THE APPLICATION AND CHALLENGES OF BLOCKCHAIN IN INTELLECTUAL PROPERTY DRIVEN BUSINESSES IN CHINA

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Abstract

"Blockchain" is the buzzword of the year, if not the decade. Aside from the role Blockchain plays in cryptocurrency transactions, Blockchain technology has the potential for significant real-world applications. Disruptive Blockchain technology can be applied to intellectual property-driven businesses – fighting piracy, securing supply-chains, and tracking and tracing provenance for example. However, the use of Blockchain in intellectual property driven businesses also raises some questions. For example, how can users be sure the information on Blockchain is completely reliable? How will providers and users cope with possible cross-jurisdictional legal issues? Can the integrity of Blockchain based data be guaranteed and how will providers and users handle data protection? Equally, regulatory issues will continue to be of major concern to the implementation of Blockchain. Discussions over these legal issues will, for now, remain to some extent embryonic. However, China is now at the forefront of releasing Blockchain Potential in Intellectual Property, and some initiatives already undertaken in China and elsewhere could potentially set new standards, norms, and legal principles.

I.   INTRODUCTION

Blockchain has received a fair amount of public attention as the underlying technology for cryptocurrencies such as Bitcoin. However, even more intriguing from a legal perspective are the myriad ways Blockchain technology can be applied to the real world. This is particularly the case for intellectual property-driven businesses and applications. Blockchain technology is setting new technical standards and concomitant legal norms in respect of intellectual property-driven businesses. This development requires some legal analysis.

In simple terms, Blockchain transactions and data are grouped into blocks, which are linked into chains in the digital space. Digital ledgers, as it were, are created and distributed throughout the Internet on a global basis (hence the term "distributed ledger technology (DLT)". Each one of these blocks contains a "header" which

includes a unique digital fingerprint (a hash)[1]. The header neatly organises and timestamps the data in that block. But the key feature is that the data in these blocks is "immutable": it cannot be modified or deleted.[2] It is this security feature which makes Blockchain so attractive in today's digital world. For example, online track-and-trace applications for trademarked products, authentication and provenance technologies, privacy and individual data protection, copyright registries, music licensing platforms and smart IP contracts are all possible outflows from Blockchain development.

The following six fundamental functions of Blockchain can be used for intellectual property purposes in the real world:

> 1) The ability to track-and-trace the origin, provenance and data of authentic products
> 2) The authentication, proof and registration of copyright
> 3) The ability to track-and-trace licence royalties for digitally-stored products such as music and films
> 4) Evidentiary proof of fake copies of artistic works such as photos
> 5) The protection of private data and trade secrets
> 6) The automatic execution of "smart" intellectual property-based contracts.

The implications are clear: disruptive Blockchain technology can be applied to intellectual property-driven businesses – fighting piracy, securing supply-chains, and tracking and tracing provenance – through intrinsic guarantees on immutability of data, distributed systemic trust, and automatic and verifiable smart contract execution.

This article will seek to explore existing uses of Blockchain and the potential for further Blockchain technology applications, as well as possible challenges facing its adoption in the intellectual property space.

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[1] A hash is used in computer science to turn any length of data into a unique numeric fingerprint. Changing the data changes the fingerprint, so if you are given data and fingerprint, you can verify that one matches the other.

[2] "A majority of users must agree to the validity of one block by adding other blocks to the specific "chain" of blocks, and since future blocks are dependent on previous blocks, it is impossible to alter or delete a block." See *Blockchain Technology Primer, version 1.0*, IAB TECH LAB (July 24, 2018), at 6, *available at* https://iabtechlab.com/wp-content/uploads/2018/07/Blockchain-Technology-Primer.pdf.

A degree of scepticism has been expressed in the tech and commercial worlds over the past two years about whether Blockchain has any practical and solid application to commerce. At the other end of the spectrum, converts are advocating Blockchain as the best software innovation since sliced bread. The hallowed middle ground is awaiting the real-world application of Blockchain with cautious optimism. Meanwhile, some actual Blockchain-based intellectual property solutions have already begun to emerge. In what follows, we will review and analyse some of the ways that Blockchain is now being used in commerce, together with both the intended and unintended norm-setting legal consequences.

II. BLOCKCHAIN APPLICATIONS AND INTELLECTUAL PROPERTY

A. *Blockchain and Trademarks*

1. Track-and-Trace and Anti-Counterfeit

Blockchain technology is now being used for track-and-trace and anti-counterfeit purposes on the trademarked goods.

For example, recently, customers in China have been able to buy Blockchain chickens.[3] Chinese insurance company ZhongAn has used Inchain[4] and IoT[5] to enable consumers to track the chickens they purchase, giving them peace of mind that the chickens are truly free-range and authentic[6]. "Gogochicken", as the product is called, allows consumers to examine the chicken's age and rearing location, how far it walked each day, the degree of air pollution in its environment, the quality of the water it drank, when it was quarantined, when slaughtered, and other details. All of this is recorded in a secure digital ledger based on Blockchain[7]. As the company boasts in its advertisement, the tech is intended "to bring

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[3] Liu Jiefei, *China is Breeding Chickens on the Blockchain to Improve Food Safety*, TECHNODE (June 1, 2018), https://technode.com/2018/06/01/china-blockchain-chickens/.

[4] Inchain is a public chain project positioning the underlying platform of the Blockchain and the first professional commercial Blockchain application eco-platform. INCHAIN, https://www.inchain.org/i-ndex_en.html (last visited Nov. 26, 2018).

[5] The Internet of Things, or IoT, is the system of interrelated computing devices, mechanical and digital machines, objects, animals or people that are provided with unique identifiers (UIDs) and the ability to transfer data over a network without requiring human-to-human or human-to-computer interaction.

[6] *See* Liu, *supra* note 3.

[7] *Id*.

you and your family *visible assurance"*[8]. French supermarket chain Carrefour SA[9] has successfully employed Blockchain technology to record the provenance of their chickens, and similar supply-chain data systems are being explored by Alibaba and JD, two China-based e-commerce giants.

Last year, Alibaba Australia launched a Blockchain-based initiative called Food Trust Framework to improve cross-border food supply chain traceability[10]. Alibaba joined forces with Australia Post, Blackmores Limited and PwC in 2017 to explore the use of Blockchain technology to address supply-chain fraud in the food industry.[11] The system, which is being piloted in Australia and New Zealand, aims to ship food, especially dairy products, from Australia and New Zealand to China via Alibaba's Tmall Global platform. The system enables online shoppers on Taobao and Tmall to verify the authenticity of food products and avoid potentially dangerous counterfeits.[12] In 2018, Tang Ren, Cainiao's senior technical expert for international logistics, promised: "With logistics data being uploaded from all parties, such as retailers and customs officials, buyers can cross-reference every detail of their purchases. Any attempts to conduct data fraud or add in counterfeit products will be as difficult as landing on Mars."[13]

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[8] GOGOCHICKEN, https://www.ibubuji.com/ (last visited Nov. 26, 2018).

[9] Luzi-Ann Javier, *Yes These Chickens Are on the Blockchain*, BLOOMBERG BUSINESSWEEK (Apr. 9, 2018), https://www.bloomberg.com/news/features/2018-04-09/yes-these-chickens-are-on-the-blockchain.

[10] Joachim Bartels, *Alibaba Turns to Blockchain in Fight Against Food Fraud*, BUS. INFO. INDUSTRY ASS'N, https://www.biia.com/alibaba-turns-to-blockchain-in-fight-against-food-fraud-2/ (last visited Nov. 26, 2018).

[11] *PwC Explores Blockchain Solutions with Alibaba and Food Industry Stakeholders to Help Address Supply Chain Fraud and Build Trust in the Food Industry*, PRICEWATERHOUSECOOPERS CHINA (Mar. 24, 2017), https://www.pwccn.com/en/press-room/press-releases/pr-240317.html.

[12] In early 2018, Tmall also announced its partnership with Cainiao, the logistics arm of Alibaba, to record detailed information on imported products. Over 30,000 imported goods from more than 50 countries can now be tracked on the Blockchain-based platform. *See* Connie Wang, *Alibaba's Logistics Affiliate Uses Blockchain to Detect Fraud in the Supply Chain of Imported Goods*, 8BTC (Feb. 28, 2018), https://news.8btc.com/alibabas-logistics-affiliate-uses-blockchain-to-detect-fraud-in-the-supply-chain-of-imported-goods.

[13] Liang Chenyu, *Tmall and Cainiao Form Blockchain Alliance*, SIXTH TONE (Feb. 28, 2018), http://www.sixthtone.com/news/1001827/tmall-and-cainiao-form-blockchain-alliance. Alibaba is currently also pursuing its "BASIC" (Blockchain, AI, Security, IoT, Computing) strategy and striving to make the most of new Big Tech in their business operations.

