nodes may make a blockchain vulnerable to attacks.[76] This questions one of the basic tenets of blockchain technology – not only that of decentralisation, but also of trust and, therefore, security.

65 See paragraph 15.

66 On the meaning of the term 'immutability', specifically with regard to its relation with the governance of blockchain networks, we refer to A. Walch, "The Path of the Blockchain Lexicon (and the Law)", *Review of Banking & Financial Law* 2017, 735-745.

67 D. Zetzsche, R. Buckley, D. Arner, "The Distributed Liability of Distributed Ledgers: Legal Risks of Blockchain", *UNSWLRS* 2017, 13.

68 NIST report (*supra*, n. 5), at p. 4.

69 The split took place after block 1920000, the block implementing the reversal of the hack. Both the Ethereum and Ethereum Classic blockchain are still in place today. See in more detail https://www.cryptocompare.com/coins/guides/what-is-ethereum-classic/. On the hack, see also the following footnote.

70 One of the most famous hacks took place from 2011 to 2014 when hackers targeted Mt. Gox, a Japan-based bitcoin exchange that was handling over 70% of all bitcoin transactions at the time (see in more detail https://blockonomi.com/mt-gox-hack/). A total of 740,000 bitcoins were lost, with a market value today of over 4.5 billion EUR. In 2016, the Ethereum DAO hack proved to be another blow to the blockchain community. The Decentralised Autonomous Organisation (DAO) was set up in 2016 as a leaderless entity built on the Ethereum blockchain and aimed at providing the ability to invest in a company via smart contracts. Later that year, one third of the DAO's funds were siphoned off to the subsidiary account of a hacker who had found a way to exploit a vulnerability in the DAO's smart contract code (see in more detail https://coincentral.com/blockchain-hacks/ and https://www.cryptocompare.com/coins/guides/the-dao-the-hack-the-soft-fork-and-the-hard-fork/). See also D. Zetzsche, R. Buckley, D. Arner, "The Distributed Liability of Distributed Ledgers: Legal Risks of Blockchain", *UNSWLRS* 2017, 7-8.

71 NIST report, at p. 44.

72 See for an in-depth discussion on this particular topic M. Atzori, "Blockchain Technology and Decentralized Governance: Is the State Still Necessary?", 2016, 37 p. available online at https://papers.ssrn.com/sol3/papers.cfm?abstract_id=2709713. See also M. Swan, *Blockchain – Blueprint for a New Economy*, Beijing-Cambridge, O-Reilly, 2015, 85.

73 AntPool (https://www.antpool.com/) and F2Pool (https://www.f2pool.com/).

74 See in more detail http://www.bitcoinmining.com/bitcoin-mining-pools/.

75 We note that, in 2017, there was a scandal surrounding AntPool, who had introduced a feature in their 'Antminer' firmware that had the potential to shut down 70 percent of all bitcoin miners. See *i.a.* https://www.antbleed.com/, https://blog.bitmain.com/en/antminer-firmware-update-april-2017/, https://www.coindesk.com/antbleed-bitcoins-newest-new-controversy-explained/.

76 Indeed, a public blockchain is anonymous, which makes it impossible to ascertain who (or which legal entity) is actually calling the shots. See D. Zetzsche, R. Buckley, D. Arner, "The Distributed Liability of Distributed Ledgers: Legal Risks of Blockchain", *UNSWLRS* 2017, 17.

Finally, with regard to private blockchains where access is regulated, issues regarding governance are less pressing. Indeed, the governance structures of such permissioned blockchains may be much more developed and clear than what is the case for a fully anonymous open ledger.[77]

24. There are definitely more challenges surrounding blockchain technology – a discussion of which would however lead us too far – such as problems of scalability and the energy use of proof of work models. We refer the interested reader to specialised technical literature on this subject.[78]

II. Blockchain and copyright

II.1. General

25. Following the above overview of blockchain-related characteristics and challenges, we turn our focus to the opportunities that blockchain technology has to offer in the field of copyright. Because, as was said earlier, tokens may represent almost anything (all types of assets, data or information can be 'tokenised'), they may represent copyright-relevant elements, such as a copy of a protected work, the status of a work (*e.g.* as an orphan work), a record of rights management information (RMI) for a work, the terms of use of protected content or remuneration encoded in a cryptocurrency.[79]

The focus of this paper will be limited to two subjects: proof of ownership (II.2) and modes of exploitation and management (II.3). In relation to both topics, a certain consensus has recently been emerging that blockchain technology may offer (alternative) solutions. In the context of blockchain, a certain mutual relationship between both topics becomes even apparent. Indeed, both may ensure a fair(er) remuneration for authors and performers, *e.g.* through a blockchain-based payment and contract system managed by the artists themselves or an intermediary platform.[80]

Sections II.2 and II.3 are structured in the same way: we describe briefly relevant legal norms before bringing blockchain technology into the equation.

26. Our choice for these topics leaves intact other opportunities and/or challenges that blockchain may hold for copyright, but these shall remain outside the scope of this paper. One may think of issues of liability[81] (*e.g.* for inaccurate data input), the moral right to withdraw that is recognised in certain countries[82] and legal issues arising from the possibility to remain anonymous on the blockchain. Additionally, the use of blockchain in a copyright context indubitably leads to questions of international private law, in view of the apparent clash between the cross-border nature of the blockchain ecosystem and the essentially territorial nature of copyright law.[83]

II.2. (Proof of) creatorship and ownership

II.2.1 Positioning blockchain opportunities within the existing legal framework

27. In contrast to most other intellectual property rights, including trademarks, patents and designs, the copyright system operates without the requirement of a registration as a condition to exercise the right.[84] Copyright protection comes into existence automatically, as from the moment a 'literary or artistic work' is created. This rule follows from a provision in the major copyright treaty, the Berne Convention, that prohibits any formal requirement – such as registration at an office or application of a © notice – as a precondition for the enjoyment and exercise of copyright protection.[85]

Yet, the Berne standards only bind the signatory states as far as their relations with foreign authors are concerned. National registration obligations may thus be imposed as regards domestic authors.[86] However, since national governments tend not to discriminate against their own nationals, the formalities ban in practice has a general application.[87]

On the other hand, the ban of formalities does not apply to copyright rules that do not affect 'the enjoy-

77 D. Zetzsche, R. Buckley, D. Arner, "The Distributed Liability of Distributed Ledgers: Legal Risks of Blockchain", *UNSWLRS* 2017, 21-22.
78 See footnote 4 above.
79 Examples given by B. Bodó, D. Gervais and J.J. Quintais, "Blockchain and smart contracts: the missing link in copyright licensing?", *International Journal of Law and Information Technology*, eay014, September 2018, 5. In this article, the authors identify four copyright domains where they see a promising (and challenging) future for blockchain technology: (1) smart contracts and private ordering (2) copyright registries (3) articulation with the legal regime of DRM and (4) fair remuneration.
80 See examples discussed in paragraphs 54 through 56.
81 See for a clear overview of possible sources of liability and measures that could be taken in this regard D. Zetzsche, R. Buckley, D. Arner, "The Distributed Liability of Distributed Ledgers: Legal Risks of Blockchain", *UNSWLRS* 2017, 29-43.
82 See in relation to the principle of immutability, with which the right of withdrawal could be considered to clash, above, paragraphs 15 and 20.
83 See, *e.g.*, M. Kiemle, "Blockchain & copyright issues outside the music industry", unpublished master thesis KULeuven, 2018, 43 p. and D. Zetzsche, R. Buckley, D. Arner, "The Distributed Liability of Distributed Ledgers: Legal Risks of Blockchain", *UNSWLRS* 2017, 26.
84 For the sake of completeness, it should be observed that in the EU, limited protection is available for non-registered designs.
85 See Articles 2 and 5.2 Berne Convention for the Protection of Literary and Artistic Works of 6 September 1886, as later amended, full text available at http://www.wipo.int/treaties/en/text.jsp?file_id=283698. See for more details S. Van Gompel, *Formalities in Copyright Law: An Analysis of Their History, Rationales and Possible Future*, 2011, 309 p.
86 Ch. J. Sprigman, "Berne's Vanishing Ban on Formalities", 28 *Berkeley Technology. Law Journal*, 2013, 1566.
87 J. Ginsburg, "The U.S. Experience with Mandatory Copyright Formalities: A Love/Hate Relationship", 33 *Colum. J.L. & Arts* 311, 2010, 313-14.

ment and the exercise' of exclusive rights and, hence, does not outlaw rules on declaratory formalities.[88] This explains the existence in some countries of public copyright offices where works can be registered. Under US law, for instance, such a registration is even mandatory for national authors seeking to enforce their rights before a federal court.[89]

28. As from the creation of a work, the question arises to whom copyright initially belongs. In most countries, copyright comes into existence through the act of creation of an original work, whereupon this right is automatically attributed to its author.[90] Yet, this issue of first ownership may only be decisively settled by the competent court, in the framework of court proceedings.

