

BLOCKCHAINS: PRIVATE LAW MATTERS

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Blockchain technology is the cornerstone of FinTech. Blockchains offer the infrastructure for online platforms which store information and digital assets. Distributed ledgers are about to be employed everywhere. Regulators have opted for a regulatory sandbox approach which demonstrates the need for efficient private law rules to fill potential lacunae. This paper identifies the crucial parameters for ascertaining the private law foundations of blockchain technology and its applications. Aspects of contract and property laws will be assessed in order to determine whether digital assets are capable of acquiring *erga omnes* status. This will include a survey of current blockchain statutes and potential negative externalities of a blockchain which might trigger liability of its members.

I. BLOCKCHAINS—THE TECHNOLOGY AND ITS POTENTIAL

A. *The Challenge*

Blockchains are generally associated with virtual currencies and the storage of information on distributed ledgers.¹ But the potential of blockchains goes well beyond the mere storage of information. They offer the infrastructure for online platforms with specific applications,² ushering in a disruption of traditional governance structures.³ Banking and finance are undergoing fundamental changes as payments are

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¹ P De Filippi & A Wright, *Blockchain and the Law: The Rule of Code* (Cambridge, Massachusetts: Harvard University Press, 2018) at 13 *et seq* [Filippi]; R Girasa, *Regulation of Cryptocurrencies and Blockchain Technologies: National and International Perspectives* (New York: Springer International Publishing, 2018) at 29 *et seq*; N Barbaroux, “Un exemple de blockchain à la frontière du droit et de l’économie: le bitcoin” in F Mermoz ed, *Blockchain et Droit* (Paris: Dalloz, 2018) at 19 *et seq*.

² See M Finck, *Blockchain Regulation and Governance in Europe* (Cambridge: Cambridge University Press, 2019) at 11, 22 *et seq* [Finck].

³ S Davidson, P De Filippi & J Potts, “Disrupting Governance: The New Institutional Economics of Distributed Ledger Technology” (19 July 2016), online: SSRN <https://papers.ssrn.com/sol3/papers.cfm?abstract_id=2811995>; LW Cong & Z He, “Blockchain Disruption and Smart Contracts” (27 December 2018) [Cong & He], online: SSRN <https://papers.ssrn.com/sol3/papers.cfm?abstract_id=2985764>.

becoming more “intelligent”.⁴ Land can be transferred online.⁵ Utility companies rely on blockchain technology and smart contracts to calibrate the supply of electricity from power plants and wind farms.⁶ Blockchains and artificial intelligence are about to play a substantial role in protecting intellectual property rights via the internet by concluding licensing agreements online for downloads and policing breaches.⁷ In healthcare, the combination of blockchains and artificial intelligence is expected to improve the quality of medical treatment.⁸ These developments demonstrate the urgency of ascertaining the private law foundations of blockchain technology and its applications.

In February 2019, the United States (“US”) House of Representatives discussed a bill for a Blockchain Promotion Act which would establish a working group to study potential applications, including non-financial applications for blockchain technology and its potential for federal agencies.⁹ On 14 March 2019, the Singapore International Commercial Court handed down a judgment on the scope of contractual duties of a virtual currency exchange platform where every transaction had undergone a blockchain verification. The Singapore judgment in *B2C2 Ltd v Quoine Pte Ltd*¹⁰ is one of the first cases involving a combination of blockchain technology, smart contracts and artificial intelligence which has come to test the viability of the law of contracts, property and tort law concepts for protecting digital assets.¹¹

Blockchains and distributed ledgers operate without a centralised clearing agency. At the outset, blockchains stand for subsets of distributed ledger technology where

⁴ See M Fenwick & E P M Vermeulen, “Technology and Corporate Governance: Blockchain, Crypto, and Artificial Intelligence” (November 2018) European Corporate Governance Institute Working Paper (Law) No 242/2018, online: <https://ecgi.global/sites/default/files/working_papers/documents/finalfenwickvermeulen_1.pdf> (assessing blockchain-based platforms relying on smart contracts and artificial intelligence).

⁵ See Sweden, “The Land Registry in the Blockchain: A development project with Lantmäteriet (The Swedish Mapping, cadastre and land registration authority), Telia Company, ChromaWay and Kairos Future” (July 2016), online: BDEW <http://ica-it.org/pdf/Blockchain_Landregistry_Report.pdf>; and A Bal, *Taxation, Virtual Currency and Blockchain* (Alphen aan den Rijn: Wolters Kluwer, 2019) at 20 et seq.

⁶ See, eg from a German perspective: bdew, Hochschule Fresenius & SAP, “Blockchain in the Energy Sector – The Potential for Energy Providers” (2018), online: <<https://www.bdew.de/media/documents/Studie-Block-chain-englische-Fassung-Dez.2018.pdf>>.

⁷ B Clark, “Blockchain and IP Law: A Match made in Crypto Heaven?” *World Intellectual Property Organisation [WIPO] Magazine* (February 2018), online: WIPO Magazine <https://www.wipo.int/wipo_magazine/en/2018/01/article_0005.html>.

⁸ See, eg P Mamoshina et al, “Converging blockchain and next-generation artificial intelligence technologies to decentralize and accelerate biomedical research and healthcare” (2018) 9:5 *Oncotarget* at 5665, online: NCBI <<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5814166/pdf/oncotarget-09-5665.pdf>>.

⁹ US, Bill HR 1361, *Blockchain Promotion Act of 2019*, 116th Cong, 2019, online: US Congress <<https://www.congress.gov/bill/116th-congress/house-bill/1361/text>>. The US Senate Committee on Commerce, Science, and Transportation endorsed the bill on 10 July 2019, proposing amendments, online: <<https://trackbill.com/bill/us-congress-senate-bill-553-blockchain-promotion-act-of-2019/1707446/>>.

¹⁰ [2019] SGHC(I) 03 [*Quoine I*]. See also the appellate judgment of the Singapore Court of Appeal: *Quoine Pte Ltd v B2C2 Ltd* [2020] SGCA(I) 02 [*Quoine II*].

¹¹ Courts in other jurisdictions have analysed the implications of blockchain technology in an insolvency scenario: see section II.2.a (below) (Mt Gox) and A ter Haar, in A Grinhaus ed, *A Practical Guide to Smart Contracts and Blockchain Law* (Toronto: LexisNexis, 2019) 221 at 222 et seq.

data are recorded and authenticated across multiple stores.¹² These data stores have the same data records.¹³ They are maintained by an algorithm which ensures that each computer participating in the network disposes of the same degree of verified information.¹⁴ Initially, these networks were designed as peer-to-peer structures.¹⁵ By downloading the software for the blockchain network, any new participant will be able to join the system. Transaction data are grouped into blocks, each of them receiving an electronic ‘fingerprint’ and a time-stamp.¹⁶ The credibility of blockchain networks is achieved through simultaneous storage on the ‘participating’ computers, based on the so-called consensus protocol which generates the current status quo of the ledger.¹⁷ These technological arrangements have earned distributed ledgers the reputation of being tamper-proof and immune from human interference.¹⁸ Smart contracts generate tokens which represent titles to digital assets.¹⁹ Once smart contracts, algorithms and artificial intelligence have completely taken over, it is posited that specific human intervention will not be required.²⁰

Blockchain and distributed ledgers substantially reduce transaction costs,²¹ although variations may occur between public and private blockchain systems: rents from network effects will be shared by all participants as long as no other player or gatekeeper can interfere with the underlying (digital) assets and data.²² Conversely, incentives to outmanoeuvre the system will increase with the value of the assets affected by consensus mechanisms.²³ Permissioned or private blockchains invite restrictive (internal) access to information under the pretext of protecting confidential

¹² *Finck*, *supra* note 2, at 8 *et seq*; J W Ibáñez Jiménez, *Derecho de Blockchain y la tecnología de registros distribuidos* (Cizur Menor: Thompson Aranzadi, 2018) at 32 *et seq* [Jiménez].

¹³ European Parliament, Policy Department for Economic, Scientific and Quality of Life Policies, R Houben & A Snyers, “Cryptocurrencies and blockchain: Legal context and implications for financial crime, money laundering and tax evasion”, Study requested by the European Parliament’s Special Committee on Financial Crimes, Tax Evasion and Tax Avoidance (July 2018), sub 2.1, online: European Parliament <<http://www.europarl.europa.eu/cmsdata/150761/TAX3%20Study%20on%20cryptocurrencies%20and%20blockchain.pdf>>.

¹⁴ *Finck*, *supra* note 2 at 6.