Chinese online retail giant JD has also taken the plunge, becoming the first Chinese business to join the Blockchain in Transport Alliance in the battle against counterfeits.[14] JD launched a Blockchain Open Platform in 2017, and has established a Blockchain Food Safety Alliance with Walmart, IBM and the National Engineering Lab for E-commerce Technology of Tsinghua University. [15] The intention is to pioneer the use of Blockchain to enhance food safety through cooperation with Chinese food suppliers, retailers and food safety supervision organizations. [16]A few examples have also emerged in the wine industry, with famous Chinese wine groups such as Maotai, Wuliangye and Yianghe cooperating with JD, IBM and Alibaba's Ant Financial to use Blockchain against the rampant fake wine trade in China[17].

Elsewhere, BlockVerify[18] is using Blockchain to authenticate and track the origin of pharmaceuticals[19]. Products are labelled with a unique tag which can be tracked on the Blockchain, allowing products to be monitored as they travel along the supply chain. This facilitates the identification of counterfeit goods, fraudulent transactions and stolen merchandise, making it easier for consumers and retailers to examine a secure history for a given product. Walmart is also using Blockchain in its supply chain to track products back to their roots – quite literally[20]. Since September 2018,[21] Walmart's Sam's Club division have required suppliers of

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[14] Daniel Palmer, *Chinese Retail Giant JD.com Joins Blockchain in Transport Alliance*, COINDESK (Feb. 2, 2018), https://www.coindesk.com/chinese-retail-giant-jd-com-joins-blockchain-in-transport-alliance.

[15] Roger Aitken, *IBM&Walmart Launching Blockchain Food Safety Alliance in China with Fortune 500's JD.com*, FORBES (Dec. 14, 2017), https://www.forbes.com/sites/rogeraitken/2017/12/14/ibm-walmart-launching-blockchain-food-safety-alliance-in-china-with-fortune-500s-jd-com/#55bb3f2c7d9c.

[16] *Id.*

[17] Li Bing (李冰), *Ali Jingdong Yu Jiuqi Cachu Huohua Qukuailian Jishu Dajia Shuaixian Shangzhen* (阿里京东与酒企擦出火花，区块链技术打假率先上阵) [*Alibaba and JD Cooperate with Wine Giants to Fight Counterfeits through Blockchain*] , ZHENGQUAN RI BAO (证券日报) [SECURITIES DAILY], Apr. 2, 2018, at B2, http://capital.people.com.cn/n1/2018/0402/c417685-29901777.html.

[18] BLOCKVERIFY, http://www.blockverify.io/.

[19] Arijit Chakrabarti, *Blockchain and its Scope in Retail*, 4 INT'L RES. J. OF ENGINEERING AND TECH. 3053 (2017).

[20] Kim S. Nash, *Walmart-Led Blockchain Effort Seeks Farm-to-Grocery-Aisle View of Food Supply Chain*, THE WALL STREET J. (June 25, 2018), https://blogs.wsj.com/cio/2018/06/25/walmart-led-blockchain-effort-seeks-farm-to-grocery-aisle-view-of-food-supply-chain/.

[21] Olga Kharif, *Walmart, Sam's Club Start Mandating Suppliers Use IBM Blockchain*, BLOOMBERG (Sept. 30, 2018), https://www.bloomberg.com/news/articles/2018-09-24/walmart-sam-s-club-start-mandating-suppliers-use-ibm-blockchain.

fresh, leafy greens to use IBM Blockchain to implement real-time, end-to-end traceability of their products back to the farm.[22]

In the pharmaceutical industry, Mediledger has launched a pilot project to use Ethereum[23] to record and verify drugs on Blockchain. Companies such as Genentech, Pfizer, McKesson, Abbvie and AmensourceBergen are involved in the implementation of this pilot project[24]. The beneficial applications of Blockchain were also debated during the Chinese vaccine scandal in July 2018, an episode that elicited widespread concern both in China and abroad[25]. Li Xiaolai, one of China's best-known cryptocurrency investors, published an article on his own WeChat public account arguing for a Blockchain-based ledger for pharmaceutical tracking[26]. He pointed out that "Openness and Transparency"[27] are the most important issues in public affairs. He proposed that a currency-free Blockchain could provide open and transparent records of all the information during transit.[28]

Blockchain's security features can also be applied to the luxury goods industry. In Britain, for example, De Beers' "Tracr" platform uses Blockchain technology to track the movement of diamonds from the time they are mined to the moment they reach customers.[29] This secure digital record enables customers and retailers to ensure the diamonds they are dealing in are genuine and conflict-free.[30]

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[22] *Id.*

[23] Ethereum is an open-source, public, Blockchain-based distributed computing platform and operating systemfeaturing smart contract (scripting) functionality. *See Etherem*, WIKIPEDIA, https://en.wikipedia.org/wiki/Ethereum (last updated Nov. 26, 2018).

[24] Nicky Morris, *Mediledger: Pharmaceutical Industry's Blockchain Network*, LEDGER INSIGHTS, https://www.ledgerinsights.com/mediledger-pharmaceutical-blockchain/ (last visited Dec. 2, 2018).

[25] Moshang Meiguo (陌上美国), *Quanqiu Meiti Ruhe Baodao Cici Zhongguo De Yimiao Chouwen Weiji* (全球媒体如何报道此次中国的疫苗丑闻危机) [*How Global Media Report China's Drug Scandal*], SINA NEWS (July 23, 2018), https://news.sina.cn/global/szzx/2018-07-24/detail-ihftenhz5800567.d.html?vt=4.

[26] Meigang Dianxun (美港电讯), *Fazhan Wubi Qukuailian Esha Weilai Duyimiao* (发展无币区块链，扼杀未来"毒疫苗") [*Develop Currency-free Blockchain to Snuff Out Tainted Vaccine*], ZHIHU (July 25, 2018), https://zhuanlan.zhihu.com/p/40513274; Andrew Ancheta, *Blockchain Could Prevent Next China Vaccine Scandal*, CRYPTO BRIEFING (July 28, 2018), https://cryptobriefing.com/blockchain-china-vaccine-scandal/.

[27] *Id.*

[28] *Id.*

[29] Barbara Lewis, *De Beers Turns to Blockchain to Guarantee Diamond Purity*, REUTERS (Jan. 17, 2018), https://www.reuters.com/article/us-anglo-debeers-blockchain/de-beers-turns-to-blockchain-to-guarantee-diamond-purity-idUSKBN1F51HV.

[30] *Id.*

Similarly, the London-based start-up Everledger [31] is using Blockchain technology to record details of the origin of coloured gemstones for identification and authentication purposes.[32]

Some observers have asked why companies do not secure their supply chain as they have always done, with a traditional database. The answer is that Blockchain allows for third-party verification and is therefore more trustworthy.

However, counterfeiting and piracy is an insidious and complex problem and Blockchain technology should not be regarded as a silver bullet solution. No one tool can address all the issues relating to fake goods; as experience has shown, counterfeiting and piracy require a holistic solution. Nonetheless, the introduction of Blockchain technology means consumers and retailers can trace a product's entire supply chain life cycle, thereby improving market transparency. This – according to Blockchain experts – is an elegant and cost-effective solution that makes information more reliable, products more trustworthy and businesses more stable.

2. Potential Blockchain Applications for Trademark Protection

The Hangzhou Internet Court has already accepted Blockchain evidence in a copyright litigation.[33] Even though there has been no trademark case involving Blockchain evidence, Blockchain technology could potentially apply in this area.

Since the timestamp is as immutable as the data, Blockchain can verify an assertion at a given time. For trademarked products, accurately recording information about a product's history can be of value, particularly by using the time of record entry for evidence of first use and adoption of a trademark. For example, when two or more applicants apply to register an identical or similar trademark for the same goods on the same day, Blockchain can help prove who is

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[31] EVERLEDGER, https://www.everledger.io/ (last visited Nov. 26, 2018).

[32] *First Blockchain for Coloured Gemstones*, GUBELIN NEWS (Jan. 9, 2018), http://www.gubelin.com/en/gemmology/news/blockchain-for-coloured-gemstones.

[33] Wu Shuaishuai (吴帅帅), *Hangzhou Hulianwang Fayuan Shouci Queren Qukuailian Cunzheng Falv Xiaoli* (杭州互联网法院首次确认区块链存证法律效力) [*Blockchain Evidence for Its First Time Admitted by Hangzhou Internet Court*], XINHUA NET (June 28, 2018), http://www.xinhuanet.com/local/2018-06/28/c_1123051280.htm.