As for all facts, evidence of authorship can be provided by all means of law, including testimonies and suspicions.[91] This proof is not always easy. How does one prove that someone was the author of a text, a drawing, a scenario, a product manual, a computer program, etc.?[92] As was mentioned earlier, in some countries, works may be registered with an official (copyright) office for the purpose of proving ownership.[93] If no such possibility exists, a number of alternative solutions may be available. In Belgium, for instance, an affiliation with a collective management organisation[94] or entrusting documents to a notary or the AAPD[95] at the Federal Ministry of Financial Affairs, or the deposit of documents as *i-Depot*[96] at the Benelux Office for Intellectual Property (BOIP) constitute helpful tools to prove ownership of a work. However, these solutions do not establish an irrefutable proof but only a 'proof of date'. As will be described below, this is where blockchain technology could come into play.

29. The question of initial ownership is often not the end of the story. The initial authors, the persons who created the work, may transfer their copyright to other physical persons and/or legal entities. Beside the operation of legal presumptions in certain situations, e.g. creations by employees[97] or particular works such as audio-visual works[98], computer programs[99] and databases[100], such transfer will typically occur by way of contractual provisions. Any such transfer of copyright is allowed, provided that it complies with the applicable rules of copyright contract law. Under Belgian copyright contract law, the main principles in this regard are the requirement of written proof of the contract against the author, certain specification obligations (duration, geographical scope, etc.) and the restrictive interpretation of the terms of the contract.[101]

30. Copyright contract law is an area which is far from harmonised and necessitates a country-by-country analysis. Rights to a work can moreover be 'sliced and diced' according to certain exploitation modes.[102] Having regard to the territorial nature of copyright that dictates that protection for each fragment of the copyright (slice) follows the domestic law of the country where its protection is sought, exploitation to a work in an international context may involve thousands of 'titles', which in turn can be transferred again and again.[103]

Also here, blockchain technology might lend a helping hand, not merely in establishing proof of ownership but also in keeping track of the various titles to a work as well as through enabling a transparent system to realise further transfers of these titles through smart contracts.[104]

31. To conclude, given the vast amount of works that may enjoy copyright protection, the aim of providing a secure system that establishes and tracks copyright ownership in a comprehensive way is a task of gargantuan proportions. Nonetheless, as we will see be-

88 S. Van Gompel, "Copyright Formalities in the Internet Age: Filters of Protection or Facilitators of Licensing", 3 *Berkeley Technology Law Journal* 2013, 1439

89 17 USC § 441. In the US such registration is *e.g.* required to defeat a plea of innocent infringement or to obtain higher (triple) damages.

90 See in Belgium Article XI.170, paragraph 1 BCEL. For the sake of simplicity, this paper will not discuss fine distinctions between countries, often resulting from their adherence to different copyright families (*i.e. droit d'auteur* vs. copyright systems).

91 See *e.g.* First instance court of Antwerp, 31 January 2006, *A&M* 2006, 444.

92 For the sake of completeness, we note that there are a number of relevant legal presumptions with regard to copyright ownership under Belgian law, for example, there is a rebuttable presumption of ownership in favour of the person whose name or acronym is affixed to (a reproduction of) the work or upon a communication of such work to the public (Article XI.170, paragraph 2 BCEL). Similarly, the publisher of an anonymous work or a work that is published under a pseudonym is deemed to be the author thereof vis-à-vis third parties (Article XI.170, paragraph 2 BCEL). These presumptions may also apply in favour of legal entities.

93 See paragraph 27.

94 See for example https://sabam.depotonline.eu/.

95 In full: "Algemene Administratie van de Patrimoniumdocumentatie", see https://financien.belgium.be/nl/over_de_fod/structuur_en_diensten/algemene_administraties/patrimoniumdocumentatie.

96 See https://www.boip.int/en/entrepreneurs/ideas.

97 We note that, under Belgian law, there is no generalised presumption of transfer of intellectual property rights of employees to their employer, except with regard to databases made in the non-cultural industry (Article XI.187 BCEL) and computer programs (Article XI.296 BCEL).

98 See under Belgian law Article XI.179 BCEL.

99 See under Belgian law Article XI.296 BCEL.

100 See under Belgian law Article XI.187 BCEL.

101 See Article XI.167, §1 BCEL. Additionally, specific provisions on particular types of copyright contracts may be found in Articles XI.182 through XI.185 (for audio-visual works) and XI.195 through XI.202 BCEL (for publishing contracts and performance contracts respectively.

102 Cf. M. O'Dair *et al.*, "Music on the Blockchain", Blockchain for Creative Industries Research Cluster. Middlesex University, 2016, 10.

103 B. Bodó, D. Gervais and J.J. Quintais, "Blockchain and smart contracts: the missing link in copyright licensing?", *International Journal of Law and Information Technology*, eay014, September 2018, 11-12.

104 See on smart contracts also paragraphs 50 *et seq.* We will not comment on whether a smart contract may comply with the requirement of a 'written instrument' under Belgian law.

low, there are a considerable number of blockchain start-ups that have risen to this challenge.

II.2.2. Establishing and tracking copyright ownership and other information regarding works

– *A blockchain-based registry*

32. As mentioned above[105], blockchain is, in essence, a 'database' that may collect information of all kinds, including relevant copyright identification data, such as regarding initial and secondary ownership, moment of creation and particular status (e.g. orphan work[106] or out-of-commerce work). Below, we will focus on ownership status.

33. Many authors have pointed out the possibilities that blockchain technology offers in establishing and timestamping ownership of copyright.[107] DLTs may host public copyright registries, which record – in a transparent manner – the ownership of works.[108] By creating an unbreakable bond between the creators and their work, blockchain might remedy the lacuna in copyright law that results from the 'no formalities rule'. An undisputable disadvantage of this latter rule is indeed the lack of legal certainty for third parties who are interested in exploiting a work and need to secure prior authorisation of the author. The multiplicity of authors and/or subsequent right owners to different 'slices' of a work[109] only increases the complexity and the legal uncertainty in this regard.

34. As was explained above, the Berne prohibition does not entail a legal obstacle to a public or private system of formalities aimed at certifying certain features or ensuring a higher degree of evidentiary value.[110] Hence, establishing a blockchain-based system for registration of works on a voluntary basis would not contravene the Berne ban. In addition to proving authorship, a registration on the blockchain may also serve as a guarantee for the authenticity[111] and the integrity of the work.

Bodo *et al.* concur with this position and further observe that such public blockchain copyright registries should take the form of a permissionless public blockchain. Such a registry needs "to be accessible and open on most if not all of its possible dimensions to enable any creator to register their ownership and to fulfil its informative function vis-à-vis third parties (other rights holders, the public, and administrative or judicial bodies)".[112]

– *Challenge of too many registries*

35. Various companies have already suited the action to the word and set up companies that offer blockchain registration services. It should be kept in mind, however, that the blockchain landscape, also in this particular field, is shifting every single day. What is new and ground-breaking today may as well be virtually obsolete tomorrow. Below, we will describe a number of projects that have caught our eye for different reasons.