¹⁵ *Filippi*, *supra* note 1 at 45 *et seq*.

¹⁶ *Finck*, *supra* note 2.

¹⁷ *Ibid* at 7; Jiménez, *supra* note 12 at 38.

¹⁸ *Filippi*, *supra* note 1 at 35 *et seq*.

¹⁹ See the report by the Swiss Government, Switzerland, *Rechtliche Grundlagen für Distributed Ledger-Technologie und Blockchain in der Schweiz* (7 December 2018) at 35 *et seq*, online: <https://www.mme.ch/fileadmin/files/documents/Publikationen/2018/181207_Bericht_Bundesrat_Blockchain.pdf>; R Veil, “Token-Emissionen im europäischen Kapitalmarktrecht” (2019) 183 ZHR 346 at 350; and section III (below).

²⁰ See, *eg* on automated interpretation devices in the context of smart contracts: M Cannarsa, “Contract Interpretation: Smart Interpretation?” in DiMatteo, Cannarsa & Poncibò, eds, *The Cambridge Handbook of Smart Contracts, Blockchain Technology and Digital Platforms* (UK: Cambridge University Press, 2019) 102 at 112 *et seq* [Cambridge Handbook].

²¹ C Catalini & J S Gans, “Some Simple Economics of the Blockchain” (11 June 2019), online: SSRN <https://papers.ssrn.com/sol3/papers.cfm?abstract_id=2874598>.

²² See, however, on hidden control structures in public blockchains: E Mik, “Blockchains: A Technology for Decentralized Marketplaces: Blockchains Are...Databases” in *Cambridge Handbook*, *supra* note 20, 160 at 170 [Mik].

²³ M Pilkington, “Blockchain Technology: Principles and Applications” (15 April 2016), online: SSRN <https://papers.ssrn.com/sol3/papers.cfm?abstract_id=2662660>.

information.²⁴ Specific blockchain and distributed ledger applications might generate negative externalities, challenging regulators' creativity to address a cross-border phenomenon (including (anti-)competitive side-effects).²⁵

Bitcoin and other cryptocurrencies have provoked sharp warnings from central banks and regulators due to the risks of greatly fluctuating exchange rates.²⁶ The insolvency of a Bitcoin exchange has generated cross-border litigation in order to determine the rights of consumer-investors.²⁷ Regulators have emphasised the need to avert corruption, moral hazard and informational asymmetries, but have refrained from introducing comprehensive blockchain legislation.²⁸ The State of New York was a frontrunner in introducing bitlicenses for virtual currencies.²⁹ Unfortunately, its regulations on bitlicenses are not considered a major success in the international market for regulating the digital economy.³⁰ Some state legislators in the US have enacted blockchain statutes which attempt to place blockchains within the law of contracts and corporation law.³¹ Vermont law is beginning to sharpen the awareness that blockchain technology and distributed ledgers will impact the law of civil procedure.³² Recent case law indicates that the substantive law on blockchains will also recalibrate the rules of discovery.³³ In Europe, legislators have focused on blockchain technology as a crucial element for FinTech.³⁴ To this end, transactions (concluded on the basis of blockchain and smart contract technology) are to be legally recognised. Sometimes the applicability of the law of contracts is explicitly acknowledged although the codifications remain unclear regarding the integration of blockchains, smart contracts and artificial intelligence without direct human intervention into traditional contract theory.

²⁴ C Catalini & C Tucker, "Antitrust and Costless Verification: An Optimistic and a Pessimistic View of the Implications of Blockchain Technology" (19 June 2018), online: SSRN <<http://ide.mit.edu/sites/default/files/publications/SSRN-id3199453.pdf>>. See on the risks of collusion due to distributing information during consensus generation: *Cong & He, supra* note 3.

²⁵ See the survey by K Werbach, "Trust, But Verify: Why the Blockchain Needs the Law" (2018) 33 *Berkeley Tech L J* 487 at 514 (on potential and real vulnerabilities of blockchain systems).

²⁶ See the surveys in C Proctor, in D Fox & S Green eds, *Cryptocurrencies in Public and Private Law* (UK: Oxford University Press, 2019) [*Fox & Green*] at para 3.27 *et seq*; Cambridge Centre for Alternative Finance, Garrick Hileman & Michel Rauchs, *Global Cryptocurrency Benchmarking Study* (2017), online: Cambridge Centre for Alternative Finance <https://www.jbs.cam.ac.uk/fileadmin/user_upload/research/centres/alternative-finance/downloads/2017-global-cryptocurrency-benchmarking-study.pdf>.

²⁷ See section II.B.1 (below) on the insolvency of the Japanese Mt Gox exchange.

²⁸ *Houben & Snyers, supra* note 13; European Securities and Markets Authority (ESMA), *Fin-Tech: Regulatory Sandboxes and innovation hubs* (Report JC 2018 74) at 10, 17, online: ESMA <https://www.esma.europa.eu/sites/default/files/library/jc_2018_74_joint_report_on_regulatory_sandboxes_and_innovation_hubs.pdf>; Ong Chong Tee, "Technological innovation and supervision of financial institutions", Keynote Speech delivered at the Asia Securities Industry & Financial Markets Association (ASIFMA) Annual Conference 2018, Singapore, (1 November 2018), online: Bank for International Settlements <<https://www.bis.org/review/r181102h.pdf>>.

²⁹ New York Codes, Rules and Regulations, tit 23, c 1, Part 200 (2015).

³⁰ See Sarah Brennan, *Contortions for Compliance: Life Under New York's Bitlicense* (21 January 2018), online: Coindesk <<https://www.coindesk.com/contortions-compliance-life-new-yorks-bitlicense>>.

³¹ See section III.B.2 (below).

³² See 12 VSA 2018, c 81, s 1913 online: <<https://law.justia.com/codes/vermont/2016/title-12/chapter-81/section-1913>>.

³³ See section III.B.3 (below).

³⁴ See section III.B.2 (below).

B. Outline of the Paper

This paper will first place blockchain technology within the law of contracts. Globally, Japan has emerged as one of the largest acceptors of bitcoins,³⁵ while Singapore is the third largest jurisdiction for initial coin offerings.³⁶ The implications of Japanese and Singaporean cases will be assessed in order to ascertain the scope of protection for investors in the context of blockchain-related virtual currency exchanges. The notions of *opposabilité* of a contract or tortious interference with a contract will be explored as instrument to confer *erga omnes* effects on contracts on digital assets. Legislators have come to recognise that the commodification of digital assets hinges on a meaningful interface between the laws of contracts and property. US and European blockchain statutes will be surveyed before Liechtenstein's new law on 'tokenisation' processes with property law effects³⁷ will be reviewed. Before highlighting data protection law issues under European Union ("EU") law, the focus will be on liability for negative externalities of distributed ledgers. It is beyond the scope of this paper to undertake a comprehensive comparative law survey. Instead, it is intended to flesh out the major paradigms of a private law approach towards blockchain technology and distributed ledgers.

II. BLOCKCHAINS—A LAW OF CONTRACTS APPROACH

A. Basics

Access to a blockchain and distributed ledger system is invariably based on acceptance of the operating conditions (governance mechanisms), established *ex ante*.³⁸ The functional arrangements of a specific blockchain system determine whether acceptance will be expressed by merely downloading the relevant software (permissionless or public blockchains).³⁹ In private or permissioned systems a gatekeeping

³⁵ M Matsutani, "Japan a global leader in cryptocurrency investment" *Japan Times (Davos Special)* (23 January 2018), online: Japan Times <https://info.japantimes.co.jp/ads/pdf/20180123-20180222-Davos_Special2018.pdf>.

³⁶ Daniel Diemers *et al*, *Initial Coin Offerings: A strategic perspective*, online: PricewaterhouseCoopers <https://www.pwc.ch/en/publications/2018/20180628_PwC%20S&%20CVA%20ICO%20Report_EN.pdf>; N Ismail & LB Ngiap, "Why Singapore ranks as the third most favourable country in the world for ICOs" *Singapore Business Review* (September 2018) at 26 *et seq*, online: Singapore Business Review <https://sbr.com.sg/sites/default/files/singaporebusinessreview/print/SBR_2018_AugSept-26-28.pdf>.

³⁷ On 3 October 2019, Liechtenstein's parliament adopted unanimously the blockchain law, Token und VT Dienstleistungsgesetz (TVTG), entering into force on 1 January 2020; Landesverwaltung des Fürstentums, "Landtag stimmt dem Blockchain-Gesetz einstimmig zu", Liechtenstein Press Release no. 3319 (3 October 2019), online: Landesverwaltung des Fürstentums <<https://www.llv.li/medienmitteilungen/detail/3319/landtag-stimmt-dem-blockchain-gesetz-einstimmig-zu>>.