"first in time and first in right" (article 31of PRC Trademark Law)[34]. Also, Blockchain evidence might possibly assist by strengthening an argument to oppose or invalidate a third party's trademark (article 32)[35] if the third party has infringed upon an existing prior right. Evidence of use recorded on Blockchain may also be helpful to prove "prior use" (article 59 paragraph 3)[36] in a variety of trademark conflicts and could possibly assist in "famous and well-known mark" proceedings (article 14)[37]. In these instances, Blockchain could potentially be used to simplify and verify the available evidence, in turn helping trademark examiners and judges.

In the United States, some private registries, such as the online platform Cognate[38], are using Blockchain to support trade mark rights in different ways, including trademark recordal Cognate provides a Cognate chain-mark Certificate,[39] (called CognateCM).

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[34] The article provides "*where two or more applicants apply to register identical or similar trademarks for use on the same kind of goods or similar goods, the trademark office shall first conduct examination of, give approval to and announce the trademark whose registration is applied for earlier than the rest. Where the applications are filed on the same day, the trademark office shall first examine, give approval to and announce the trademark which is used earlier than the rest, and it shall reject the applications for registration of the other trademarks and shall not announce them*". *See* Shangbiao Fa (商标法) [Trademark Law] (promulgated by the Standing Comm. Nat'l People's Cong., Aug. 23, 1982, effective Mar. 1, 1983) (2013) art. 31 (Chinalawinfo).

[35] The article provides "*no applicant for trade mark application may infringe upon another person's existing prior rights, nor may he, by illegitimate means, rush to register a trade mark that is already in use by another person and has certain influence*". *See* Shangbiao Fa (商标法) [Trademark Law] (promulgated by the Standing Comm. Nat'l People's Cong., Aug. 23, 1982, effective Mar. 1, 1983) (2013) art. 32 (Chinalawinfo).

[36] The article provides "*where, before a trademark registrant applies for registration of a trademark, another party has used a trademark that is of certain influence and is identical with or similar to the registered trademark on the same kind of goods or similar goods, the holder of the exclusive right to use the registered shall have no right to prohibit the said party from continued use of the trademark within the original scope of use, however, the holder may require the latter to add a proper mark for distinguishment*". *See* Shangbiao Fa (商标法) [Trademark Law] (promulgated by the Standing Comm. Nat'l People's Cong., Aug. 23, 1982, effective Mar. 1,1983) (2013) art. 59 (Chinalawinfo).

[37] The article provides "*A well-known trademark shall, upon the request of the party concerned, be determined as one fact to be cognized in dealing with trademark related matters. The following factors shall be considered in determining a well-known trademark: (1) reputation of the trademark in the relevant sector of the public; (2) duration of use of the trademark;(3) duration, degree, and geographical scope of any publicity for the trademark;(4) history of protection of the trademark as a well-known trademark; and (5) other factors contributing to the reputation of the trademark.*" *See* Shangbiao Fa (商标法) [Trademark Law] (promulgated by the Standing Comm. Nat'l People's Cong., Aug. 23, 1982, effective Mar. 1, 1983) (2013) art. 14 (Chinalawinfo).

[38] COGNATE, https://cognate.com/ (last visited Nov. 26, 2018).

[39] This fast and inexpensive registration takes one day and costs about $40. *See* Monica Bay, *Startup Snapshot: Cognate*, STAN. L. SCH., https://law.stanford.edu/2017/02/07/startup-snapshot-cognate/ (last visited Nov. 26, 2018); *See also* Luciano Monteleone, *How Blockchain Will Alter*

Whether the courts will accept the position that these Blockchain-recorded trademarks offer the same weight of proof as officially registered trademarks is another question.[40] The European Union Intellectual Property Office has also taken an interest in Blockchain. The co-chair of the Blockchain Intellectual Property Council,[41] Mark Kaufman, has intimated that "the EUIPO is looking very seriously and actively at using Blockchain to record and enforce IP Rights".[42]

B.   *Blockchain and Copyright*

Even though copyright usually vests automatically with the owner upon creation, copyright owners are advised to use notarial evidence or official registration certificates to establish the crucial proof of "first in time, first in right". A common misunderstanding exists among writers and other creatives that posting a copy of their *magnum opus* – "the poor man's copyright" – will protect their ownership and save on registration costs. In a digital world this approach is even less reliable.

Moreover, writers who use an online pseudonym may well have difficulties proving authorship in future, with the accompanying risk that their work is considered to be an orphan work. Orphan works present significant difficulties, not just for their authors, but for any third parties who might be interested in buying those works. Since a time-stamped fingerprint on a Blockchain provides evidence of existence at a given time, this is where Blockchain potentially comes into play via official or private copyright registries. Time will tell whether private registry certificates will be accepted by the courts.

Trademarks' Registration and Enforcement, MEDIA LAWS (Mar. 8, 2018), http://www.medialaws.eu/how-blockchain-will-alter-trademarks-registration-and-enforcement/.

[40] *Id.*

[41] An initiative of the Chamber of Digital Commerce to promote Blockchain innovation and help companies better navigate intellectual property decision-making processes. *See Blockchain Intellectual Property Council*, CHAMBER OF DIGTAL COMMERCE, https://digitalchamber.org/ initiatives/blockchain-intellectual-property-council/ (last visited Nov. 26, 2018).

[42] Luciano Monteleone, *How Blockchain Will Alter Trademarks' Registration and Enforcement*, MEDIA LAWS (Mar. 8, 2018), http://www.medialaws.eu/how-blockchain-will-alter-trademarks-registration-and-enforcement/. The Blockathon event sponsored by the EUIPO and held in Brussels earlier this year was aimed at fighting fake products and creating the next level of anti-counterfeiting infrastructure, *see* EUROPEAN INTELL. PROP. OBSERVATORY, https://euipo.europa.eu/ohimportal/web/o-bservatory/blockathon (last visited Nov. 26, 2018).

Official government registries in the areas of tax and land registrations are also taking a serious look at Blockchain technology. Blockchain is being used to maintain registries of vehicle-ownership rights: the Danish Customs and Tax Administration, for example, is exploring the use of Blockchain to facilitate the registration and transfer of ownership of vehicles.[43] When vehicles are sold, sellers must currently trust buyers to notify authorities about the change in ownership. Unscrupulous buyers who fail to re-register their vehicles expose sellers to liability for parking fines and speeding tickets, while avoiding paying tax. Blockchain provides a mechanism for the sellers' transfer of ownership to be conducted securely and automatically, while allowing buyers to ascertain the authenticity of a vehicle and examine its history.

It is easy to imagine an analogous system being applied in the context of copyright: a Blockchain-powered copyright registry could record copyright transfers, reducing transaction costs and facilitatating licensing. Three years ago, Toronto-based band 22HERTZ used Blockchain to record the copyright[44] in their music, stating that Blockchain was "more powerful than having a certificate with a title on it"[45] and enabled them "to save a lot of money and have absolute proof that your material existed at that time"[46], which is "much more concrete and substantial than the traditional way"[47]. Another commentator has proposed the use of Blockchain to record a "diligent search" (a requirement for permitted use of an orphan

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[43] *Blockchain Technology Could Add Transparency to Buying and Selling a Car*, NETS.EU (Sept. 22, 2017), https://www.nets.eu/perspectives/Pages/Blockchain-technology-could-add-transparency-to-buying-and-selling-a-car.aspx.

[44] Thom Isaacs, *22hertz is the First Band to Copyright Music on the Blockchain*, COINBUZZ (June 11, 2015), http://www.coinbuzz.com/2015/06/11/ 22hertz-are-the-first-band-to-copyright-music-on-the-blockchain/.

[45] *Id.*

[46] *Id.*

[47] *Id.*

work) [48] to overcome problems posed by the diligent search requirement. [49]

Blockchain is also able to identify fake artwork, including photos, by providing evidentiary proof of infringement. In April of 2018, the Chinese search engine giant Baidu launched "Totem" [50], a Blockchain-based stock photo service. [51] Totem allows copyright holders to upload photographs and uses Blockchain to timestamp each submitted work with the user's identity and other data. [52] With the help of artificial intelligence and big data, Totem then automatically compares images which are displayed on the Internet. [53] Once a possible infringement surfaces, the Totem system automatically preserves the infringing work and rapidly uploads it onto its Blockchain. [54] The subsequent data comparison allows copyright holders to detect potential infringements and substantiate claims of verified ownership more easily.

In addition, Weibo, China's leading social media platform, has announced that they have joined the Digital Copyright Identifier, a Blockchain-supported system created by the Copyright Protection Centre of China, [55] to better protect users' copyright on its platform. [56]

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[48] *See* Article 3 of Directive 2012/28/EU (Orphan Works Directive). To establish the orphan status of a work or use an orphan work, a prior "diligent search" for the work must be carried out, which includes consulting the appropriate sources such as legal deposits, library catalogues and authority files, online databases and catalogues, etc. In practice, the 'diligent search' requirement is cumbersome because it is required that "records of the diligent searches" should be provided to relevant authorities.