36. A first pioneer in the field was Berlin-based start-up *Ascribe*[113]. In January 2015, *Ascribe* officially launched a platform allowing for registration of digital artworks. One year later, the *Ascribe* team built a blockchain database called *BigChainDB*[114] with ascribe itself as the lead customer. Every work that was registered on ascribe received a unique cryptographic identifier that was stored on the *BigChainDB* ledger and served as a watermark linking up the identity of the artist with the digital artwork at issue. The aim was to help creators 'lock-in' their authorship and manage their valuable digital creations by providing secure attribution, easy sharing and visibility. All ascribe data were indexed and, as a result, it was possible to search for specific data without having to scan the entire blockchain. All in all, ascribe offered many opportunities for creators. However, in August 2018, the founders of the *Ascribe* project decided to bring it to an end and, instead, make the ascribe codebase fully open source.[115] As a result, interested artists and institutions should now be able to run their own 'ascribe' service.

105 See paragraph 17.
106 On this issue, and in particular the possibility of a blockchain-based platform to help compliance with the burdensome requirement to perform 'a diligent search', see J. Goldenfein and D. Hunter, "Blockchains, Orphan Works, and the Public Domain", 41 *Columbia Journal of Law & the Arts*, 2017, 1; and B. Bodó, D. Gervais and J.J. Quintais, "Blockchain and smart contracts: the missing link in copyright licensing?", *International Journal of Law and Information Technology*, eay014, September 2018, 15-18.
107 B. Clark, *l.c.* 2018; B. De Jonghe and V.I.Laan, "Blockchain in de realiteit", *Computerrecht* 2017, 347 e.v.; P. De Filippi, G. McMullen, T. McConaghy, C. Choi, S. De la Rouvière, J. Benet en D.J. Stern, "How blockchains can support, complement, or supplement intellectual property", Paper Coalition of Automated Legal Applications, 2016, available at https://www.intgovforum.org/multilingual/index.php?q=filedepot_download/4307/529; Y. Poullet and H. Jacquemin, "Blockchain: une revolution pour le droit?", *JT* 2018, 805.
108 B. Bodó, D. Gervais and J.J. Quintais, "Blockchain and smart contracts: the missing link in copyright licensing?", *International Journal of Law and Information Technology*, eay014, September 2018, 4.
109 See paragraph 30.
110 See paragraph 27.
111 Note that also the requirements for a qualified electronic time stamp should be fulfilled as determined by Regulation 910/2014 on electronic identification and trust services for electronic transactions in the internal market, *OJ* L 257, 28 August 2014, p. 73-114.
112 B. Bodó, D. Gervais and J.J. Quintais, "Blockchain and smart contracts: the missing link in copyright licensing?", *International Journal of Law and Information Technology*, eay014, September 2018, 8.
113 https://www.ascribe.io/.
114 https://www.bigchaindb.com/.
115 See https://www.ascribe.io/announcements/an-update-on-ascribe/.

37. Another pioneer in the blockchain start-up field, established in 2014, is the *Bitmark*[116] blockchain. It is aimed at recording ownership transfers and has set itself the ambitious goal of recording the property rights to all the world's assets, not only digital artworks. The idea is to create a digitally signed chain for each digital asset, consisting of "a single Issue Record and one or more Transfer Records", which is stored on (not necessarily successive) blocks of the Bitmark Blockchain.[117] The result is meant to be a unique property title not unlike what is available in the analogue world for a house or a car.

38. The end of *Ascribe* is surprising in one way (in view of its many qualities), but not really in another. It appears that, as the founders also acknowledge in their statement on this subject, ascribe was ahead of its time. Five years ago, when work on ascribe first started, Ethereum did not exist yet. Now, it is possible to build blockchain registries upon the popular Ethereum ecosystem[118] and, as a result, the amount of blockchain projects related to IP ownership is increasing at an ever-changing rate. Examples are *Blokur*[119] and *Jaak*[120]. Yet, not all blockchain start-ups today make use of the Ethereum platform. For instance, *Bernstein*[121] is currently deployed on the Bitcoin blockchain, while *Creativechain*[122] appears to have created its very own blockchain, with a dedicated cryptocurrency called *CREA*.

39; As the amount of IP registries on the blockchain increases, so does the degree of competition. Since each start-up wants to outperform all of the others, innovation progresses at an impressively quick pace. However, the differing commercial and financial models of the many start-ups lead to a somewhat chaotic system that may confuse and hence deter users. Another problematic aspect is that the high degree of diversity of the IP registries goes hand in hand with a (renewed) scattering of the copyright repertoire. This might add to a sense of frustration in potential users. We must then ask ourselves whether blockchain actually offers a better alternative than what exists today.

– *Characteristic of immutability and the transaction time as specific challenges for copyright*

40. As mentioned above[123], one of the essential characteristics of the blockchain is its *immutability*. The data stored are indelible. This characteristic is generally considered advantageous as it creates the sense of trust and reliability upon which the success of blockchain technology depends. It ensures that the content of the database will not be tampered with or otherwise compromised. As a result, the evidentiary power of information recorded on the blockchain will no doubt be substantial.[124]

However, the characteristic of immutability may prove to be problematic when certain corrections need to be made[125], e.g. following a court order. Indeed, anyone can register a work on the blockchain. There is no prior control of the correctness of the authorship and/or ownership data.[126] Inaccurate claims are thus possible. Because blockchain lacks a central authority, generally no one person can comply with a takedown notice. A similar applies to the issue of protectability, if a court were to hold that the work does not fulfil the criteria for protection and should therefore be denied copyright protection.[127] It is unclear how such data can be properly rectified on the blockchain – with the word 'properly' implying the need to retroactively ensure the dissemination of correct copyright ownership information.

41. Another problem associated with the use of blockchain technology for the purpose of determining copyright ownership is the *transaction time*. As described above, there are several different ways to achieve consensus using blockchain technology. However, the validation of a blockchain entry under such consensus models is not at all an instantaneous process.[128] This technical *caveat* might prove to be problematic in copyright cases: one could easily imagine a situation where a dishonest party would attempt to register a certain work on the blockchain seconds after it was communicated to the public by the original author. Even if this original author also regis-

116 Website: https://bitmark.com/. Tagline: "*A universal system for digital property ownership*".
117 See for more detailed information S. Moss-Pultz, "Bitmark. A universal system for digital property ownership", *Summer School on Real-World Crypto and Privacy* 9 June 2017, quote taken from slide 9, available online at https://summerschool-croatia.cs.ru.nl/2017/slides/Bitmark.pdf.
118 See also above paragraph 9.
119 https://www.blokur.com/, introducing itself as "a blockchain building the most accurate source of global music publishing data in the world using blockchain technology and machine learning".
120 https://jaak.io/, introducing itself as follows "Making content Smart. At Jaak, we're building a blockchain network that will allow the music and media industries to collaborate on a global view of content ownership and rights."
121 https://www.bernstein.io/.
122 https://www.creativechain.org/.
123 See paragraph 15 and 20.
124 A. Savelyev, "Copyright in the blockchain era: promises and challenges", Higher School of Economics Research Paper No. WP BRP 77/LAW/2017, 21 November 2017, available on ssrn, at 9.
125 T.F.E. Tjong Tjin Tai, "Juridische aspecten van blockchain en smart contracts", *TPR* 2017, n° 1, 574.
126 More in general, we note that the actual nature and/or status of an asset itself lies beyond the reach of any blockchain. This constitutes an inherent and inevitable limitation of blockchain technology. If the information stored on the blockchain is not reliable, not even a blockchain will remedy this unreliability.
127 M. Loney, "How blockchain will change intellectual property – copyright", *Managing Intellectual Property* 13 March 2018. See also A. Savelyev, "Copyright in the blockchain era: promises and challenges", Higher School of Economics Research Paper No. WP BRP 77/LAW/2017, 21 November 2017, available on ssrn, at 21: "Blockchain records need to be changed in accordance with the decisions of courts and state authorities, otherwise blockchain will become an enemy of the state, not its ally".
128 See in this sense also M. Loney, "How blockchain will change intellectual property – copyright", *Managing Intellectual Property* 13 March 2018.

ters the work at issue, what happens if both entries end up in the same block with two different authentication stamps that directly contradict each other?