³⁸ P Murck, "Who Controls the Blockchain" *Harvard Business Review* (19 April 2017), online: Harvard Business Review <<https://hbr.org/2017/04/who-controls-the-blockchain>>, *cf* P Paech, "The Governance of Blockchain Networks" (2017) 80:6 MLR 1073 at 1081 *et seq* [Paech].

³⁹ For a survey see Financial Markets Law Committee, "Distributed Ledger Technology and Governing Law: Issues of Legal Uncertainty" (2018) Financial Markets Law Committee Working Paper at sub 3.3, online: <http://fmic.org/wp-content/uploads/2018/05/dlt_paper.pdf> [*Financial Markets*].

institution grants authorisation to access the system.⁴⁰ Permissioned systems reserve the right to register transactions.⁴¹ Ledgers which record transactions may be designed to serve purely evidentiary purposes. But a ledger can be so programmed that transfers of a title are secured by the ledger itself, representing transfers of rights to a non-digital asset.⁴² Conversely, such transfers of title can be completely dissociated from ‘real-world’ assets, so that a ‘virtual asset’ represents a value in itself.⁴³

The mere downloading of blockchain software is difficult to reconcile with the traditional contractual notions of offer and acceptance.⁴⁴ Contractual and legal intent have to be converted into digital language, provoking concerns about interpretation and the degree of enforceability.⁴⁵ Changes of the underlying software protocol and the terms of operations, including the ledger, have to be approved by the participants, although this presents a major challenge to public blockchain systems.⁴⁶ One of the major obstacles to exploring blockchain systems from a private law perspective appears to result from the role of smart contracts, algorithmic processes, which control data storage processes and trigger new applications once a transaction is verified. After Lawrence Lessig proclaimed that ‘code is law’,⁴⁷ blockchain technology and supporting algorithmic processes apparently rule out any subsequent challenge of these processes in court. There seems to be no room for principal-agent analysis, as smart contracts are deemed to be efficient.⁴⁸ The digitalisation of contracting and decision-making challenge the belief that there is still room for (private) law and its classic mix of mandatory and default rules.⁴⁹ The Court of Justice of the

⁴⁰ *Ibid.*

⁴¹ *Ibid.*

⁴² See Monetary Authority of Singapore (MAS), “MAS clarifies regulatory position on the offer of digital tokens in Singapore”, Press Release (1 August 2017), online: MAS <<https://www.mas.gov.sg/news/media-releases/2017/mas-clarifies-regulatory-position-on-the-offer-of-digital-tokens-in-singapore>> [*Monetary Authority of Singapore*].

⁴³ See section III.B.2 (below); on the Liechtenstein law on tokens, see Government of the Principality of Liechtenstein, “Bericht und Antrag der Regierung an den Landtag des Fürstentums Liechtenstein betreffend die Schaffung eines Gesetzes über Token und VT- Dienstleister (Token- und VT-Dienstleister-Gesetz; TVTG) und die Abänderung weiterer Gesetze”, Nr 54/2019 (May 2019), online: <<https://www.regierung.li/media/attachments/BuA-TVTG-18042019-CLEAN-636942017742518511.pdf?t=637174267105496317>> [*Liechtenstein government report*].

⁴⁴ Cf R Villarraig & C Pastors Sempere, *Blockchain: Aspectos Tecnológicos, Empresariales y Legales* (Arranzadi, Cizur Menor: Thompson Reuters, 2018) at 89 *et seq.*

⁴⁵ See G Patrick & A Bana, “Rule of Law Versus Rule of Code: A Blockchain-Driven Legal World” (2017) International Bar Association Legal Policy & Research Unit Legal Paper, at 27, online: <<https://www.ibanet.org/Document/Default.aspx?DocumentUid=73B6073F-520D-45FA-A29B-EF019A7D7FC9>>; J Frankenreiter, “The Limits of Smart Contracts” 175 JITE 149 at 153 *et seq.* (on the limited potential of using decentralised smart contracts for enforcing obligations); for a less pessimistic perspective: M Clément, “Smart Contracts and the Courts: Coding Contractual Commitments” in *Cambridge Handbook*, *supra* note 20, 271 at 276 *et seq.*

⁴⁶ S Rajagopalan, “Blockchain and Buchanan: Code as Constitution” in Richard E Wagner, ed, *James M. Buchanan—A Theorist of Political Economy and Social Philosophy* (Cham: Palgrave Macmillan, 2018) 359 at 373. See *supra* note 38.

⁴⁷ L Lessig, *Code: Version 2.0* (New York: Basic Books, 2006) at 5, 77 *et seq.*

⁴⁸ Cf Filippi, *supra* note 1 at 74 *et seq.*

⁴⁹ See the approach chosen by K Werbach & N Cornell, “Contracts *Ex Machina*” (2017) 67 Duke LJ 102 at 162 *et seq.*; and the argument by J Nida-Rümelin & N Weidenfeld, *Digitaler Humanismus: Eine Ethik für das Zeitalter der Künstlichen Intelligenz*, 2d ed (München: Piper Verlag, 2018) at 73 *et seq.*, in favour of a limitation to digitising economic processes.

European Union (“CJEU”) has indicated that judges are nonetheless prepared to examine who is best qualified to control the risks of digitalisation and to protect consumer interests.⁵⁰ Moreover, the application of mandatory law cannot be frustrated by algorithmic processes.⁵¹

In an attempt to re-enforce the contractual elements of permissionless blockchain systems, practitioners have proposed the notion of a ‘governed blockchain’ which is to engender both legal certainty and flexible dispute settlement mechanisms.⁵² ‘Governed blockchains’ are intended to supply a legal framework to permissionless blockchains.⁵³ In subscribing to the protocol, in downloading the relevant software, any user of the blockchain will accept its so-called constitution.⁵⁴ Transactions undertaken via the blockchain will only be registered in the distributed ledger as valid if they carry a reference to that ‘constitution’.⁵⁵ Apart from imposing duties for cooperative behaviour towards the other participants of the blockchain, the ‘constitution’ provides for a choice of law clause in order to reduce uncertainty in cross-border scenarios.⁵⁶ Moreover, the ‘constitution’ is to prescribe the legal value of smart contracts, from both a substantive and an evidentiary perspective. Sanctions are envisaged irrespective of whether actual monetary damage has occurred.⁵⁷ The ‘constitution’ may also provide for mechanisms to amend its provisions.⁵⁸ It does not necessarily dispense with courts, but stipulated dispute settlement mechanisms are to overcome potential difficulties with enforcing smart contracts.⁵⁹ Thus, interpretive problems with smart contracts inadequately translating business agreements or practices into digital language shall be solved by arbitration.⁶⁰ The principles of the ‘blockchain constitution’ as proposed by practitioners should also qualify for application to permissioned or private blockchains. But permissioned blockchain systems in finance add a qualification for identifying customers. Admission depends on the completion of know-your-customer or know-your-business procedures.⁶¹

⁵⁰ See joint cases *Pommer v Reederei Karl Schlüter GmbH & Co KG*, C-585/08, [2010] ECR I-12527; and *Hotel Alpenhof GesmbH v Oliver Heller*, C-144/09, [2010] ECR I-12527. However, damages will be the only realistic remedy: *Paech*, *supra* note 38 at 1096.

⁵¹ See *Paech*, *supra* note 38 and O Borgogno, “Usefulness and Dangers of Smart Contracts in Consumer Transactions: Facilitating Enforcement of Rights through Smart Contracts” in *Cambridge Handbook*, *supra* note 20, 288 at 296 *et seq* (on promoting consumer protection through smart contracts).

⁵² Norton Rose Fulbright, *Legal analysis of the governed blockchain*, online: Norton Rose Fulbright <https://www.nortonrosefulbright.com/-/media/files/nrf/nrfweb/imported/emea_4957_online-publication-and-pdf_legal-analysis-of-the-governed-blockchain_v4.pdf?la=en&revision=c15aa8eb-48d5-4d06-8851-8226bdb1145f> [*Legal analysis of the governed blockchain*].

⁵³ *Ibid* at 2. See on the importance of ‘off-chain governance’ for public blockchains: *Mik*, *supra* note 22, at 169 *et seq*.

⁵⁴ *Legal analysis of the governed blockchain*, *supra* note 52 at 3-6.

⁵⁵ *Ibid* at 2.

⁵⁶ *Ibid* at 7.