[49] Balázs Bodó et al., *Blockchain and smart contracts: the missing link in copyright licensing?* OXFORD ACAD. INT'L J. L. INFO. TECH., available at https://academic.oup.com/ijlit/article/26/4/311/5106727 (last visited Nov. 26, 2018).

[50] PIC-CHAIN, http://c-chain.baidu.com/eco/index?f=bdback#/ (last visited Nov. 26, 2018).

[51] Wolfie Zhao, *Search Giant Baidu Unveils Blockchain Photo Platform*, COINDESK, https://www.coindesk.com/ search-giant-baidu-unveils-blockchain-stock-photo-platform/ (last visited Nov. 26, 2018).

[52] *Id.*

[53] Ma Wenyue (马文玥), *Baidu Tuteng Zhengshi Shangxian: Yong Qukuailian Jishu Jiejue Tupian Banquan Tongdian* (百度图腾正式上线：用区块链技术解决图片版权痛点) [*Totem's Debut: Use Blockchian Technology to Protect Pictures' Copyright*], SOHU.COM (July 18, 2018), http://www.sohu.com/a/241932636_115565.

[54] *Id.*

[55] CPCC plays a significant role in the national Internet copyright public services.

[56] Li Wu (李兀), *Duihua Weibo CEO Gaofei, Weibo de Chuxian Bu Yiweizhe Meiti de Xiaoshi* (对话微博CEO王高飞：微博的出现不意味着媒体的消失) [*Weibo's CEO WANG Gaofei: The Advent of Weibo Doesn't Mean the End of Media*], SINA FINANCE (Apr. 24, 2018), http://finance.sina.com.cn/roll/2018-04-24/doc-ifzqvvsa4080087.shtml.

It is noteworthy that even though China is taking a strict approach on crypto-currencies,[57] the Chinese Government, seems to support the use of Blockchain to protect copyright. The Cyberspace Administration of China, the Office of the Central Cyberspace Affairs Commission and the Ministry of Culture of China, for example, are all promoting Blockchain applications in copyright.[58] Zhang Jiandong, director of the Digital Copyright Registration Department of CPCC, has pointed out that "Blockchain technology can record all the details of the works' creation, dissemination, transaction, etc., forming a complete chain of evidence subject to public examination and verification, which can ensure a transparent and trustworthy ownership and authorship of the copyrighted work in the market."[59]

Apart from being a potential asset in litigation, a Blockchain-powered copyright registry could record copyright transfers, reduce transaction costs and facilitate licensing. Last year, a Spanish business built Voise [60], an anonymous, decentralized, music streaming and downloading platform powered by Blockchain. The platform aims to help independent artists monetize their work in a collaborative peer-to-peer marketplace.[61] Further, in 2017, Spotify bought Blockchain start-up Mediachain to help them keep track of song owners and royalty payments to musicians and song publishers.[62] This year, a Taiwan-based start-up called Bitmark partnered with CTBC Bank and KKBOX.[63] The intention is to make royalty payments faster and more transparent by using Bitmark's

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[57] Ashton Felix, *People's Bank of China Reminds to Stay Away From ICO*, ASIA CRYPTO TODAY (Sept. 18, 2018), https://www.asiacryptotoday.com/peoples-bank-of-china-reminds-to-stay-away-from-icos/.

[58] *Qukuailian Yingyong Yanjiu Xilie (Si) Qukuailian + Banquan Lingyu* (区块链应用研究系列（四）：区块链+版权领域) [*Study on Blockchain Application Series (4): BLockchain + Copyright*], SINA FINANCE (June 6, 2018), http://finance.sina.com.cn/blockchain/coin/2018-06-06/doc- ihcqccip432 1489.shtml.

[59] *Id.*

[60] VOISE, available at https://www.voise.com/.

[61] Bitcoinist, *Revolutionizing Music Streaming with Voise, the First Music Platform on the Ethereum Blockchain*, BITCOINIST (Jan. 24, 2018), https://bitcoinist.com/revolutionizing-music-streaming-with-voise-the-first-music-platform-on-the-ethereum-blockchain/.

[62] Jonathan Vanian, *Spotify Buys Startup to Help It Track Musician Royalties*, FORTUNE (Apr. 27. 2017), http://fortune.com/2017/04/26/spotify-mediachain-blockchain-royalties/?iid=sr-link1.

[63] Asia's largest music streaming service, KKBOX controls over 80% of the market and has more than 10 million paid users.

Blockchain to record and fractionalize song rights for hundreds of high-profile Asian musicians.[64]

In the United States, the American Society for Composers, Authors and Publishers, the Society of Authors, Composers and Publishers of Music, and PRS for Music – three of the largest collecting societies in the world – have partnered with IBM to adopt a shared, decentralized database of musical works.[65] An open-source Blockchain is then used to manage links between the codes[66] used to catalogue business transactions related to musical composition and sound recording. The result is faster licensing and fewer errors during royalty matching.[67]

Smart contracts relying on Blockchain technology have also entered the copyright space. In China, for example, Blockchain-based smart contracts are already playing a role in digital copyright transactions. In January 2017, the National Copyright Administration of the People's Republic of China, the Huaxia Micro-Movie Culture Media Centre, Beihang University and other institutions jointly built a Blockchain-supported transaction platform for micro-movies and video clips. This platform enables copyright owners to encode set licence fees into smart contracts and get paid promptly when users click to watch their videos. Payment and distribution of the work is also automatically executed by the same smart contract.[68]

C. *Blockchain and Evidence*

Evidence lies at the heart of many challenges in enforcing intellectual property rights online. When a copyright work is made available online, it is often difficult for right holders to track down pirated copies, due to the sheer scale of unauthorised copies on the

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[64] Ian Allison, *Bitmark Partnered with Asia's Biggest Streaming Service KKBOX for Music Rights and Royalties*, INT'L BUS. TIMES (Jan. 11, 2018), https://www.ibtimes.co.uk/bitmark-partners-asias-biggest-streaming-service-kkbox-music-rights-royalties-1654831.

[65] *ASCAP, SACEM, PRS for Music Launch Joint Blockchain Project*, MUSICALLY (Apr. 7,2017) https://musically.com/2017/04/07/ascap-sacem-prs-music-blockchain/.

[66] ISWCs, or International Standard Work Codes, and ISRCs, International Standard Recording Codes.

[67] *Id*.

[68] Zou Ren (邹韧), *Weidianying Weishiping Zuopin Quanyi Gai Ruhe Baohu* (微电影微视频作品权益该如何保护) [*How to Protect Legitimate Rights and Interests Concerning Micro-movies and Micro-Video Clips?*], NAT'L COPYRIGHT ADMIN. PEOPLE'S REPUBLIC CHINA (Feb. 9, 2017), http://www.ncac.gov.cn/chinacopyright/contents/518/314483.html.

Internet. When trademarked goods are sold online, it is often difficult for consumers, right holders and platforms to track down where the goods have come from and to figure out whether the goods are counterfeits or pirated. The anonymity of Bad Actors on the Internet exacerbates the difficulty of tracking down the source of counterfeits or pirated goods.

China is currently at the forefront of realising Blockchain's potential in intellectual property enforcement, especially in evidence collection. In 2018, the Hangzhou Internet Court accepted Blockchain-authenticated evidence in a copyright infringement case, the first court to do so anywhere in the world.[69] In this case,the Blockchain-based evidence preservation service "Baoquan" was used to securely capture and store a snapshot of a website. The snapshot proved that the defendant in the case had unlawfully disseminated the claimant's copyright material.[70] The value of the Blockchain tool here was to enable the claimant to prove that the evidence of infringement – the snapshot of the website – was authentic and had not been tampered with. In the instant the snapshot is captured, a copy is digitally signed and "hashed" with a timestamp before being stored on the Factom Blockchain. This copy functions as a secure record that cannot be altered.[71] The tool thus allowed the court to compare the evidence presented by the claimant with the secure Blockchain record, establishing that it had not been tampered with and could be relied upon.[72] The Hangzhou Internet Court went to considerable trouble in the course of its verdict to explain the credibility and trustworthiness of Blockchain technology itself.[73]

This is not the first time that Blockchain has played a big role in the production of evidence. Last year Weizhong Bank, Guangzhou Arbitration Commission and Hangzhou Yibi Science and Technology Ltd. Co. jointly built the world's first Blockchain-

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[69] Zhang Yanlai (张延来), *Quanguo Shouli Qukuailian Cunzheng Panjue zai Hangzhou Hulianwang Fayuan Dansheng* (全国首例区块链存证判决在杭州互联网法院诞生！[附判决书]) [*China's First Judgment Recognizing Blockchain Evidence Rendered by Hangzhou Internet Court! (with part of the verdict attached)*], SINGULARITY FINANCIAL NEWS (June 29, 2018), https://www.sfgroup.hk/news_post/2575/.