– *Interim conclusion*

42. While the use of blockchain technology for the purpose of proving copyright ownership holds many promises in theory, there clearly still is a lot of work in realising its possibilities in practice. We refer in particular to the vast diversity in IP registries on the blockchain that exists today, as well as the challenges associated with blockchain's characteristic of immutability and the transaction time.

II.3. Exploitation and management

II.3.1 Positioning blockchain opportunities within the existing legal framework

43. The exploitation and management of copyright can take many different forms. As explained above[129], the initial author of a work can transfer the economic attributes of copyright to another physical or legal person, either partially or in full. Additionally, these economic rights may be the subject of a licence, be it on an exclusive or non-exclusive basis. Against the author, proof of the contract must be provided in writing and, further, the contract terms must be interpreted restrictively.[130]

44. Specific rules exist when copyright in a certain work is vested in different persons and/or entities. If the individual contribution of each of the authors to an original work can be determined, they may exploit their contribution separately, insofar this exploitation does not jeopardise the common work.[131] However, if the author(s) collaborate(s) with another person in the context of this work, appropriate contractual arrangements must be made.[132] For some types of copyright-protected works, co-ownership of copyright is the rule rather than the exception. For example, in relation to audiovisual works, Belgian law applies a presumption that not only the main director holds copyright in the work but that this is *i.a.* also the case for the screenwriter and the music composer.[133] In such cases, it goes without saying that solid arrangements must be made in relation to copyright exploitation and management.

Thus, it is important for authors to first sort out the extent of their rights before any decision on exploiting and managing these rights in practice can be taken.

45. A further important choice for authors is whether to exploit and manage their rights on an individual basis or to call upon the services of a collective rights management organisation (hereinafter "CMO").

While collective management of copyright is sometimes mandatory, the main incentive for collective management to date is a practical one. Indeed, once a work has been created, it is near impossible to individually control every use that is made thereof. This rings all the more true in the digital age where protected content may be catapulted across the globe in a matter of milliseconds. Additionally, collective management has its benefits from the perspective of the consumers of creative content as it is often impossible to track down the right owner(s) and obtain the required prior authorisation. If the author has chosen the route of collective management, the CMO at issue may usefully serve as an intermediary by reducing transaction costs on both sides and thus enabling access to creative content.

46. On the other hand, collective management of copyright is not without its problems. A challenge that CMOs are faced with lies in their fragmentation. In Belgium, for example, a grand total of 26 CMOs exists[134], each of them tasked with managing a specific type of rights. This may lead to a high administrative burden for users of creative content. To alleviate this issue, we note the establishment of one-stop shops, a type of clearinghouses where the users need only obtain permission once in order to be able to use a protected work.[135]

Another problem associated with CMOs pertains to the scope of a CMO's mandate, which can sometimes be unclear, not only on a substantive level[136] but also territorially speaking. Indeed, a vital principle in the field of copyright is the principle of territoriality, as a result of which copyright laws only apply within the confines of a certain country. CMOs may only act within such confines. However, while copyright thus has strict borders, creative content does not – especially in the digital age. This has brought CMOs to conclude reciprocity agreements with their foreign

129 See paragraph 29.
130 See Article XI.167, §1 BCEL.
131 Article XI.169, paragraph 2 BCEL.
132 Article XI.169, paragraph 1 BCEL. See also Article XI.168 as regards the exploitation of divisible vs. indivisible works.
133 Article XI.179 BCEL. Are presumed to be the author: a) the screenwriter, b) the editor, c) the copywriter, d) the graphic designer of important animated works or animation sequences in an audiovisual work and e) the author of musical works with or without words specially created for the audiovisual work.
134 See list on http://economie.fgov.be/nl/ondernemingen/Intellectuele_Eigendom/auteursrecht/Controledienst.
135 See for example in Belgium the so-called "eengemaakte aangifte" (in English: "unified declaration"), which grew from a co-operation between three Belgian CMOs (SABAM, SIMIM and PlayRight).
136 For example, the question arises whether CMOs may represent the interests of artists that are not a member of the CMO at issue. In Belgium, this issue was decided by the Supreme Court, who ruled in 2009 that CMOs cannot do this (Cass. 16 January 2009, *RW* 2009-2010, 711, case note M.-C. Janssens).

counterparts, which ensure that artists receive compensation for use of their work at home as well as abroad. However, not all CMOs across the globe are connected, so that the web of reciprocity agreements is not (yet) fully spun. While this process is still ongoing, other approaches to licencing have been explored, such as the idea of multi-territorial licences.[137] Already in 2005, the European Commission favoured the establishment of a multi-territorial licence system over the existing network of reciprocity agreements, advocating the establishment of a single CMO managing online copyright in several different countries.[138] In 2014, the European legislator took measures aimed at promoting multi-territorial licencing in the music sectors in the Collective Management Directive.[139] However, a European CMO where all rights are managed in a centralised manner – let alone a global one-stop shop – does not exist. It is even doubtful whether such a global CMO could ever be legally established, *i.a.* in view of competition law issues and the question of compatibility with the principle of territoriality.

Finally and despite the many practical advantages CMOs offer, users perceive their image negatively at times as being non-transparent or even abusive. Throughout the years, legislative action has been taken to remedy this and thereby ensure transparency in the organisation and operation of CMOs.[140]

47. Could blockchain technology provide a solution to the problems outlined above? In the next section, we will treat this question in more detail, outlining current practice as well as future possibilities in the blockchain world.

II.3.2. Transparency, disintermediation and decentralisation: the promise of blockchain

48. Blockchain is not only hailed by some as the solution to proving ownership of copyrighted works, but it is also said that blockchain will play an important part in the exploitation and management of copyright, the code words in this regard unsurprisingly being transparency, disintermediation and decentralisation. Since the opportunities of blockchain have been mainly discussed in the context of the music industry, this paper will hereafter primarily focus on the music sector while briefly noting what may be relevant in other sectors.

- *A licencing tool through the vehicle of smart contracts*

49. First, the use of a blockchain may lead to a higher degree of transparency in the copyright value chain, aiding artists in licencing their work and ensuring fair compensation for the use thereof.[141] As a result, it could be argued, blockchain eliminates the need for a middleman such as a CMO or any other kind of centralised system (e.g. *Spotify* or *Deezer*) that lacks sufficient transparency. Proponents of such a licencing model see many opportunities (actually too many, in the eyes of the authors):

"Blockchain development in this area could lead to multi-territorial licensing policies and enhanced legal certainty for creators and purchasers while providing effective dispute resolution mechanisms, particularly in relation to tariffs, licensing conditions, entrustment of online rights for management and withdrawal of online rights."[142]

50. The issue of licencing brings us to the concept of 'smart contracts'. In the context of this paper, we define smart contracts as pieces of software code that are installed directly on the blockchain – not on a central server – which contain agreements (which in turn imply 'real-world' commitments) that are automatically executed when predefined conditions, equally translated into the software, are fulfilled.[143] In most cases, smart contracts encode 'if-then' conditional statements that both parties must agree upon beforehand (if person A completes payment of X, then the contract will grant them access to the work).

Since a smart contract is grounded in an agreement between parties, its legally binding force will depend on the applicable principles of contract law.[144] The first step of creating a smart contract is thus the identification of this agreement and the verification of its validity. Only then, the contractual conditions can be

137 See for practical examples e.g. the Santiago Agreement and the BIEM/Barcelona Agreement (both now defunct) and the IFPI Simulcasting Agreement.