⁵⁷ *Ibid* at 8-9.

⁵⁸ *Ibid* at 9.

⁵⁹ *Legal analysis of the governed blockchain*, *supra* note 52 at 10.

⁶⁰ See *Clément*, *supra* note 45 at 279, 285.

⁶¹ T Swanson, *Consensus-as-a-service: a brief report on the emergence of permissioned, distributed ledger systems* (6 April 2015), online: Great Wall of Numbers <<http://www.ofnumbers.com/wp-content/uploads/2015/04/Permissioned-distributed-ledgers.pdf>>.

B. Litigation

1. Mt Gox

Electronically stored signals and digital assets are essentially by-products of private ordering. The focus on commodification aspects demonstrates that courts are beginning to struggle with the legal status of blockchain-related contracts and their protection from third-party interference.⁶² The Japanese Mt Gox case is both illustrative and exemplary for its implications on conferring property law status on bitcoin, virtual currencies and digital assets. Closer inspection suggests that the Mt Gox scenario also calls for an analysis of its law of contract foundations.

Mt Gox was a Japanese online exchange, owned by its major shareholder who had played a major role in assuring the public that investments in the exchange were safe.⁶³ Mt Gox went bankrupt in 2014 after it had suffered two hacks which led to the theft of more than 850,000 bitcoins.⁶⁴ When Mt Gox was operative, investors would deposit fiat currencies and bitcoins with the exchange, which would use these deposits to buy and sell bitcoins to other users.⁶⁵ These transactions were undertaken via blockchains and distributed ledgers. Although the exchange never acquired any legal title to the cryptocurrency, it had knowledge of the private key of the 'owners' of bitcoins in order to engineer financial transactions on behalf of its users.⁶⁶ The exchange automatically transferred virtual and real money to the accounts of the individual user which resulted in a 'bitcoin balance'.⁶⁷ Under the blockchain and distributed and ledger technology operated by the exchange, transactions would be recorded on the ledger, but digital value would not be stored on the exchange's ledgers.⁶⁸

As a consequence of the hack, the users of the exchange could no longer gain access to their accounts. They suffered the (financial) loss of their bitcoins, and initiated proceedings before the Tokyo District Court, arguing that as owners of the virtual currency they could exercise their right of segregation from the bankruptcy estate of

⁶² For a survey of blockchain litigation and the obstacles to protecting investors' interests: N Webster & A Charfoos, "How the Distributed Public Ledger Affects Blockchain Litigation" (2018) 37:1 Banking & Financial Services Policy Report 6 at 7 *et seq*; see also *ter Haar*, *supra* note 11 at 222 *et seq*, on whether cryptocurrencies are part of the insolvency estate.

⁶³ See the factual analysis in *Greene v Karpeles*, 2019 WL 1125796 (N D Ill, 2019).

⁶⁴ W Zhao, *Mt Gox Creditors Are Preparing to Claim for Bitcoin Repayments* (3 August 2018), online: Coindesk <<https://www.coindesk.com/mt-gox-creditors-are-preparing-to-claim-for-bitcoin-repayments>>; I Kokorin, *'Hacked' insolvencies of crypto exchanges* (5 July 2018), online: (blog) <<https://leidenlawblog.nl/articles/hacked-insolvencies-of-crypto-exchanges>>.

⁶⁵ See J Redman, "Japanese Bank Mizuho Sued by Mt Gox Customer" *Bitcoin News* (2 August 2018), online: Bitcoin News <<https://news.bitcoin.com/japanese-bank-mizuho-is-being-sued-by-a-mt-gox-customer/>>.

⁶⁶ District Court, Tokyo, 5 August 2015, (2014 (Wa) 33320) (Japan), Reference number 25541521 (English translation commissioned by the Digital Assets Project Harris Manchester College, Oxford, online: <https://www.law.ox.ac.uk/sites/files/oxlaw/mtgox_judgment_final.pdf> [*Tokyo District Court judgment*]).

⁶⁷ *Tokyo District Court judgment*, *ibid* and L Gullifer, M Hara & C Moony, *English Translation of the Mt Gox judgment on the legal status of bitcoin prepared by the Digital Assets Project* (6 February 2019), online: Oxford Law Faculty <<https://www.law.ox.ac.uk/research-subject-groups/commercial-law-centre/blog/2019/02/english-translation-mt-gox-judgment-legal>>.

⁶⁸ *Ibid*.

Mt Gox.⁶⁹ This approach faced several obstacles under traditional Japanese property law doctrine. Tangible assets qualify for ownership, but this does not include the ownership of personal rights (*ie*, to cryptocurrencies).⁷⁰ After rejecting the ownership argument,⁷¹ the Tokyo court went to address the plaintiffs' claim for proprietary restitution which Japanese bankruptcy law recognises for intangible assets (*eg*, intellectual property rights and receivables).⁷² In the context of cryptocurrencies such a claim is predicated, however, on the ability to exert exclusive control over what is stored on the blockchain. The Tokyo District Court thought that current blockchain technology relies on interference of third parties, and hence excludes exclusivity.⁷³ It would seem, though that the current practice of private keys and accounts with blockchains would in fact allow for exclusive control.⁷⁴ Although Japan has legislated for business trusts,⁷⁵ the court did not examine whether Mt Gox had assumed the role of a trustee with respect to the account-holders.⁷⁶ At a later stage in 2018, the Tokyo District Court stayed insolvency proceedings against Mt Gox, ordering the commencement of civil rehabilitation proceedings which would allow creditors to pursue their contractual claims (including damages).⁷⁷ In May 2019, Japan adopted a law defining cryptoassets *inter alia* as a proprietary value transferred via a data processing system.⁷⁸

Prior to the commencement of the rehabilitation proceedings in Tokyo, disenchanted investors pursued several (foreign) liability strategies in order to recoup the value of some of their lost bitcoins. At least one (non-US) financial institution had continued to accept investor money which it deposited with Mt Gox although it had been aware that the bitcoin exchange was experiencing problems due to a hack.⁷⁹ US district courts were prepared to accept jurisdiction over the foreign bank if it had purposefully directed its business at the US and a US-based investor had made deposits with the bank.⁸⁰ These deposits were to be transferred to

⁶⁹ *Tokyo District Court judgment*, *supra* note 66.

⁷⁰ K Takahashi, "Cryptocurrencies entrusted to an exchange provider: Shielded from the provider's bankruptcy?" in Charles Hugo, ed, *Annual Banking Law Update 2018: Recent Legal Developments of Special Interest to Banks* (Cape Town: Juta and Company (Pty) Ltd, 2018) 1 at 3 *et seq* [Takahashi].

⁷¹ *Tokyo District Court judgment*, *supra* note 66.

⁷² See Takahashi, *supra* note 70 at 4 *et seq*.

⁷³ *Ibid* at 5 *et seq*. See Japan Times, "Bitcoins lost in Mt Gox debacle 'not subject to ownership' claims: Tokyo court" *Japan Times* (6 August 2015), online: Japan Times <<https://www.japantimes.co.jp/news/2015/08/06/national/crime-legal/bitcoins-lost-in-mt-gox-debacle-not-subject-to-ownership-claims-tokyo-court-rules/>>.

⁷⁴ Takahashi, *supra* note 70 at 5 *et seq*.

⁷⁵ *Trust Business Act*, 2004 (Japan), Act No 154 of 2004 (English translation available at <http://www.japaneselawtranslation.go.jp/law/detail/?id=3305&vm=04&re=02>).

⁷⁶ Takahashi, *supra* note 70 at 8 *et seq*.

⁷⁷ Tokyo District Court, *Announcement of Commencement of Civil Rehabilitation Proceedings* (22 June 2018) at 1 (English translation available at https://www.mtgox.com/img/pdf/20180622_announcement_en.pdf).

⁷⁸ K Kawai & T Nagase, "The Virtual Currency Regulation Review – Edition 2: Japan" *The Law Reviews* (September 2019), online: The Law Reviews <<https://thelawreviews.co.uk/edition/the-virtual-currency-regulation-review-edition-2/1197588/japan>>.