[70] *Id.*

[71] *Id.*

[72] *Id.*

[73] *Id.*

supported "arbitration chain".[74] In addition, the Guangzhou Arbitration Commission issued its first ruling based on an "arbitration chain" in March 2018[75] – very likely the first to use Blockchain in this way. The ruling also confirmed that transparent and traceable real-time data, provided through Blockchain, is acceptable evidence.

Alongside Baoquan[76], there are other similar platforms in China, including Zhigui[77], Yuanben[78], Banquanjia[79], that have implemented Blockchain.

The use of Blockchain in this context is only going to grow: on 28 June 2018, the Hangzhou Internet Court launched a dedicated e-evidence platform that offered access to Blockchain-based evidence deposition platforms,[80] alongside traditional notarization services, signalling the growing confidence in the technology and its ability to assist in litigation. At the same time, the Court issued regulations on its e-evidence platform as well as a document entitled *The Rules for Judicial Review of Electronic Data Evidence in Civil Litigation*[81], which set the specific rules and standards for digital evidence verification.

In order to harmonize the litigation procedures of the Internet Courts in China, the Supreme People's Court has also issued the *Provisions of the Supreme People's Court on Several Issues Concerning the Trial of Cases by Internet Courts* on 6 September

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[74] Zhou Lei（周蕾）, *Weizhong Yinhang Lianshou Guangzhou Zhongcaiwei, "Qukuailian+ Cunzheng" Shoufen Caijueshu Dansheng* (微众银行联手广州仲裁委，"区块链+存证"首份裁决书诞生) [*Weizhong Bank Partnered with Guangzhou Arbitration Committee, China's First Arbitration Award Featuring "Blockchain +Evidence Preservation"*], LEIPHONE (Mar. 12, 2018), https://www.leiphone.
com/news/201803/oM9atpSLhbisM69u.html.

[75] *Id.*

[76] BAOQUAN.COM, https://www.baoquan.com/ (last visited Nov. 26, 2018).

[77] ZIGGURAT, https://ziggurat.cn/ (last visited Nov. 26, 2018).

[78] YUANBEN, https://yuanben.io/ (last visited Nov. 26, 2018).

[79] BANQUANJIA, https://bqj.cn/index.html#/ (last visited Nov. 26, 2018).

[80] *Hangzhou Hulianwang Fayuan Shangxian Duo Shuju Jiekou Dianzi Zhengju Pingtai* (杭州互联网法院上线多数据接口电子证据平台) [*Hangzhou Internet Court Launched Multi Data Interface E-evidence Platform*], XINHUA NET (June 28, 2018), http://www.xinhuanet.com/legal/2018-06/28/c_11230051535.htm.

[81] Wu Wei (吴巍) *Hangzhou Hulian Wang Fayuan Shangxian Quanguo Shouge Dianzi Zhengju Pingtai* (杭州互联网法院上线全国首个电子证据平台) [*Hangzhou Internet Court Launched China'S First E-evidence Platform*], DAFENG HAO (June 28, 2018), http://wemedia.ifeng.com/67002134/wemed-ia.shtml.

2018.[82] In this document, the Supreme Court approves the use of Blockchain in the law of evidence. Article 11 paragraph 2 specifies that "[f]or electronic data submitted by the parties concerned, if collected through electronic signature, trusted timestamping, hash value verification, Blockchain and other evidence collection, and verified with retention and tamper-proof technical means or via the electronic forensics and deposit platform, which are able to prove its authenticity, the Internet Court shall confirm its authenticity."[83] This statement by the Supreme Court encourages parties to adopt more cost-effective approaches to compensate for the deficiencies of electronic evidence identification through conventional notarization. This judicial explanation from the Supreme People's Court, together with PRC e-signature law, civil procedure law and administrative procedure law, potentially sets a new international norm and legal principle in China and other jurisdictions to accept Blockchain-based evidence.

Hard on the heels of the Supreme Court's decision, the Beijing Internet Court opened on 9 September 2018, and accepted its first case, *Douyin v. Baidu*. In this case, regarding the right to disseminate video clips via information networks, the claimant entrusted the preservation of relevant evidence to a third-party platform, Zhong Jin Tian Ping, using Blockchain.[84]

A few days later, on 18 September 2018, the Hangzhou Internet Court launched China's first official judicial Blockchain platform,[85] which is jointly developed by public notary offices, the Certification Authority and Registration Authority, forensic evaluation centres and

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[82] *See Zuigao Renmin Fayuan Guanyu Hulian Wang Fayuan Shenli Anjian Ruogan Wenti De Guiding* (最高人民法院关于互联网法院审理案件若干问题的规定) [Provisions of the Supreme People's Court on Several Issues Concerning the Trial of Cases by the Internet Courts] (promulgated by Sup. People's Ct. Sept. 6, 2018, effective Sept. 7, 2018) (Chinalawinfo).

[83] *Zuigao Renmin Fayuan Guanyu Hulian Wang Fayuan Shenli Anjian Ruogan Wenti De Guiding* (最高人民法院关于互联网法院审理案件若干问题的规定) [Provisions of the Supreme People's Court on Several Issues Concerning the Trial of Cases by the Internet Courts] (promulgated by Sup. People's Ct. Sept. 6, 2018, effective Sept. 7, 2018) art 11, para. 2 (Chinalawinfo).

[84] This case is still on trial. *See Beijing Hulian Wang Fayuan Shouli Diyi An* (北京互联网法院受理第一案：采用区块链技术取证) [*The First Case Accepted by Beijing Internet Court: Evidence Preserved by Blockchain*], SINA NEWS (Sept. 13, 2018), https://tech.sina.com.cn/i/2018-09-13/doc-ihiycyfy0035883.shtml.

[85] BLOCKCHAIN.NETCOURT.GOV.CN, http://blockchain.netcourt.gov.cn/ (last visited Nov. 26, 2018).

the Court.[86] It has already attracted several consortium Blockchain platforms, including Xin Hua Zhi Yun, an online Blockchain-based copyright protection platform jointly established by Alibaba and Xinhua News Agency.[87] The intention is to develop the judicial Blockchain platform into a multifaceted Blockchain ecosystem. Potentially, Internet users will only be one click away from safe and tamper-resistant storage for digital evidence which will be judicially recognised by courts.[88]

In the United States, Vermont has now also passed a law that formally recognises data recorded on Blockchain as evidence,[89] expanding the judicial acceptance of Blockchain beyond China.

D.   *Blockchain, Data Privacy and Trade Secrets*

No sooner had the Cambridge Analytica data breach scandal of March 2018 subsided another one arose, Facebook was hacked on 28 September and almost 50 million users were affected[90] – including Mark Zuckerberg himself.[91] Facebook is now facing a possible $1.63 billion fine under the EU General Data Protection Regulation (hereinafter referred to as "GDPR"). Such security incidents have raised serious concerns about personal privacy and data protection, and Blockchain possibly offers a solution. With its unique hashing process, Blockchain can transform the information uploaded on a chain to a form from which the original information is not derivable, but which is exactly reproducible from the original

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[86] *Id.*

[87] *Id.*

[88] Following these developments of Blockchain in the law of evidence, Beijing Dongchen District Court recognised the legal effect of Blockchain e-evidence in the case of the Chinese All Digital Publishing Group Co. Ltd. v. JD and issued its ruling on 25 September 2018. *See* Yi Ming (以鸣), *Beijing Dongcheng Fayuan Shouci Renke Qukuailian Quzheng, Qukuailian+Dianzi Cunzheng Chubu Luodi* (北京东城法院首次认可区块链取证，区块链+电子存证初步落地) [*Beijing Dongcheng District Court For the First Time Admitted Blockchain Evidence, Blockchain + E-evidence Initially Recognized*], BIANEWS (Sept. 28, 2018), https://www.bianews.com/news/details?id=21481.

[89] Xander Landen, *Vermont Bullish on Blockchain as New Law Takes Effect,* VTDIGGER (Aug. 28, 2018), https://vtdigger.org/2018/08/28/vermont-bullish-blockchain-new-law-takes-effect/.

[90] Sarah Frier, *Facebook's Latest Breach: Not the Same as Cambridge Analytica*, BLOOMBERG (Oct. 1, 2018), https://www.bloomberg.com/news/articles/2018-10-01/facebook-s-latest-breach-not-the-same-as-cambridge-analytica.