138 Commission Recommendation of 18 May 2005 on collective cross-border management of copyright and related rights for legitimate online music services, *OJ* L 21 October 2005, n° 276, 54-57.

139 Directive 2014/26/EU of 26 February 2014 of the European Parliament and of the Council of 26 February 2014 on collective management of copyright and related rights and multi-territorial licensing of rights in musical works for online use in the internal market, *OJ* L 20 March 2014, n° 84, 72-98. See in relation to the organisational and operational control of CMOs under Belgian law Book XI, Title 5, Chapter 10 BCEL.

140 See previous footnote.

141 See *i.a.* M. O'Dair *et al.*, "Music on the Blockchain", Blockchain for Creative Industries Research Cluster. Middlesex University, 2016, 12 *et seq.*

142 P. Boucher, *How blockchain technology could change our lives. In-depth analysis*, European Parliamentary Research Service, STOA PE 581.948, February 2017, available at http://www.europarl.europa.eu/RegData/etudes/IDAN/2017/581948/EPRS_IDA(2017)581948_EN.pdf, p. 9.

143 B. Clark, "Blockchain and IP Law: A Match made in Crypto Heaven?", *WIPO Magazine* 2018, n° 1, http://www.wipo.int/wipo_magazine/en/2018/01/article_0005.html; vgl. A. De Backer en V. De Boe, "Smart contracts in de financiële sector: grote verwachtingen en regulatoire uitdagingen", *Computerrecht* 2017, 355. Note that the terminology 'smart contract' is already in use since the late 90s and thus before blockchain technology existed; see N. Szabo, "Formalizing and Securing Relationships on Public Networks, *First Monday* 1997, available at http://ojphi.org/ojs/index.php/fm/article/view/548/469.

144 Under Belgian law: Title III of the Civil Code.

properly analysed, isolated and translated into programming language. This is often not an easy task given the inherent subjectivity of 'human' language (see e.g. concepts such as 'in good faith' and 'within a reasonable delay') – and computer language's complete lack thereof.

51. Smart contracts are decentralised and autonomous. First, the aspect of decentralisation goes back to the essence of DLT and implies that smart contracts are "*distributed and self-executing across network nodes*".[145] Second, the automatic and autonomous nature of a smart contract eliminates human judgment and, thus, the need for trust between the parties, at least to a certain extent.[146] A smart contract is therefore said to be efficient, fast and secure. The analogy with a vending machine is clear: there is a set of algorithmic instructions at play that ensures release of the item once payment and selection have been made.[147] In a similar vein, a smart contract will always execute the code, no matter what. Yet, smart contracts "*are only as smart as what is programmed into them.*"[148] Hence, the quality of a smart contract still depends in a way on human judgment, unmistakably leaving room for error. With the immutability of a blockchain being one of the quintessential characteristics thereof, such margin for error may lead to significant risks. Furthermore, as regards the performance of the contract, computer code cannot make situational determinations outside of the exact conditions written into terms of the contract.[149] There is e.g. no room for consideration of unforeseen or extenuating circumstances.

This paper will not further discuss such legal issues and shortfalls relating to smart contracts[150] and shall merely assume their existence, as they are already used in practice.

52. The smart coding behind blockchain technology allows parties to carry out reliable transactions whose authenticity is determined by mass collaboration between different participating computers on the network without the intervention of intermediaries (and their own interest). Applied to a copyright situation, smart contracts thus offer the promise of automatic, self-enforcing and personalised licencing, apparently eliminating the need to call upon the services of intermediaries such as publishers, music labels or CMOs.

Indeed, in their role of 'trusted third party', such intermediaries typically take a certain percentage of the income to compensate for their work and costs. They also decide on tariff setting in a way that is not always welcomed by users and sometimes condemned by courts.[151] Hence, some competition from blockchain-related management models might be beneficial from a competition angle.

– *The promise of disintermediation*

53. At first sight, and from a financial view, the disappearance of a 'middleman' looks promising for right owners who can directly deal with potential users. The latter pay to the right owner (in cryptocurrency) and can make use of the copyrighted content – e.g. download or stream one song – under certain conditions specified in a smart contract. In this model, the right owners themselves set a price for their work and are paid immediately by consumers. This constitutes a clear disruption of the traditional industry model with a large economic potential for right holders. The close link between right owner and users of their business model may indeed guarantee a higher remuneration for the right owner. Further, the automated and personalised nature of such a licencing model could lead to a high degree of precision with low transaction costs.[152]

54. In any case, blockchain start-ups based on the principle of disintermediation have been springing up like mushrooms across the globe over the last few years. Each of these start-ups promises artists a digital utopia, where royalty payments are made quasi-instantly, automatically and in a fully transparent way. By way of example, we refer to the 'play-per-pay' model of music streaming platform *Musicoin* where users can exchange the platform's own cryptocurren-

145 M. Swan, *Blockchain – Blueprint for a New Economy,* Beijing-Cambridge, O-Reilly, 2015, 16.
146 *Ibid.*, at 16-17.
147 *Ibid.*
148 P. De Filippi, G. McMullen, T. McConaghy, C. Choi, S. de la Rouviere, J. Benet and D.J. Stern, "Working draft: How Blockchains can Support, Complement, or Supplement Intellectual Property", Coalition of Automated Legal Applications (COALA), May 2016, 2, available online at https://github.com/COALAIP/specs/blob/master/presentations/COALA%20IP%20Report%20-%20May%202016.pdf.
149 See on this topic P. De Filippi and S. Hassan, "Blockchain technology as a regulatory technology: From code is law to law is code", *First Monday* 2016, n° 12, available online at http://firstmonday.org/ojs/index.php/fm/article/view/7113/5657.
150 For more details and critical reflections, see *i.a.* M. Giancaspro, "Is a 'smart contract' really a smart idea? Insights from a legal perspective", *Computer Law & Security Review* 2017, 825-835; K. Levy, "Book-Smart, Not Street-Smart: Blockchain-Based Smart Contracts and The Social Workings of Law", *Engaging Science, Technology, and Society*, vol. 3, 2017, 1; E. Tjong Tjin Tai, "Juridische aspecten van blockchain en smart contracts", *TPR* 2017, n° 1, 563-608; R. O'Shields, "Smart Contracts: Legal Agreements for the Blockchain", N.C. Banking Inst. 2017, 177-194; É. Barbry, "Smart contracts... Aspects juridiques", *Annales des Mines - Réalités industrielles* 2017, n° 3, 77-80,115,120,122 ; A. Savelyev, "Contract law 2.0: 'Smart' contracts as the beginning of the end of classic contract law", *Information and Communications Technology Law* 2017, n° 2, 116-134; M. Giancaspro, "Is a "smart contract" really a smart idea? Insights from a legal perspective", *Computer Law & Security Review* 2017; G. Governatori, F. Idelberger, Z. Milosevic, R. Riveret, G. Sartor and X. Xu, "On legal contracts, imperative and declarative smart contracts, and blockchain systems", *Artif. Intell. Law* 2018, 27 p; ISDA and Linklaters Whitepaper, "Smart Contracts and Distributed Ledger – A Legal Perspective", 2017, 23 p., available online at https://www.isda.org/a/6EKDE/smart-contracts-and-distributed-ledger-a-legal-perspective.pdf; D. Zetzsche, R. Buckley, D. Arner, "The Distributed Liability of Distributed Ledgers: Legal Risks of Blockchain", *UNSWLRS* 2017, 24-25.
151 See recent decision of Pres. Commercial Court Brussels, 12 April 2018, *ICIP* 2018, 298.
152 M. O'Dair *et al.*, "Music On the Blockchain", Blockchain for Creative Industries Research Cluster. Middlesex University, 2016, 10 *et seq.*

cy *Musicoin* for music streams.[153] Other examples include *Voise*[154], *Choon*[155], *UJO Music*[156], *Potentiam*[157] and many others.