⁷⁹ See the analysis of the banking relationship between Mt Gox and the Japanese Mizuho Bank: *Carmel v Mizuho Bank, Ltd*, 2018 WL 6982840 (C D Cal, 2018)

⁸⁰ *Greene v Mizuho Bank, Ltd*, 169 F Supp (3d) 855 (N D Ill, 2016) at 861 *et seq*; *Carmel v Mizuho Bank, Ltd*, 2018 WL 6982840 (C D Cal, 2018) [*Carmel*]

Mt Gox.⁸¹ It appears that the crucial element is investor reliance on the bank's statements and an actual online deposit with the transferring bank.⁸² In a comparable case, a digital currency depositor tried to implicate an online exchange with respect to a scam in which a hacker had succeeded in stealing money from his \$-account: the depositor alleged that the exchange had failed to avert the scam.⁸³ Ultimately, this assumes an organisational duty of the exchange to undertake an *ex ante* scrutiny of its online services to protect depositors' interests. If an exchange is made aware of hacked passwords due to criminal interference, it may be held liable for damages if it does not take appropriate action.⁸⁴

Nonetheless, a contract-based argument will encounter difficulties if a blockchain-based investment system is based on a network of interrelated contracts which go beyond the 'blockchain constitution'.⁸⁵ In a case of data breach in a network of payment card contracts a US district court has relegated the party to the specific contract, rejecting a duty to maintain data security standards arising under a network of independent, but interrelated contracts.⁸⁶ Consequently, in suing Mt Gox's partner bank, US investors resorted to tort law, claiming that the bank had tortiously interfered with their contractual relationship with the Japanese exchange.⁸⁷ 'Tortious interference' was the only possibly venue to implicate the bank in a scenario which was marked by network of legally independent, but interrelated contracts.⁸⁸ On the other hand, creditors have to acknowledge that such a non-proprietary claim will leave them worse off in an insolvency scenario.

2. Tortious interference with a contract and the French concept of *opposabilité*

It is common ground that contractual relationships operate on the basis of relativity. Hence, they do not generate *erga omnes* effects. Current practice in the financial industry confirms that even registration of digital asset on a distributed ledger does not automatically engender a property-like status.⁸⁹ Nonetheless, the increasing use of blockchain technology raises the question whether a blockchain-related contract or network of blockchain-related contracts may obtain protection from the law even if legislators shy away from statutory commodification projects.⁹⁰ In this context, the

⁸¹ *Carmel*, *supra* note 80.

⁸² See also *Pearce v Mizuho Bank, Ltd*, 2018 WL 4094812 (E D Penn, 2018).

⁸³ See *Sultan v Coinbase, Inc*, 354 F Supp (3d) 156 (E D N Y, 2019) at 158 *et seq* (case not decided on the merits due to arbitration clause).

⁸⁴ See *Asa v Verizon Communications, Inc*, 2017 WL 5894543 (E D Tenn, 2017): stolen password for accessing telecommunications facilities (not decided on the merits due to arbitration clause).

⁸⁵ See section II.A (above).

⁸⁶ *Bellwether Community Credit Union v Chipotle Mexican Grill, Inc*, 353 F Supp (3d) 1070 (D Colo, 2018) at 1084 *et seq*.

⁸⁷ *Greene et al v Mizuho Bank, Ltd*, 206 F Supp (3d) 1362 (N D Ill, 2016) at 1370 *et seq* [*Greene et al v Mizuho*].

⁸⁸ See also the facts in *Investment Partners, LLC v Coinlab, Inc et al*, 2013 WL 5926111 (S D N Y, 2013).

⁸⁹ See section III.B (below).

⁹⁰ See N Dreyfus, *La blockchain face au droit* (23 January 2017), online: Village de la Justice <<https://www.village-justice.com/articles/blockchain-face-droit,24049.html>>; and Olivier Senot, *L'archivage blockchain "à vocation probatoire" au service de la dématérialisation* (10 October 2017), online: (blog) <<https://www.archimag.com/demat-cloud/2017/10/10/archivage-blockchain-valeur-probatoire>>.

application of tort law principles might operate as to raising the threshold for interfering with blockchain-related contracts. Financial intermediaries channelling investor money into a blockchain-based exchange for virtual currencies may be faced with a claim for tortious interference if they have not adequately protected their customers from hacking distributed ledgers or digital asset storage devices.⁹¹

Historically, common law principles on tortious interference with contracts sought to protect contractual relationships from interference by third parties.⁹² Modern US applications of tortious interference focus on acts, constituting a tort themselves, actions inducing breach of fiduciary duties, misuse of economic power or retaliatory activities.⁹³ Other common law jurisdictions are taking a more restrictive approach.⁹⁴ English law recognises damages for intentionally causing economic loss. But liability for unlawful interference will only arise if unlawful means have been used for interfering with a contract with the intention to create damage.⁹⁵ In a network of blockchain-related contracts it is unlikely that a financial institution will actively cooperate to induce damage to its customers. If, however, tort law doctrine were to condition tortious interference only on intentional conduct frustrating promised performance under a contract, a claim for interfering with a contract on digital assets might succeed.⁹⁶

French law recognises the relativity of contracts, but allows nonetheless for third party effects so that certain contracts may generate *erga omnes* effects.⁹⁷ Contracts on absolute subjective rights have third party effects.⁹⁸ Thus creditors' rights emanating from a contract with a debtor may not be interfered with.⁹⁹ Likewise, contracts for the rent of a realty or an apartment generate exclusionary right with respect to third parties.¹⁰⁰ French legislative practice suggests that blockchain contracts as such are incapable of generating *erga omnes* effects. In 2017, the French National Assembly passed a law recognising that contracts concluded via a blockchain system for the acquisition of minibonds were 'opposable', and hence capable of creating *erga omnes* effects with respect to third parties.¹⁰¹ In 2018, French law authorised the use of tokens.¹⁰² As far as tokens are issued for financing an initial coin offering, they

⁹¹ See the claim in *Greene et al v Mizuho*, *supra* note 87 at 1370 *et seq.*

⁹² See J Danforth, "Tortious Interference with Contract: A Reassertion of Society's Interest in Commercial Stability and Contractual Integrity" (1981) 81 *Columbia Law Review* 1491 at 1494 *et seq.*; *Restatement (Second) of Torts* §766 (1977).

⁹³ DB Dobbs, "Tortious Interference with Contractual Relationships" (1980) 34 *Arkansas Law Review* 335 at 365 *et seq.*

⁹⁴ For a comprehensive analysis see B Donovan, "Intentionally Inflicted Economic Harm in Canada" (2010) 68 *University of Toronto Faculty of Law Review* 9 at 17 *et seq.*

⁹⁵ For a survey over economic torts: Carty, Hazel, "The Economic Torts in the 21st Century" (2008) 124 *LQR* 641 at 642 *et seq.*; B Ong, "Two tripartite economic torts" (2008) 8 *JBL* 723 at 725 *et seq.*

⁹⁶ See PW Lee, "Inducing Breach of Contract, Conversion and Contract as Property" (2009) 29:3 *OJLS* 511 at 523 *et seq.*

⁹⁷ R Wintgen, *Étude critique de la notion d'opposabilité: Les effets du contrat à l'égard des tiers en droit français et allemand* (Paris: LGDJ, 2004) at 83 *et seq.*

⁹⁸ *Ibid* at 121 *et seq.*

⁹⁹ Cf J Duclos, *L'opposabilité: essai d'une théorie générale* (Paris: LGDJ, 1984) at 175 *et seq.*

¹⁰⁰ See M Levis, *L'opposabilité du droit réel: De la sanction judiciaire des droits* (Paris: Economica, 1989) at 237 *et seq.*

¹⁰¹ See art 2 of the Ordonnance n° 2016-520 of 28 April 2016 relative aux bons de Caisse, JORF n°0101 of 29 April 2016.

¹⁰² On tokens, see section III (below).

are capable of obtaining the status of a tradable commodity.¹⁰³ Nonetheless, the very listing of a tokenised security does not automatically turn it into a financial instrument.¹⁰⁴

3. B2C2 Ltd v Quoine Pte Ltd—*The common law perspective*

In *B2C2 Ltd v Quoine Pte Ltd*, the Singapore International Commercial Court was faced with a virtual currency trading platform which had reversed electronic trades after it had considered the exchange rate as in conflict with actual market rates (“*Quoine I*”).¹⁰⁵ The business model of defendant Quoine Pte Ltd (“Quoine”) resembles the Mt Gox scenario.¹⁰⁶ Quoine operates a currency exchange platform where third parties can buy and sell virtual currencies for other virtual currencies or national fiat currencies.¹⁰⁷ In order to record orders from traders, Quoine relies on blockchain technology.¹⁰⁸ An electronic ledger registers all orders for buying or selling a virtual currency in exchange for a virtual or fiat currency. Quoine accepts orders for spot trading with instant settlement of the transaction or margin trading on the basis of borrowed funds, provided that a certain threshold is observed.¹⁰⁹ Funds deposited by traders were kept in a single cryptocurrency wallet, owned and managed by Quoine separately from its own assets. Thus, members (*ie* traders) of the platform would not keep their currencies in online wallets.¹¹⁰

B2C2, the plaintiff, had opened an account online with Quoine’s platform. The plaintiff accepted Quoine’s Terms and Conditions. Later, Quoine had uploaded a Risk Disclosure Statement which provided for certain corrective action to be taken by the platform. In April 2017, B2C2 concluded a series of sales of Ethereum against Bitcoins and the proceeds were automatically credited to its accounts. The transactions were a clear case of blockchain technology, smart contracts and artificial intelligence put to work. There was no human intervention. A day later, Quoine realised that the transactions had been undertaken at abnormally high exchange rates and reversed the transactions. During court proceedings evidence was adduced that Quoine’s ‘quoter programme’¹¹¹ had been inactive due to an oversight in the system. This had resulted in an artificial shortage of currency and liquidity from other exchanges so that prices were driven up. There was no doubt about the beneficiaries of the currency transactions as they were holders of individual currency accounts.