[91] Post Staff Report, *Zuckerberg's Own Facebook Account Got Hacked in Breach*. NEW YORK POST (Sept. 29, 2018), https://nypost.com/2018/09/29/zuckerbergs-own-facebook-account-got-hacked-in-breach/.

information, thus potentially enabling it to protect private data and trade secrets.[92]

Some companies have already started to use Blockchain to protect trade secrets. MyDocSafe[93], a Blockchain-supported platform based in the UK, protects clients' trade secrets and other sensitive information by using Ethereum.[94] The Estonian software security company Guardtime, founded back in 2007, has also started using Keyless Signature Infrastructure Blockchain to provide reliable data protection. US company Verizon operates 200 data centers in 22 countries.[95] Director of corporate communications Kevin King explained, "KSI Blockchain uses well-established security building blocks – a combination of Secure Hash Algorithms (for example, SHA-256), and Merkle Trees (also known as Hash Trees). Instead of copying sensitive enterprise data into a distributed and widely-witnessed ledger, the enterprise data is hashed and only the hashes ever leave the enterprise boundary – meaning privacy for enterprise IP." In Taiwan, Bitmark provides a platform for individuals, institutions or organizations to create a Blockchain-supported Bitmark Account. The account enables users to control their own private data. The account also ensures that access to their data is only granted to those it is intended for, while the users retain control of sensitive or private information.

Placing a company's trade secrets on Blockchain, as a form of encryption, could potentially qualify as taking "reasonable steps to keep the information secret" (see the PRC Anti-Unfair Competition Law, article 9 paragraph 3, and the Interpretation of the Supreme People's Court on Several Issues Concerning the Application of the Law in the Trial of Civil Cases of Unfair Competition, article 11, paragraph 3). Blockchain could be applied to similar provisions in EU and US laws concerning trade secrets.

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[92] *What Is Hashing? Under the Hood of Blockchain*, BLOCKGEEKS, https://blockgeeks.com/guides/what-is-hashing/ (last visited Nov. 26, 2018).

[93] MYDOCSAFE, https://mydocsafe.com/uk/ (last visited Nov. 26, 2018).

[94] See *The Easiest Way to Protect Trade Secrets with Blockchain Solutions Such as Timestamping*, MYDOCSAFE, https://mydocsafe.com/uk/security-us/blockchain-solutions-using-ethereum-us/ (last visited Nov. 26, 2018). See also *Public Key Infrastructure*, MYDOCSAFE, https://mydocsafe.com/uk/ke-y-escrow/ (last visited Nov. 26, 2018).

[95] Nathan Cranford, *Verizon to Deploy Blockchain Platform Based on Guardtime Technology*, RCR WIRELESS NEWS (Feb. 15, 2018), https://www.rcrwireless.com/20180215/verizon-to-deploy-blockchain-platform-based-on-guardtime-technology-tag27.

E. Blockchain and Smart Contracts

Blockchain can also support intellectual property licensing through the use of "smart contracts". In simple terms, a "smart contract" is a self-executing contract: the terms are written in code and automatically enforced when the terms stipulated in the contract are met. When smart contracts are based on Blockchain, this potentially offer an automated and a cost-efficient solution.

For example, Brooklyn-based start-up Ujo Music has used a smart contract to sell digital copies of Imogen Heap's song "Tiny Humans."[96] When a fan pays $0.60 to download the song from the Ujo Music website, the smart contract is triggered, dividing the payment between the artist Imogen Heap (who receives 91.25% of the sale price) and seven other collaborators who assisted with the creation of the song (each of whom receives 1.25%).[97] Similarly, VOISE, Spotify, Bitmark and the micro-movie Blockchain[98] built by the National Copyright Administration of People's Republic of China all are using smart contracts to empower copyright owners. Such technology allows them to directly distribute their works, authorise its use and collect remuneration. This circumvents the need for an intermediary such as a performance rights organisation to administer payment and can make micro transactions much faster and cheaper to administer.

Smart contracts may not always be appropriate – for example, in the case of single use. If I buy a book from a bookshop, a normal contract would be much more convenient.[99] Neither are smart contracts ideal when it comes to fair use involving a complex and delicate case-by-case analysis.[100] Furthermore, conflicts may arise between smart contracts and traditional licences when some information is "on chain" and some is "off chain". For example, if an exclusive licence is not properly included on Blockchain, another exclusive licence could be initiated or triggered through a pre-set

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[96] Jerome Pons, *Blockchains and Smart Contracts in the Culture and Entertainment Business*, RESEARCH GATE (Mar. 2018), https://www.researchgate.net/profile/Jerome_Pons/publication/32732220 3_Blockchains_and_smart_contracts_in_the_culture_and_entertainment_business/links/5b887a2a45851 51fd13dc4fe/Blockchains-and-smart-contracts-in-the-culture-and-entertainment-business.pdf.

[97] *Id.*

[98] See examples about blockchain and copyright in part II(B).

[99] Bodó, *supra* note 49 at 11.

[100] *Id.*

smart contract. Such de-synchronization may lead to conflicts rather than making things easier.[101] In addition, under the current standard practice, it is not clear how to ensure on behalf of a client that a smart contract – written in code rather than on paper – can be fully enforced. This is a challenge for both lawyers and judges.[102]

III. CHALLENGES FACING THE ACCEPTANCE OF BLOCKCHAIN TECHNOLOGY

A. How to Ensure that the Information Recorded on Blockchain is Trustworthy

A key challenge facing Blockchain technology is ensuring that the evidence recorded is accurate and trustworthy. As Primavera De Filippi, a researcher at Harvard's Berkman Klein Center for Internet and Society points out: "Registries and recording systems are only as good as the information they manage. For instance, if a land or intellectual property registry contains gaps in title transfers or errors, it would do little to solve uncertainties of property ownership. If inaccurate information is stored on a Blockchain, there is little the technology can do to address the problem. In fact, Blockchain technology could exacerbate these issues by making it difficult to delete or rectify false information once it has been recorded."[103]

To Ms. De Filippi's point, Blockchain users have no way of validating the origin and accuracy of the information originally placed on the chain. If, for example, false information about a De Beers diamond was inserted on a Blockchain as authentic data at the beginning, hashing and unique identification become pointless. Moreover, since the Blockchain record is virtually immutable, the situation becomes very awkward for experts seeking to authenticate product. As the saying goes, garbage in, garbage out. Consequently, current Blockchain applications focusing on traceability are mostly limited to QR codes and are therefore not necessarily secure, as such codes can be easily replaced.

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[101] *Id.*
[102] *Id.*
[103] PRIMAVERA DE FILIPPI & AARON WRIGHT, BLOCKCHAIN AND THE LAW: THE RULE OF CODE (2018).

In the verdict of the Baoquan case,[104] the Hangzhou Internet Court gave as much attention to the credibility of the third-party evidence-preservation platform[105] and the webpage capture and source-recognition technology[106] as it did to Blockchain. The Hangzhou Court believed that when it comes to a situation involving both "on-chain" and "off-chain" information, a neutral and authoritative third part, adds to the authenticity of a Blockchain record. This is because they can help ensure consistency between the two sources.

For this reason, many Blockchain platforms, including Baoquan and the "Judicial Blockchain", initiated by the Hangzhou Internet Court, have partnered with some trusted third party or official organization. An important factor in ensuring the accuracy of a Blockchain Intellectual Property registry and provenance will be to avoid fragmentation.[107] It will be crucial to have key players within an industry sector supporting a single registry. Previous attempts at digital IP registries in the context of the music industry have failed, because without tenable support, it was impossible for the registry to be comprehensive or provide reliable proof of copyright ownership.

It should be noted that historical information can be amended as long as over 51% of the parties on a Blockchain agree to an erasure and correction, but it is by no means as simple as it sounds. Besides, if there is no means of ensuring that the information originally encrypted was valid and trustworthy, using Blockchain for traceability and authentication is spurious indeed.

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[104] See the case about blockchain and evidence in part II(C).

[105] The third-party platform company has no stock controlling or competition relationship with the plaintiff, and is therefore neutral. It has also been approved by the National Quality Supervision and Testing Center for Information Network Products (NTI). Therefore, Baoquan, which is operated by this company, has the credential to serve as an electronic evidence preservation platform.

[106] The Baoquan database is on Alicloud and has been put on the online security record of the Ministry of Public Security and NTI. Therefore, Baoquan has a safe environment to preserve digital data. It has also used Google's Open Source software program "puppeteer" to capture the webpage and "curl" to obtain the source code. These two programs are operated automatically by Google's system and are open to the general public, so there is little risk the process of evidence preservation will be tampered with. The source of the electronic data is therefore highly trustworthy, unless there is enough evidence to prove otherwise.