55. A particularly well-thought-out example is the blockchain rights management platform *Rightsshare*. It enables direct music licencing between authors and digital service providers, including direct remuneration, making use of smart contracts.[158] As the image below explains, a number of data sets with relevant copyright information need to be provided before the smart contract can be created. The verification of the contract is moreover only valid after all parties involved (creators, publishers) have agreed. Then, the smart contract is embedded in a blockchain and in the 'master tape'. Every play verified by the digital service provider containing all relevant usage information is automatically stored on the blockchain. All information is directly and transparently provided to all right holders. Payments can be made directly through this service provider.

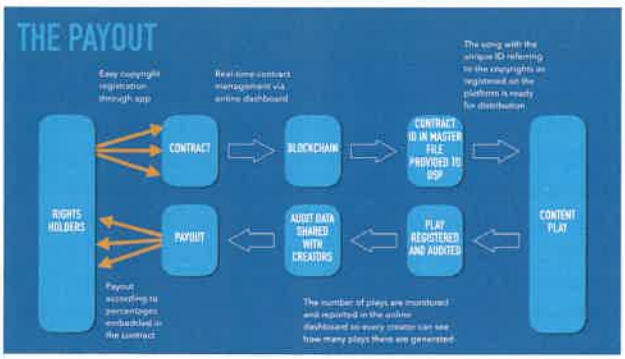


Figure 3 (source: https://rightsshare.com/?page_id=209)

56. Some artists even take matters into their own hands. An often cited example in this respect is Grammy Award-winning artist Imogen Heap who founded her own blockchain music platform *Mycelia*[159] on the Ethereum blockchain. Already in 2015, Heap played an active role in the blockchain music community. At that time, she released the song *Tiny Human*, which consumers could download via a smart contract upon the payment of *Ether*.[160] While the financial revenues of this experiment were limited, Heap's hopes for the use of blockchain for music licencing purposes remain high to this day.[161]

57. While the greater part of blockchain-related business initiatives aimed at revolutionising the *music* industry, in January 2018, the multinational Kodak launched the blockchain-based platform 'KodakOne' with a view of securing protection for the rights of *photographers*.[162] KodakOne, which is housed on the Ethereum blockchain, offers photographers the opportunity to register their photos on the ledger and promises that their system will facilitate licencing and may even help put a stop to illicit reproductions. The KodakOne platform comes with its very own cryptocurrency, the somewhat unoriginally named *KodakCoin*.

– *An empty promise ?*

58. While Heap's and other start-ups' enthusiasm may be contagious, none of these projects appears to have gathered the momentum that is necessary to make a real difference in the music industry. Caution is indeed advised since music licencing based on smart contracts is not entirely unproblematic on a legal, nor on a practical level.

59. First, every such smart contract must take account of the multitude of possible right holders (e.g. in audiovisual works), as well as specific contractual arrangements that may exist between them. Adding in another layer of contracts may in such a case lead to chaos, instead of the transparency that is sought.

A related problem lies in the multiplicity of licencing models that exists today, not only across different blockchains, but also on other online platforms and in the analogue world. How will all of these licences be managed in practice? How will they be synchronised and brought together?[163] How to avoid conflicts between smart contracts and 'normal' or traditional licences that have not, or not properly, been recorded on a digital ledger?[164] The desynchronisation that characterises blockchain-based services may still require (human?) intervention of an intermediary, which would run counter to the original goal.

60. Furthermore, these new blockchain platforms do not actually make users' lives any easier than existing streaming platforms such as e.g. *Deezer, Spotify* or

153 https://musicoin.org/.
154 https://www.voise.com/.
155 https://choon.co/.
156 https://ujomusic.com/.
157 https://www.potentiam.io/.
158 https://rightsshare.com/. The information in this paragraph is taken from this website.
159 http://myceliaformusic.org/.
160 See *i.a.* P. De Filippi, G. McMullen, T. McConaghy, C. Choi, S. de la Rouviere, J. Benet and D.J. Stern, "Working draft: How Blockchains can Support, Complement, or Supplement Intellectual Property", Coalition of Automated Legal Applications (COALA), May 2016, 2-3.
161 *Ibid.*, at 3.
162 See in more detail https://www.digitaltrends.com/photography/kodakone-creates-photo-registry-blockchain-ces2018/ and http://www.netimperative.com/2018/01/kodak-uses-blockchain-photo-copyright-protection/.
163 In this regard, we do note the existence of *Interledger* (https://interledger.org/), a protocol that is meant to ensure a seamless exchange of data between different blockchains and *Blockstream* (https://blockstream.com/) which creates so-called 'sidechains', *i.e.* extensions to existing blockchains aimed at enhancing their privacy and functionality.
164 B. Bodó, D. Gervais and J.J. Quintais, "Blockchain and smart contracts: the missing link in copyright licensing?", *International Journal of Law and Information Technology*, eay014, September 2018, 13.

Tidal already do. Indeed, the quality of the services offered by these more 'traditional' digital platforms is often high, which begs the question of why consumers would make the switch to blockchain.[165]

What is certainly not helpful in this respect is that most start-ups have developed their own dedicated cryptocurrency, which can only be used on 'their' platform.[166] This is not only likely to put off potential users, but also potential artists who might hesitate to receive income from unknown cryptocurrencies with an unstable market value.[167]

61. Finally, the new platforms often involve a new 'intermediary' that may want part of the pie, as the setting up of the blockchain application involves an investment in time and/or money.[168] This way, it could be argued that we are right back where we started, namely in a position where a middleman impedes the direct relationship between artist and consumer. Or to put it differently, blockchain does not necessarily eliminate centralisation, intermediation or trusted intermediaries.[169]

62. It should furthermore be borne in mind that most traditional intermediaries and in particular CMOs provide additional services, such as monitoring illegal activities and fighting piracy, eventually by way of court proceedings. It goes without saying that a blockchain can e.g. not monitor the use of music in local cafés and restaurants. More importantly, while the web of reciprocity agreements is not fully completed on a global level, the CMOs of most larger countries are connected, to the extent that they can represent a large repertoire. While DLTs may upset the status quo, it therefore appears unlikely that the use of blockchain technology will put CMOs across the globe out of business.[170]

63. Incidentally, blockchain technology might actually even benefit the current intermediary management organisations and improve their working. Bodo *et al.* provide the example of the possibility of setting up distributed databases to facilitate the interorganisational identification of works and payment of royalties.[171] For certain transactions, such as the cross-border accounting of royalties among CMOs, the blockchain will typically be set up in the form of a private permissioned blockchain.[172] Yet, in view of the requirement of transparency that the European framework sets as a benchmark[173], open access to the chain – at least to a certain extent – should be contemplated.

64. In connection with the foregoing, we refer to an initiative by three of the largest member-owned collection societies in the world: the American Society for Composers, Authors and Publishers *(ASCAP)*[174], the French Society of Authors, Composers and Publishers of Music (*SACEM)*[175] and *PRS for Music*[176]. In April 2017, they announced a ground-breaking partnership to set up a new shared system of managing authoritative music copyright information using blockchain technology.[177] The goal of the project is to prototype how the music industry could create and adopt a shared, decentralised database of musical work metadata with real-time update and tracking capabilities. Although the current status of this project is unclear, such initiatives certainly deserve support.

This project can be seen as a follow-up to earlier (failed) initiatives to create an authoritative, accessible database on music copyright information (including data regarding ownership and licencing terms) – a hurdle which has been proven near impossible to overcome time and again.[178] We refer by way of example to commendable, although unsuccessful initiatives such as the Global Repertoire Database (*GRD)*[179] and WIPO's International Music Registry (IMR), which was started within WIPO in 2011[180].