¹⁰³ See the legal analysis offered by the French Autorité des Marchés Financiers (AMF), Caroline Le Moign, *ICO Françaises: Un Nouveau Mode de Financement?* (November 2018) at 6, online: AMF <<https://www.amf-france.org/Publications/Lettres-et-cahiers/Risques-et-tendances/Archives?docId=workspace%3A%2F%2FSpacesStore%2F27604d2f-6f2b-4877-98d4-6b1cf0a1914b>>; and the preparatory report by the French government, France Stratégie, Rapport du groupe de travail présidé par J Toledano, *Les enjeux de blockchains* (June 2018) at 92, online: France Stratégie <<https://www.strategie.gouv.fr/sites/strategie.gouv.fr/files/atoms/files/fs-rapport-blockchain-21-juin-2018.pdf>> [AMF, *ICO Françaises*].

¹⁰⁴ AMF, *ICO Françaises*, *ibid*.

¹⁰⁵ *Quoine I*, *supra* note 10.

¹⁰⁶ See section II.B.1 (above).

¹⁰⁷ *Quoine I*, *supra* note 10 at para 1 *et seq*.

¹⁰⁸ See Annex 2 to *Quoine I* (“the Risk Disclosure Statement”).

¹⁰⁹ *Quoine I*, *supra* note 10 at para 15 *et seq*.

¹¹⁰ *Ibid* at para 139.

¹¹¹ For details of the Quoter Programme see *Quoine I*, *supra* note 10 at para 18.

As B2C2 sought to recover its purchased (virtual) currencies or, alternatively, claim damages, the court had to determine the nature of the contractual relationships with the platform.¹¹² The court noted a multitude of contracts as the general framework contract with the platform is supplemented by contractual relationships arising from individual transactions.¹¹³ This includes a pure trading contract between the buyer and seller, and margin contracts when an element of lending is involved to finance the currency transaction. Basically, Quoine's defence rested on two prongs.¹¹⁴ It argued that the doctrine of unilateral mistake was applicable, since the situation was allegedly engineered by one of B2C2's representatives. However, if a unilateral mistake could not be established, the owner of the platform had nonetheless the right to reverse 'abnormal' transactions.

Although the decisive currency transactions had been made by robotic processes without any human intervention, the court insists on requiring a mental element in the analysis of algorithmic processes. The court expressly refers to the programmer's mindset when the relevant software programme or a relevant part thereof was written for the trading company.¹¹⁵ Cross-examination did not establish that the programmer had designed the software for exploiting the errors of others. This led the defendant to argue that courts should treat algorithmic processes and computers employed for concluding online contracts as agents of their human masters.¹¹⁶ The upshot of this submission is that programmers in writing a software programme should also consider factual scenarios which might arise under the absence from computers. The court rejects this argument by making a risk-related observation. The parties had opted for computerised trading contracts, acknowledging the absence of any human interference. Thus, "... the relevant mistake must be a mistake by a person on whose behalf the computer placed the order as to the terms on which the computer was programmed to form a Trading contract in relation to that order". The court expressly refrains from extending these conclusions to a factual setting "where the computer ... is creating artificial intelligence and could therefore be said to have a mind of its own".¹¹⁷ This observation may well open the floodgates for an analytical approach where responsibility for a combination of blockchain technology, smart contracts and artificial intelligence may have to lie with the beneficiary of the technology.¹¹⁸

The judgment of the Singapore International Commercial Court adds substance to the law of blockchains by applying a law of contracts analysis. Its reasoning can also be read as an invitation to flesh out a detailed regime of duties owed by those who organise a platform, write the underlying software programmes and create negative externalities of a platform. According to the court, platforms for trading in virtual

¹¹² For the plaintiff's claim, see *Quoine I*, *supra* note 10 at para 133 *et seq.*

¹¹³ *Ibid* at para 126 *et seq.*

¹¹⁴ *Ibid* at para 147 *et seq.*

¹¹⁵ *Ibid* at para 206 *et seq.*

¹¹⁶ *Ibid* at para 200 *et seq.*

¹¹⁷ *Ibid* at para 206.

¹¹⁸ The Court's emphasis on a mental element and the parties' mindset might be read as an application of the common law doctrine of *consensus ad idem* (see *United Dominions Trust Ltd v Western* [1976] QB 513 at 519 *et seq.* (CA)). It would seem, though, that the Court was trying to avoid a statement on the legal complexity of machines implementing contracts (see also the analysis by CC Nicoll, "Can computers make contracts?" [1998] JBL 35 at 36 *et seq.* and the foreseeability assessment by Curtis EA Karnow, "The application of traditional tort theory to embodied machine intelligence" in Calo, Fromkin & Kerr, eds, *Robot Law* (Cheltenham: Edward Elgar Publishing, 2016) 51 at 75 *et seq.*

currencies may change the contractual framework by posting an amendment on the website.¹¹⁹ In *concreto*, however, the terms of the amendments were insufficient. Quoine was not entitled to reverse the currency transactions. Moreover, as Quoine had removed the B2C2 funds it was also found to be in breach of trust.¹²⁰ On appeal, the Singapore Court of Appeal rejected the trust reasoning (“*Quoine I*”).¹²¹ The *Quoine II* court declined to decide under what circumstances cryptocurrencies can be accommodated in property law: Storage of bitcoins in cold storage wallets did not amount to a segregation of assets, hence there were no funds to be held in trust.¹²² This ushers in an analysis of under what circumstances digital signals attain the status of an asset administered by a trust.

III. FROM DIGITAL SIGNALS TO ASSETS

A. Quoine and Property Law

Virtual currencies and associated rights are the creatures of private contracting. The commodification of contracts on virtual currency transactions demonstrates that there is a market for virtual currencies. The market demand for commodification forces capital market authorities to decide whether investors in non-physical, quasi-corporate schemes qualify for protection by mandatory law. The United Kingdom Financial Conduct Authority (“UK FCA”) focuses on contractual arrangements and investors’ rights thereunder, including ownership, in order to assess whether cryptoassets qualify as a specified investment.¹²³ This seems to suggest that the law of contracts and a property law informed approach towards modern electronic trading determine whether the application of capital market regulation will be triggered. It also invites an analysis on whether the commodification of digital signals or digital assets is conditioned on attaining property-like status.

Cryptocurrencies and digital information stored on distributed ledger are difficult to reconcile with traditional categories of personal property under English law.¹²⁴ They are neither choses in possession nor do they qualify as choses in action. Moreover, information stored on a distributed ledger does not constitute property.¹²⁵ In *Your Response Ltd v Datateam Business Ltd* the English Court of Appeal denied a common law possessory lien over a computer data base, as the underlying contract did not envisage an obligation for the data manager to provide “a copy of the data base in its latest form”.¹²⁶ The *Quoine I* court attempts to bridge the gap between a purely contractual perspective of towards blockchain technology and a property law informed approach by classifying electronic currencies as intangible property with an identifiable value. From a comparative law perspective, the court’s reasoning is

¹¹⁹ *Quoine I*, *supra* note 10 at para 171.

¹²⁰ *Ibid* at para 253.

¹²¹ *Quoine II*, *supra* note 10.

¹²² *Ibid* at paras 144, 146.

¹²³ UK Financial Conduct Authority, *Guidance on Cryptoassets*, Consultation Paper CP19/3 (January 2019), online: <<https://www.fca.org.uk/publication/consultation/cp19-03.pdf>> [UK FCA].

¹²⁴ D Fox, in *Fox & Green*, *supra* note 26 at 6.28 *et seq*.