[107] *See How Standards Proliferate*, XKCD, available at https://xkcd.com/927/ (last visited Nov. 26, 2018).

B.   Issues Concerning Jurisdiction and Governing Law

While Blockchain technology has promising applications in the field of intellectual property, its widespread adoption could be slowed by the lack of clear rules governing how it can be used and what should happen in the event of a dispute. This goes back to the perennial issue of technology far outpacing the development of the law. The big challenge to the use of Blockchain in the area of intellectual property rights is establishing the appropriate jurisdiction and law to apply when a dispute occurs.[108] The issue arises because of Blockchain's decentralized nature. In a Blockchain, information is stored in distributed ledgers across the world via a network of individual participants called "nodes".[109] As this is a decentralized database in which nodes can be physically located anywhere in the world, figuring out which court has the authority to adjudicate a dispute and what rules it should apply can be challenging.[110] The risk is that Blockchain transactions could fall under the jurisdiction of all of the nodes, and thus under a multiplicity of legal regimes.[111]

Taking copyright law. While international treaties recognise copyright protection in multiple jurisdictions, there is no "international copyright", and copyright works are protected under the copyright laws of each country.[112] National jurisdictions differ greatly in certain aspects of copyright law. For instance, under the interpretation of originality, there are four different families of standards, ranging from the strictest to most generous.[113] These include: the EU's personal intellectual creation standard, the United States' Feist standard, Canada's CCH standard, and the United Kingdom's skill and labor standard. Additionally, countries are free to apply different types of exhaustion doctrine: "national exhaustion" in countries such as Russia and Brazil, "regional exhaustion" in the

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[108] John McKinley et al., *Blockchain: Background, Challenges and Legal Issue*, DLA PIPER (Feb. 2, 2018), https://www.dlapiper.com/en/uk/insights/publications/2017/06/blockchain-background-challenges-legal-issues/.

[109] *Id.*

[110] *Id.*

[111] *Id.*

[112] Bodó *supra* note 49, at 11.

[113] *See* Elizabeth F Judge & Daniel Garvais, *Of Silos and Constellations: Comparing Notions of Originality in Copyright Law*, 27 CARDOZO ARTS & ENT. L. J. 376, 377 (2010), https://papers.ssrn.com/sol3/ papers.cfm?abstract_id=1545986.

EU and "international exhaustion"[114] in the US. Moreover, the terms of copyright protection also vary in different countries. The Berne Convention,[115] for instance, sets a minimum protection standard of only 50 years, and while some countries, including China, follow the international treaty, some other jurisdictions such as US and EU have moved to 70 years of protection.[116]

Copyright is made up of a "bundle" of rights, and the elements making up the bundle in different jurisdictions can vary greatly in scope and duration. It's therefore possible to imagine a situation where a smart contract permits the use of a copyrighted work in one jurisdiction, but that same use infringes the copyright of another legitimate holder in a different region.[117] When a copyright owner tries to enforce their copyright on an inherently cross-jurisdictional Blockchain, the need for some form of coordination emerges.[118] However, it is not yet clear whether and indeed how Blockchain platforms can address such jurisdictional issues.[119] It is quite possible these problems will disrupt the efficiency of the distributed ledger or even render it completely useless.[120]

Of course such jurisdictional issues may be less problematic in a private Blockchain than in a public Blockchain, because the creator of the former is able to establish clear contractual obligations and rules governing all the nodes on their chain.[121] For example, they could maintain distributed ledgers only on nodes located within the same jurisdiction.[122] However, with the inherently expansive nature of DLT, jurisdictional disputes are bound to emerge.[123] We would argue that it will be necessary to establish a consistent procedure for

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[114] Bodó *supra* note 49, at 11.

[115] The Berne Convention for the Protection of Literary and Artistic Works, Sept. 9, 1886, 828 U.N.T.S. 221.

[116] *Id.*

[117] *Id*

[118] *Id.*

[119] *Id.*

[120] Katherin West, *Where is Blockchain?: Jurisdiction Issues That May Affect Distributed Ledgers*, LEXOLOGY (May 30, 2018), https://www.lexology.com/library/detail.aspx?g=35f40e2e-38d8-49d7-81ca-9872d8ab9532.

[121] Praveen Jayachandran, *Blockchain Explained: the Difference Between Public and Private Blockchain*, IBM (May 31, 2017), https://www.ibm.com/blogs/blockchain/2017/05/the-difference-between-public-and-private-blockchain/.

[122] West, *supra* note 120, at 25.

[123] *Id.*

determining the location of a distributed ledger, and that the parties concerned should reach agreement beforehand by means of smart contracts or offline agreements. Otherwise it is likely that issues concerning jurisdiction and governing law will become apparent and should not be underestimated.[124]

As Blockchain begins to be applied to areas beyond intellectual property, the same concerns will arise. For example, where a Blockchain stores personal data across multiple jurisdictions, data-protection compliance becomes more difficult, given that it would be impractical to obtain the requisite consent from data subjects.[125] In addition, one of the very features making Blockchain secure – the immutability of the information stored on it –only serves to complicate data protection when that personal information needs to be erased or corrected.[126] There are also implications for compliance with data-protection law, including Europe's GDPR.[127]

C. *The Integrity of Blockchain Technology*

Another important question is how and when liability for Blockchain mistakes or infrastructure failure will be triggered.[128] Because the technology is automated, service providers will be likely to exclude assurances on performance, in turn posing concerns about the reliability and security of Blockchain as a service.[129] Operators and users alike will need to assess the risks associated with a lack of control over distributed ledger technologies.[130] Blockchain must be run on Blockchain software, software is written by humans, and humans make mistakes. There is every chance that security flaws are present in the design, coding and operation of Blockchain's software. The problem is that, thanks to Blockchain's much-vaunted security features, these flaws are immutably fixed for as long as the

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[124] *Id.*

[125] Henry Chang, *Blockchain: Disrupting data protection?*, 41 PRIVACY L. & BUS. INT'L REP, 150, 152 (2017).

[126] *Id.*

[127] David Meyer, *Blockchain Technology is on a Collision Course with EU Privacy Law*, IAPP (Feb. 27, 2018), https://iapp.org/news/a/blockchain-technology-is-on-a-collision-course-with-eu-privacy-law/.

[128] John Mckinley, *supra* note 108.

[129] *Id.*

[130] *Id.*

Blockchain is used.[131] In 2016, for example, a flaw in the smart contract code of the Distributed Autonomous Organization was exploited by hackers, costing the companies involved $30 million.[132] Given the potential for chaos lurking in these coding bugs, some observers are even questioning whether Blockchain smart contracts are worth the trouble.[133]

No guarantee yet exists that software created by humans will function as expected. However, as the old Chinese saying goes: "Don't give up eating for fear of choking". Considerable investment has been made into developing solutions to Blockchain's security vulnerabilities.

In 2018, Quantstamp[134] devised a security-auditing protocol for smart contracts written in Ethereum's programming language Solidity. The protocol allows clients to have their smart contracts scrutinized by peer-submitted verification software and "bug finders".[135] CertiK[136] is a formal verification framework led by Yale and Columbia University professors and backed by software engineers from Facebook, Google, and FreeWheel.[137] Users now deploy it to debug Blockchain software codes, identify flaws and ensure the coding is hacker-resistant.[138] In China this year, the Blockchain Security Research Centre put in place the Blockchain Smart Contract Security Checking System,[139] the very first formal

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[131] Wilton Thornburg, *The Dao Hack and Blockchain Security Vulnerabilities*, COINCENTRAL (July 7, 2018), https://coincentral.com/blockchain-security-vulnerabilities/.

[132] Joon Ian Wong, *A Coding Error Led to $30 Million in Ethereum Being Stolen*, QUARTZ (July 20, 2017), https://qz.com/1034321/ethereum-hack-a-coding-error-led-to-30-million-in-ethereum-being-stolen/.

[133] Sherman Lee, *Blockchain Smart Contracts: More Trouble Than They Are Worth*, FORBES (July 10, 2018), https://www.forbes.com/sites/shermanlee/2018/07/10/blockchain-smart-contracts-more-trouble-than-they-are-worth/#e7e3eba23a60.

[134] QUANTSTAMP, https://quantstamp.com/ (last visited Nov. 26, 2018).

[135] Lee, *supra* note 133.

[136] CERTIK, https://certik.org/# (last visited Nov. 26, 2018).

[137] Dylan Grabowski, *NEO Partners with Formal Verification Company Certik*, NEONEWSTODAY (Aug. 2, 2018), https://neonewstoday.com/general/neo-partners-with-formal-verification-company-certik/.