165 M. Van Lerbeirghe, *Blockchain en auteursrecht: de deus ex machina voor de muzikant?*, Unpublished master thesis KU Leuven, 2018, 34 e.v. ("Welk voordeel heeft de consument?").
166 M. O'Dair *et al.*, "Music on the Blockchain", Blockchain for Creative Industries Research Cluster. Middlesex University, 2016, 17-18.
167 B. Owsinski, "Despite Predictions, Blockchain Will Not Be The Future Of The Music Industry", *Forbes*, 18 November 2017.
168 A. Savelyev, "Copyright in the blockchain era: promises and challenges", Higher School of Economics Research Paper No. WP BRP 77/LAW/2017, 21 November 2017, available on ssrn.
169 Cf. B. Bodó, D. Gervais and J.J. Quintais, "Blockchain and smart contracts: the missing link in copyright licensing?", *International Journal of Law and Information Technology*, eay014, September 2018, 8-9; M. O'Dair *et al.*, "Music On the Blockchain", Blockchain for Creative Industries Research Cluster. Middlesex University, 2016, 16 and K. Werbach, "Trust, But Verify: Why the Blockchain Needs the Law", 2017, 27-30, available online at https://papers.ssrn.com/sol3/papers.cfm?abstract_id=2844409.
170 B. Bodó, D. Gervais and J.J. Quintais, "Blockchain and smart contracts: the missing link in copyright licensing?", *International Journal of Law and Information Technology*, eay014, September 2018, 7.
171 *Ibid.*, at 4.
172 *Ibid.*, at 8.
173 See footnote 2.
174 https://www.ascap.com/.
175 https://www.sacem.fr/.
176 https://www.prsformusic.com/.
177 Information available on the website of these CMOs as well as on http://www.cisac.org.
178 Examples given by B. Rosenblatt, "Watermarking Technology and Blockchains in the Music Industry", 3, available at www.digimarc.com.
179 See for a full overview of the GRD's fateful history http://www.hypebot.com/hypebot/2015/08/the-failure-of-the-global-repertoire-database-effort-draft.html.
180 See *i.a.* http://www.wipo.int/meetings/en/doc_details.jsp?doc_id=183060.

– *Blockchain as the new DRM?*[181]

65. With its capability to make a copyrighted work traceable all the way through a chain of transactions, blockchain technology *may* play a useful role in monitoring authorised use of copyright-protected works. A related question then arises whether it could also be a useful tool in combatting *unauthorised* digital use, in other words whether blockchain could constitute a form of Digital Rights Management 2.0.

66. Digital Rights Management (DRM) refers to measures aimed at monitoring the use of copyrighted material by deploying technological means that combine technological protection measures (TPMs) and Rights Management Information (RMI). DRM entails e.g. encoding certain software into the protected file that prevents the user from performing certain acts, such as copying or sharing the file on peer-to-peer networks or simply accessing the protected content. DRM came to the foreground in the early onset of the battle against piracy in the digital age. At a later stage, anti-DRM circumvention laws were set at the international[182] and European level[183] and implemented in the national legislation of EU Member States.[184] However, DRM has sometimes been criticised for restricting consumers' access rights to creative content, even when exceptions to copyright apply (such as private use or exemption for scientific purposes)[185], and for stifling competition and innovation.[186]

67. Blockchain and DRM are not the same. Indeed, blockchain technology cannot really provide any help in preventing copyrighted work from being copied.[187] As computer security expert Bruce Schneier said over 15 years ago: "*Digital files cannot be made uncopiable, any more than water can be made not wet.*"[188] Blockchain technology *can,* however, aid in recording certain specific information in relation to use of a copyrighted work in a secure and transparent way.

This is how the idea of using blockchain in a sort of DRM 2.0 came into existence. It entails using a combination of more traditional DRM measures and the idea of recording information pertaining to a digital file on a blockchain, not only in relation to the copyright but also in relation to the user's right. Blockchain could thereby be used in combination with the technique of watermarking a digital file. The uniquely identifying watermark, containing information regarding copyright ownership, could be registered on a blockchain, allowing for e.g. the identification of unauthorised copies and distribution sources. In such a way, the focus of DRM 2.0 is clearly more on the RMI aspects, than on TPM aspects, for which some authors do not foresee a widespread use.[189]

Yet, there remain thorny challenges such as in the case of derivative works, where only parts of a work are reused. How will blockchain technology determine whether such reutilisation concerns a substantial part of the work or, even more difficult, parts that make out the originality of a work? Only in these latter cases, the exclusive rights are at stake and a situation of infringement will occur. While technology might be able to make a quantitative assessment, also qualitative aspects matter very much.

68. DRM 2.0 may also provide a way to overcome another problem set by DRM 1.0, namely the need to enforce user access rights in case exceptions to copyright apply. By way of example, in April 2018, the multinational Sony filed a US patent[190] relating to blockchain-based DRM that would keep track of a person's user rights, allowing for use of the copyrighted work in accordance with all applicable copyright rules (and exceptions).[191]

69. However, blockchain as DRM 2.0 is still in its infancy and raises questions. How to deal with conflicting claims on the same work? While being an excellent technology to store meaningful copyright data, blockchain cannot check their accuracy or validity at the time of its encoding. With this in mind, Bodo *et al.* question whether certain blockchain applications will be possible without some intervention of (hu-

181 On the interface between blockchain and the legal protection of DRM, see also B. Bodó, D. Gervais, J.J. Quintais, "Blockchain and smart contracts: the missing link in copyright licensing?", *International Journal of Law and Information Technology*, eay014, September 2018, 18 ff.

182 See Articles 11-12 WIPO Copyright Treaty 1996.

183 See Articles 6 and 7 Directive 2001/29/EC of 22 May 2001 on the harmonisation of certain aspects of copyright and related rights in the information society, *OJ* L 167 of 22 June 2001.

184 See in Belgium Articles XI.291 and XI.292 BCEL.

185 See *i.a.* S. Dusollier, *The Relations between Copyright Law and Consumer's Rights from a European Perspective*, European Parliament Publication, 2010. Available at SSRN: https://ssrn.com/abstract=2127736.

186 P. Boucher, *How blockchain technology could change our lives. In-depth analysis*, European Parliamentary Research Service, STOA PE 581.948, February 2017, available at http://www.ep.europa.eu/stoa/, p. 20.

187 See however for a very ambitious whitepaper regarding the use of blockchain to detect counterfeiting and IP infringement on the Ethereum platform StopTheFakes, "White Paper: Blockchain Service. Anti-Counterfeit & Copyright Infringement", 26 September 2017, 58 p., available online at https://stopthefakes.io/.

188 See https://www.schneier.com/crypto-gram/archives/2001/0515.html#2.

189 B. Bodó, D. Gervais and J.J. Quintais, "Blockchain and smart contracts: the missing link in copyright licensing?", *International Journal of Law and Information Technology*, eay014, September 2018, 18.

190 US Patent Application 20180115416, available through http://appft.uspto.gov/. Other pertinent patent applications are US Patent Application 20180262341 and 20180262493, both also relating to the use of blockchain technology for DRM purposes.

191 See in more detail https://unblockedevents.com/2018/05/09/drm-in-the-blockchain-era/. See for two interesting academic papers on this subject Z. Ma, M. Jiang, H. Gao and Z. Wang, "Blockchain for digital rights management", *Future Generation Computer Systems* 2018, 746-764 and J. Rinaldi, "Peer to peer digital rights management using blockchain", 2018, 66 p., available online at https://scholarlycommons.pacific.edu/cgi/viewcontent.cgi?article=4135&context=uop_etds.

man) third parties, e.g. to provide dispute settlement instruments to handle conflicting claims.[192]

More in general as long as a comprehensive database collecting copyright data information does not exist[193], inefficiencies, inaccuracies and ensuing legal risks will remain, independently of whether technological innovation will lead to a successful 'marriage' of blockchain technology and DRM.[194]

– *Interim conclusion*

70. As of yet, only a very small number of established multinationals have openly embraced the opportunities that blockchain has to offer. It further appears that the larger part of IP-related blockchain start-ups is only known to a select club of blockchain aficionados who, like the authors of this paper, conducted internet searches specifically aimed at finding out about their existence.[195] The quality of the services offered by more 'traditional' digital platforms, such as *Spotify* and *iTunes*, might keep consumers away from 'futuristic' blockchain-related platforms for the time being. These consumers might be more enticed to do this if more artists got on board in what appears to be a chicken-and-egg dilemma in the making.[196] The key question is whether (and how[197]) copyright-related blockchain platforms will gather the momentum that is necessary to elicit a mass move in favour of blockchain in the copyright industry.[198] Until then, the promise of transparent, efficient and fair exploitation of copyright for artists with the (sole) aid of the blockchain risks to remain empty.