¹²⁵ See L Sagar, *The Digital Estate* (London: Sweet & Maxwell Thompson Reuters, 2018) at paras 4-01 *et seq*, 4-57 *et seq* [Sagar].

¹²⁶ [2014] EWCA (Civ) 281 at para 33.

highly instructive as it reveals how digital signals, stored on a distributed ledger, may enjoy legal protection with *erga omnes* effects. The court invokes recent law on electronic trading which recognises a third category of personal property, *ie*, intangible property.¹²⁷ On the other hand, the appellate decision in *Quoine II* is reminiscent of the approach chosen by the Tokyo District Court in the Mt Gox case. Although current blockchain technology allows for exclusive control, the Japanese court thought that the (assumed) interference of third parties excluded separability of electronic assets stored on a ledger.¹²⁸

In a search and seizure case under the Fourth Amendment to the US Constitution, the US Supreme Court has noted that state legislators and state courts have come to recognise that a digital record may constitute intangible property: this finding is based either on specific codifications¹²⁹ or an interpretation of common law principles.¹³⁰ Under New York law, electronic documents and records stored on a computer can be converted into paper form and hence, qualify as intangible property.¹³¹ In determining whether an “identifiable thing of value”¹³² constitutes intangible property, the *Quoine I* court relies on the classic test, formulated by Lord Wilberforce in *National Provincial Bank v Ainsworth*.¹³³ to qualify as a property right, “it must be definable, identifiable by third parties, capable in its assumption by third parties, and have some degree of permanence of stability”.¹³⁴ Based on this test, courts have recognised textile export quotas¹³⁵ and a waste management licence¹³⁶ as property.

*Armstrong DLW GmbH v Winnington Networks Ltd*¹³⁷ dealt with a proprietary restitutionary claim in the context of a fraudulent transfer of carbon emission allowances under EU law. The court noted that carbon emission allowances exist only in electronic form.¹³⁸ EU law allows for the transfer of allowances on what the

¹²⁷ See on intangible personal property other than choses in action: Fox & Green, *supra* note 72 at 6.32 *et seq.*

¹²⁸ See *supra* note 72 and accompanying text.

¹²⁹ See, *eg* *Stored Communications Act* 18 USC §2701 (1986) *et seq* and the definition in the Texas Property Code Ann §111.004 (12).

¹³⁰ *Carpenter v United States*, 138 SC 2206 (2018) at 2270, referring to *Ajemian v Yahoo! Inc*, 478 Mass 169 (2017) at 170: “... decedent’s electronic mail (e-mail) account: Such an account is a form of property often referred to as a “digital asset.”; and to *Eysoldt v ProScan Imaging*, 194 Ohio App (3d) 630 at 639 (Ohio App 1st Dist, 2011). See also survey by Sagar, *supra* note 125 at para 4-28 *et seq* and paras 4-43 (commenting on New York common law) and 4-54.

¹³¹ *Thyroff v National Mutual Insurance Company*, 8 NY (3d) 283 at 292 (N Y App, 2007): “We cannot conceive of any reason in law or logic why this process of virtual creation should be treated any differently from production by pen on paper or quill on parchment.”; and comment by Sagar, *supra* note 125 at para 4-42.

¹³² *Quoine I*, *supra* note 10 at para 142.

¹³³ *Ibid.*

¹³⁴ *National Provincial Bank v Ainsworth* [1965] 1 AC 1175 at 1248 (HL).

¹³⁵ *Attorney-General of Hong Kong v Nai-Keung* [1987] 1 WLR 1339 at 1341 *et seq* (PC) (theft of textile export quotas).

¹³⁶ *Re Mineral Resources Ltd* [1999] BCC 422 at 423 *et seq* (Neuberger J) (property for the purposes of insolvency law) (Ch D) [*Mineral Resources*]; *In re Celtic Extraction* [2001] Ch 475 at 478 *et seq* (CA) [*Celtic Extraction*].

¹³⁷ [2013] Ch 156 (Ch D) [*Armstrong*]. For a detailed analysis of the case: Sagar, *supra* note 125 at para 4-78 *et seq.*

¹³⁸ *Armstrong*, *ibid* at 157.

court describes as an active market for trading.¹³⁹ Each carbon emission allowance is identifiable by its unique number.¹⁴⁰ The court does not classify emission allowances as choses in action. Nonetheless, it confers the status of ‘intangible property’ on them.¹⁴¹ Obviously, a carbon emission allowance represents a digital token, similar to financial digital cryptographic tokens.¹⁴² In applying existing case law to the carbon allowances case, the court accepted that there has to be a statutory framework establishing an entitlement which has some market value.¹⁴³ The *Quoine I* decision of the Singapore International Commercial Court goes one step further. It applies Lord Wilberforce’s test, but does not enquire about the statutory basis of a possible entitlement to virtual currencies or digital assets.¹⁴⁴ The Singapore court appears to combine the liberal approach of US courts with the contract-informed interpretation of the UK FCA.¹⁴⁵ Digitally stored virtual currencies are capable of commodification with status of intangible property (and, hence, an asset administered by a trust), depending on their identifiability, marketability, and the underlying network of contracts. Civil law jurisdictions will have to choose a different regulatory path to recognise such commodification developments, as they do not normally see intangible property as property.¹⁴⁶

B. Tokenisation and Blockchain Statutes

1. *The state of art*

The *Quoine I* judgment appears to endorse property law status for any digital commodity or any token. A token stands for the contractual right to receive a quasi-dividend; it also stands for the underlying value which the investor has invested.¹⁴⁷ Tokens can be supported by underlying physical or digital assets.¹⁴⁸ They can be used for payment purposes, for trading value, but they also stand for investment

¹³⁹ *Ibid.* See also art 1 of the EC Directive 2003/87/EC of 13 October 2003, establishing a scheme for greenhouse gas emission allowance trading within the Community and amending Council Directive 96/61/EC, [2003] OJ, L 275/32.

¹⁴⁰ See *Mineral Resources* and *Celtic Extraction*, *supra* note 136.

¹⁴¹ *Ibid.*

¹⁴² *Sagar*, *supra* note 125 at para 4-85.

¹⁴³ See analysis by *Sagar*, *ibid.*

¹⁴⁴ *Quoine I*, *supra* note 10 at paras 142-143.

¹⁴⁵ A similar approach is chosen by *Sagar*, *supra* note 125 at para 4-95.

¹⁴⁶ This has not stopped some courts from including bitcoins in the debtor’s insolvency estate: see *Rechtbank Amsterdam* (Amsterdam District Court), judgment of 14 February 2018 (C/13/642655 FT RK 18.196), online: Rechtspraak <<https://uitspraken.rechtspraak.nl/inziendocument?id=ECLI:NL:RBAMS:2018:869>>. See also: the judgment of the Russian 9th Arbitration Court of Appeals, judgment of 7 May 2018 at *Russia: Court Rules Bitcoin is Property in Landmark Bankruptcy Case*, online: Bitcoinist <<https://bitcoinist.com/russiancourt-rules-bitcoin-property/>>; South Korean Supreme Court, judgment of 30 May 2018 at *South Korean Supreme Court Rules Bitcoin Is an Asset*, online: NASDAQ <<https://www.nasdaq.com/articles/south-korean-supreme-court-rules-bitcoin-asset-2018-06-05>> (bitcoin seized in their capacity as fruits of a crime). See also the comment by *ter Haar*, *supra* note 10 at 222 *et seq.*

¹⁴⁷ J Hargrave, N Sahdev & O Feldmeier, “How Value is Created in Tokenized Assets” (5 May 2018), online: SSRN <https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3146191>.

¹⁴⁸ See *Monetary Authority of Singapore*, *supra* note 42.

purposes.¹⁴⁹ Each token-related transaction will be recorded by blockchain technology. More sophisticated schemes will combine blockchain technology with smart contracts and artificial intelligence.¹⁵⁰

Tokens have become an instrument for digital transactions on financing investment schemes, building on quasi-corporate structures without the establishment of a traditional corporate body:¹⁵¹ initial coin offerings and investments in decentralised autonomous organisations combine the flexibility of distributed ledgers scenarios with shareholder-like rights without the statutory law protections of corporation law.¹⁵² These investments convey a high notion of risk and—due to their contractual nature—are not insolvency-proof. In addressing the shortcomings of the trade in initial coin offerings, regulators have invoked national securities laws which impose prospectus duties, transparency obligations and codes of conducts for those who offer a scheme for investment.¹⁵³ In June 2018, a US District Court determined that digital tokens offered in an initial coin offering qualify as securities within the 1933 Securities Act.¹⁵⁴ The precedential value of this holding may be limited since the court had to rule on a motion for a temporary restraining order.¹⁵⁵ The chairman of the US Securities and Exchange Commission (“SEC”) has opined that most Initial Coin Offerings (“ICO”) qualify as investment contracts which have to comply with securities regulations.¹⁵⁶ From the perspective of offering efficient relief then, mandatory law may furnish the most attractive venue, as investors may ultimately receive some compensation under US securities laws.¹⁵⁷

The application of securities regulations to tokenised transactions hinges on the interpretation of contracts and the degree of commodification of the respective tokens. It should be noted that the US concept of ‘securities’ is broader than the notion of

¹⁴⁹ *Monetary Authority of Singapore*, *supra* note 42.