[138] Brita Belli, *This Yale Technology Could Fix Blockchain's Security Issues and Make it a lot More Viable*, OFF. OF COOP. RESEARCH YALE U., https://ocr.yale.edu/news/yale-technology-could-fix-blockchain-s-security-issues-and-make-it-lot-more-viable (last visited Nov. 26, 2018).

[139] BLOCKCHAIN SMART CONTRACT SECURITY CHECKING SYSTEM, http://www.sjtubsrc.net/ (last visited Nov. 26, 2018).

verification platform in China, which can help identify coding bugs and access potential risks beforehand.[140]

Additionally, the China Electronics Standardization Institute, part of China's Ministry of Industry and Information Technology, is planning to release three standards for Blockchain applications, including smart contracts, by the end of 2019. [141]

Beyond the challenges mentioned above, there are certain vulnerabilities inherent in Blockchain technology that could be exploited in the future. For example, while access to a public Blockchain requires a private key, if this key is not secured, virtually anyone can take it and write on the ledger.[142] The result is that information added by malicious actors is immutably stored on the ledger. In another hypothetical scenario, it might become necessary for users to convert the information and transactions stored on a Blockchain into another format (a computer hard drive for example). That format is then vulnerable to attack, potentially allowing hackers to subvert the system and gain access to the information on the ledger.[143] We anticipate that, as Blockchains are used in different contexts and access rights are expanded, new vulnerabilities will be created in the system.

In response, some countries have begun enacting technology-specific legislation requiring the registration of companies operating DLTs. For example, Gibraltar now requires companies using DLTs for "storing or transmitting value belonging to others" to register and obtain a DLT Provider's License from the Gibraltar Financial Services.[144] They must follow certain principles when conducting

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[140] Blockchain Security Research Center, *Qukuailian Anquan Yanjiu Zhongxin Tuichu Guonei Diyige Qukuailian Zhineng Heyue Jiance Pingtai* (区块链安全研究中心推出国内第一个区块链智能合约检测平台) [*Blockchian Security Research Center Launched China's First Smart Contract Security Checking System*], COINTIME (Aug. 27, 2018), https://www.jinse.com/bitcoin/233812.html.

[141] Samburaj Das, *China to Establish National Blockchain Standards by 2019: Govt. Official*, CCN BLOCKCHAIN NEWS (May 10, 2018), https://www.ccn.com/china-government-to-establish-national-blockchain-standards-by-2019-report/. *See also* Lester Coleman, *China to Draft for Three Domestic Blockchain Standards in 2018*, CCN BLOCKCHAIN NEWS (Oct. 08, 2018), https://www.ccn.com/china-to-drafts-for-three-domestic-blockchain-standards-in-2018/.

[142] Interview with Henry Franks (Jan. 31, 2017).

[143] *Id.*

[144] FINANCIAL SERVICES (DISTRIBUTED LEDGER TECHNOLOGY PROVIDERS) REG. 2017 (2017), http://www.gibraltarlaws.gov.gi/articles/2017s204.pdf

business, such as honesty and integrity, and maintain security systems to appropriate high standards.[145]

Blockchain technology has huge potential in the field of intellectual property, but its vulnerabilities are significant. Addressing these vulnerabilities should be a condition of its global adoption by users.

D. Issues Concerning Privacy and Blockchain

From a technical perspective, Blockchain does not support anonymity. [146] Steven R. Gordon, Professor of Information Technology Management at Babson College, [147] points out, "[h]aving data disperse throughout the Blockchain presents its own privacy concerns, because public Blockchain transactions are pseudonymous and users can take steps to hide their identity, but ultimately anonymity is not guaranteed."[148] Blockchain is vulnerable to breaches of transactional privacy because any unscrupulous user can relate your "pseudonym" (your public key code) to your account address by analysing information about relevant transactions. Once an individual's address is known, it is also possible to identify the details and value of all transactions made from that address.[149] For companies, transaction records may also reveal trade secrets. Steven R. Gordon concludes "[t]heoretically, yes, Blockchain can solve data privacy issues, but practically, no." [150] While "anonymisation technologies" including Dash, Monero and Zcashare in development, [151] these tools are still in their infancy. Significant concerns remain over Blockchain's ability to protect privacy and data.[152]

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[145] *Id.* Schedule 2.

[146] Microsoft Research, *Yiwen Dudong Qukuailian Shang de Yinsi yu Jianguan Wenti* (一文读懂区块链上的隐私与监管问题) [*Understanding Privacy and Supervision Issues on Blockchain in One Article*], Sina Blog (Dec. 13, 2016), http:// blog.sina.com.cn/s/blog_4caedc7a0102wpbi.html.

[147] *Babson College Faculty Profiles*, Babson C., http://www.babson.edu/ Academics/faculty/ profi-les/Pages/Gordon-Steven.aspx (last visited Nov. 26, 2018).

[148] Ruksana Hussain, *Can Blockchain Really Address Data Privacy Concerns?*, Econtent (June 18, 2018), http://www.econtentmag.com/Articles/News/News-Feature/Can-Blockchain-Really-Address-Data-Privacy-Concerns-125624.htm.

[149] Microsoft Research, *supra* note 146.

[150] *See* Hussain, *supra* note 148.

[151] Microsoft Research, *supra* note 146.

[152] *Id*.

IV. CONCLUSION

Much of the discussion about Blockchain's legal implications remains for the moment abstract, and will need to be tested in practice. Nevertheless, Blockchain's application in the field of intellectual property shows potential.

Some observers are concerned that counterfeiters may be able to use Blockchain cryptocurrencies to hide the financial gains of their unlawful business.[153] It is still unclear to what extent Blockchain might enable the very activities it is intended to thwart. Fundamentally it comes down to the eternal race against time between Good and Bad actors: who will be the first to adopt new technologies to their advantage? These considerations deserve careful scrutiny. The *de facto* norms currently being developed in practice and commerce in China and other jurisdictions, and the legal framework needed to advance the progress of Blockchain in the intellectual property space, requires urgent international research.

All of which raises the thorny issue of regulation as a possible answer to Blockchain and the use of digital technology by Bad actors more generally.[154] Regulation, it must be said, is at odds with the Internet's prime directive. John Postel, Sir Tim Berners-Lee and Vint Cerf, those original dreamers of the digital age, postulated a free and unfettered cyberworld. In this utopian environment, information flows freely, the right to know is a given, scientific collaboration is easy, and free competition allows you to set up an online business that knows neither boundaries nor borders. So how to reconcile what is potion with what is poison? Blockchain, in fact, is an exemplar of the Web's early informational ideals, part of a new generation of decentralising technologies taking back control of information.[155]

The problem of Digital regulation is even more pressing. The ability of courts and legislatures around the world to curtail the

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[153] Dennis Collopy & Tim Drye, *Share and Share Alike – The Challenges from Social Media for Intellectual Property Rights*, INTELLECTUAL PROPERTY OFF., https://uhra.herts.ac.uk/handle/2299/1947-0.

[154] *See* David Canellis, *Blockchain Doesn't Kill People, But Smart Contract Does, Law Professor Says*, THE NEXT WEB (Sept. 4, 2018), https://thenextweb.com/hardfork/2018/09/04/smart-contracts-super-dumb-blockchain/.

[155] *See ActivityPub*, WIKIPEDIA, https://en.wikipedia.org/wiki/ActivityPub (last visited Nov. 26, 2018); *see also Mastodon*, WIKIPEDIA, https://en.wikipedia.org/wiki/Mastodon_(software) (last visited Nov. 26, 2018).

activities of Bad actors online is woefully inadequate. We are witnessing an unprecedented volume and velocity of online activity. The law has traditionally lagged behind commercial and scientific development. But playing catch-up has turned into an increasingly desperate struggle as digital technology evolves at the lightning speed predicted by Moore's Law.[156]

For example, it makes no sense for a brand or content owner to run to court at great expense to stop the sale of a pirated or counterfeited product on a digital platform as the actual listing typically appears for only a few hours online. Nor would preventing that single sale do anything to address the multitude of other fake listings posted by Bad actors. As much as one would wish a court of law to mete out individual justice in every single case, this ideal is unrealistic and makes no sense in the digital and Blockchain environment.

Consequently, *de facto* technical and legal guidelines have already developed around the world, thanks to voluntary cross-border collaboration between Big Tech, governments and consumers. Because Blockchain is by its nature global, these guidelines will require further refinement – presenting an intriguing digital challenge to forward-thinking professionals in the field.

Enabling the emergence of Blockchain in business is, we believe, dependent on the development of voluntary and collaborative technical and legal standards. As Blockchain technology is applied to industry in China and elsewhere, research is urgently needed to establish norms to govern its use. These norms must and will pave the way for new legal principles throughout the world.

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[156] That is, that overall processing power for computers will double every two years.