III. Blockchain and other IP rights: a first glimpse

71. Copyright is not the only intellectual property right that is said to face a possible revolution by the hands of blockchain. In the following paragraphs, we will highlight by way of example a few possible applications of blockchain technology in relation to other intellectual property rights.[199]

72. Regarding *industrial property rights* depending upon registration formalities in general, DLT technology offers ample opportunities for IP offices to create 'smart IP registries' that will keep track of and record various events in the life of a particular registered IP right.[200] Outside the realm of IP rights, a similar observation can be made for domain name registries.

73. As regards *trademark law*, blockchain technology might serve as a way to increase efficiency and transparency in trademark registration, prosecution and/or maintenance (the latter by offering a secure tool to provide proof of genuine use).[201] DTL can also improve the transparency of supply chains, which would make it easier for consumers to verify the (commercial) origin of branded products and/or services. Furthermore, blockchain-based solutions that allow for immediate authentication and traceability of products may aid trademark owners in the detection and countering of counterfeits.[202] In a similar vein and as noted by CLARK, "the ability to track goods on an immutable blockchain could help brand owners enforce their contractual arrangements regarding distribution and spot leaks in their distribution system as well as helping to identify parallel imports or grey market activity". [203]

74. Blockchain could play a similar role in *patent law*, with the implicit (although possibly utopian) promise of a fully transparent global patent registry.[204] An ambitious patent-related blockchain start-up is *Kyna*, which has built a blockchain patent exchange on the Ethereum blockchain aimed at establishing automated transactions of patents between buyers and sellers and recording these transactions on a blockchain.[205]

192 *Ibid.*, at 18-19.
193 See above paragraph 64.
194 Examples given by B. ROSENBLATT, "Watermarking Technology and Blockchains in the Music Industry", 3, available at www.digimarc.com.
195 See in a similar vein regarding blockchain technology in general: E. COMBIER, "Viva Technology: la blockchain reste encore cantonnée à quelques secteurs", *Les Echos* 19 June 2017, available through ProQuest Central.
196 Cf. M. LONEY, "How blockchain will change intellectual property – copyright", *Managing Intellectual Property* 2018 (13 March 2018).
197 In this regard, inspiration may be taken from larger (online) platforms in similar sectors, such as *Wikipedia* (https://www.wikipedia.org/) or *Creative Commons* (https://creativecommons.org/).
198 Cf. M. O'DAIR *et al.*, "Music on the Blockchain", Blockchain for Creative Industries Research Cluster. Middlesex University, 2016, 19-20.
199 See also H. SHERATON and B. CLARK, "Blockchain and IP: Crystal Ball-gazing or Real Opportunity?" *Practical Law Magazine*, 28 September 2017, 39.
200 See e.g. B. CLARK, "Blockchain and IP Law: A Match made in Crypto Heaven?", *WIPO Magazine* 2018, n° 1, http://www.wipo.int/wipo_magazine/en/2018/01/article_0005.html.
201 See e.g. M. LONEY, "How blockchain will change intellectual property – trade marks and brands", *Managing Intellectual Property* 2018 (27 February 2018).
202 Communication from the Commission to the European Parliament, the Council and the European Economic and Social Committee, "A balanced IP enforcement system responding to today's societal challenges", COM(2017) 707 final, 29 November 2017, 10. See also more recently Draft Council Conclusions of the Council of 24 September 2018 on the EU Customs Action Plan to Combat IPR Infringements for the Years 2018 to 2022 (12002/1/18 REV 1), referring to blockchain technology on p. 15 as a new technique that may be employed in combatting IP infringements. See for an example in practice https://diamonds.everledger.io/, a blockchain-based platform for the diamond and jewellery industry allowing for a clear demonstration of the provenance of certain gems. See in this regard e.g. Y. POULLET and H. JACQUEMIN, "Blockchain: une revolution pour le droit?", *JT* 2018, 805.
203 B. CLARK, "Blockchain and IP Law: A Match made in Crypto Heaven?", *WIPO Magazine* 2018, n° 1. See also K.TOYODA et al. "A Novel Blockchain-Based Product Ownership Management System (POMS) for Anti-Counterfeits in The Post Supply Chain", June 2017, available on research gate.
204 See e.g. M. LONEY, "How blockchain will change intellectual property – patents", *Managing Intellectual Property* 2018 (6 March 2018).
205 See in more detail https://www.f6s.com/kyna.

75. Because blockchain is a software-based technology, its applications may constitute patentable subject matter according to the established case law of the Technical Boards of Appeal (TBA) of the EPO on computer-implemented inventions[206]. On the condition that the blockchain-related invention is a novel technical solution to a technical problem[207], a patent may be granted.

Even though most blockchain applications such as *Bitcoin*, *Ethereum* and *Hyperledger* are open source, a proliferation of patent application for blockchain-related inventions has been noted across the globe. Let us hope that this will not give rise to another 'litigation war'[208] and the emergence of patent trolls that a race to patents often entails.[209]

Conclusion

To conclude, we believe that the answer to the question in the title of this article – *Beyond the buzzword?* – is a positive and cautiously optimistic one. Blockchain technology may have an impact on everyone's life that is comparable to the impact of the internet today.[210] This can be illustrated and substantiated with yet another buzzword, 'The Internet of Things', the reality of which can hardly be disputed today. Many of its applications use blockchain technology.[211] The potential of blockchain technology is huge and we see no reason why it could not be deployed to overcome specific – certainly not all – problems in the domain of copyright and other IP rights in the future.

All exaggerations accompanying buzzwords should, however, be avoided. While the use of blockchain technology for the purpose of proving copyright ownership and aiding fair and transparent exploitation and management of copyright holds many promises in theory, there is still a lot of work in realising its possibilities in practice.

Finally, sceptics should realise that innovation in the blockchain sector is very quick paced. We would in any case be delighted if some practical concerns highlighted in this paper were to be overcome by future technological evolutions.

206 See EPO, *Guidelines For Examination*, Part G, Chapter II (G.II), available on the website of the EPO.

207 This will not always be the case (e.g. a smart reservation service through payment will probably be denied protection as being a mere business model)

208 See S. O'Neil, "Is Blockchain About to Become a Patent War Battleground?", Cointelegraph, 25 July 2018, https://cointelegraph.com/news/is-blockchain-about-to-become-a-patent-war-battleground. This author notes that according to Fortune's sources, the overall number of blockchain-related patents and applications for the next year is expected to be around 1,245. See also Y. Poullet and H. Jacquemin, "Blockchain: une revolution pour le droit?", *JT* 2018, 807.

209 In this regard, we refer to the recent establishment of the Blockchain Intellectual Property Council (BIPC), which was set up by the Chamber of Digital Commerce in order to pre-empt and combat blockchain patent trolling. See more information at e.g. https://digitalchamber.org/initiatives/blockchain-intellectual-property-council/ and http://www.ipwatchdog.com/tag/blockchain-intellectual-property-council/.

210 Cf. the words of Marc Andreessen in The Washington Post in 2014: "In 20 years, we'll talk about Bitcoin like we talk about the Internet today" (article of B. Fung of 21 May 2014).

211 IDC, "IDC Futurescape: Worldwide Internet of Things 2017 Prediction", November 2016, https://www.idc.com/getdoc.jsp?containerId=US40755816. See Prediction 4: "By 2019, as IoT Adoption Grows in Major Industry, Government, and Consumer Sectors, 20% of All IoT Deployments Will Have Basic Levels of Blockchain Services Enabled".