¹⁵⁰ See, *eg* Monetary Authority of Singapore, Press Release, “MAS and SGX successfully leverage blockchain technology for settlement of tokenised assets” (11 November 2018), online: Monetary Authority of Singapore <<https://www.mas.gov.sg/news/media-releases/2018/mas-and-sgx-successfully-leverage-blockchain-technology-for-settlement-of-tokenised-assets>>.

¹⁵¹ See, *eg* Monetary Authority of Singapore, “A Guide to Digital Token Offerings” (last updated 30 November 2018), at para 2.4 *et seq*, online: Monetary Authority of Singapore <<http://www.mas.gov.sg/~media/MAS/News%20and%20Publications/Monographs%20and%20Information%20Papers/Guide%20to%20Digital%20Token%20Offerings%20last%20updated%20on%2030%20Nov.pdf>>.

¹⁵² For an introduction see: P Hacker & C Thomale, “Crypto-Securities Regulation: ICOs, Token Sales and Cryptocurrencies under EU Financial Law” (2018) 15 *European Company and Financial Law Review* 645 at 650 *et seq* [Hacker & Thomale].

¹⁵³ See the country survey by W A Kaal, “Initial Coin Offerings: The Top 25 Jurisdictions and their Comparative Regulatory Responses” *Stanford Journal of Blockchain Law & Policy* (1 October 2018), online: <<https://stanford-jblp.pubpub.org/pub/ico-comparative-reg>>.

¹⁵⁴ *Rensel v Centra Tec, Inc*, 2018 WL 4410126 (S D Fla, 2018).

¹⁵⁵ *Ibid* and MA Dale & M Harris, *First Decision in Class Action Context Concludes Digital Tokens Can Be Securities* (17 August 2018), online: (blog) <<https://www.blockchainandthelaw.com/2018/08/first-decision-in-class-action-context-concludes-digital-tokens-can-be-securities/>>.

¹⁵⁶ Securities and Exchange Commission (SEC) Chairman J Clayton, “Statement on Cryptocurrencies and Initial Coin Offerings” (Public Statement delivered on 11 December 2017), online: SEC <<https://www.sec.gov/news/public-statement/statement-clayton-2017-12-11>>.

¹⁵⁷ See also *Solis et al v Latium Network, Inc et al*, 2018 WL 6445543 (D N J, 2018) and comment by D Taneja, *Lawsuit Alleging that LATX Tokens are Securities Survives Motion to Dismiss* (7 January 2019), online: (blog) <<https://www.blockchainandthelaw.com/2019/01/lawsuit-alleging-that-latx-tokens-are-securities-survives-motion-to-dismiss/>>.

‘financial instruments’ under EU Law.¹⁵⁸ Moreover, there is not necessarily overlap between a US security and a security under EU law where transferability, standardisation and transferability on capital markets are decisive.¹⁵⁹ Capital market authorities have established a hierarchy of tokens in order to determine the reach of mandatory securities law: the UK FCA would classify bitcoins as exchange tokens as they do not give right receiving any dividend or interest payment.¹⁶⁰ Security tokens qualify as financial instruments conferring rights comparable to that of shareholders and bondholders.¹⁶¹ In accordance with US, English and Singaporean laws, exchange and security tokens in their capacity as cryptoassets are capable of attaining status as intangible property.¹⁶² Conversely, utility tokens grant access to a current or prospective product or service.¹⁶³ Although they do not conform with the requirements for intangible property, they may constitute e-money,¹⁶⁴ and enjoy property-like protection. The French Capital Market Authority (“AMF”) has noted that the majority of (French) initial coin offerings are still financed by the issuance of utility tokens.¹⁶⁵ Unfortunately, the qualification as a security token under French law conveys little information on its status under property law.¹⁶⁶ With respect to the acquisition of minibonds via blockchains, a statutory intervention has been necessary to confer ‘opposabilité’ on such transactions to generate *erga omnes* effects.¹⁶⁷ A 2019 statute authorises investment funds to invest funds into digital assets, including initial coin offerings. The acquisition of digital assets is valid and generates property-law status once it has been registered on a blockchain.¹⁶⁸ The German BaFin¹⁶⁹ has chosen a similar regulatory technique: tokens constitute a ‘transferable security’, which is negotiable on the capital market,¹⁷⁰ once they are registered on a blockchain. The blockchain or the distributed ledger has to identify the owner of the token.¹⁷¹ The Swiss Capital Market Authority takes a comparable approach.¹⁷²

¹⁵⁸ AMF, *ICO Françaises*, *supra* note 103 at 6.

¹⁵⁹ Hacker & Thomale, *supra* note 152; see also AMF, *ICO Françaises*, *supra* note 103 at 6.

¹⁶⁰ UK FCA, *supra* note 121 at 2.5

¹⁶¹ *Ibid*; Hacker & Thomale, *supra* note 152.

¹⁶² See section III.A (above).

¹⁶³ UK FCA, *supra* note 121 at 2.5

¹⁶⁴ *Ibid*.

¹⁶⁵ AMF, *ICO Françaises*, *supra* note 103 at 10.

¹⁶⁶ See the criticism of the AMF’s administrative practice by T Bonneau, “‘Tokens’, titres financiers ou bien divers”, (2018) 19:1 *Revue de droit bancaire et financier* 1 at 2 *et seq*.

¹⁶⁷ See section II.B.2 (above).

¹⁶⁸ See art 88 of the *Loi n° 2019-486 du 22 mai 2019 relative à la croissance et la transformation des entreprises*, JORF, n° 0119 of 23 May 2019 texte n° 2, online : <<https://www.legifrance.gouv.fr/affichTexte.do?cidTexte=JORFTEXT000038496102&categorieLien=id>>.

¹⁶⁹ BaFin is the German Federal Financial Supervisory Authority.

¹⁷⁰ The BaFin aims at classifying certain tokens, *inter alia*, as ‘transferable securities’ within the meaning of art 4(1)(44) of the Markets in Financial Instruments (MiFID II) Directive 2014/65/EU of 15 May 2014 on markets in financial instruments and amending Directive 2002/92/EC and Directive 2011/61/EU (recast), [2014] OJ, L 173/349.

¹⁷¹ BaFin, *Hinweisschreiben (WA), GZ: WA 11-QB 4100-2017/0010, Aufsichtsrechtliche Einordnung von sog. Initial Coin Offerings (ICOs) zugrunde liegenden Token bzw. Kryptowährungen als Finanzinstrumente im Bereich der Wertpapieraufsicht*, online: BaFin <https://www.bafin.de/SharedDocs/Downloads/DE/Merkblatt/WA/dl_hinweisschreiben_einordnung_ICOs.pdf?__blob=publicationFile&v=2>.

¹⁷² Switzerland, Swiss Financial Market Supervisory Authority (FINMA), *Guidelines for enquiries regarding the regulatory framework for initial coin offerings (ICOs)* (16 February 2018) at 3.2.2, online: FINMA

Tjio and Hu argue for an intermediate property status for tokens.¹⁷³ In clarifying the status of cryptocurrencies under international accounting rules, the International Financial Reporting Interpretations Committee (“IFRIC”) appears to favour a comparable approach. The Committee accepts that a cryptocurrency constitutes an intangible asset under International Accounting Standards (“IAS”) 38.¹⁷⁴ On the other hand, a cryptocurrency does not qualify as financial asset within the meaning of IAS 32.¹⁷⁵ The Committee feels that the cryptocurrency does not engender a contractual right for the holder or a contract to be settled with the holder’s equity instruments.¹⁷⁶ Tax authorities may also be inclined to focus on the economics of a transaction with cryptocurrencies and less so on the (civil) law underpinnings of digital assets.¹⁷⁷

2. Blockchain statutes—Survey

Several US states have enacted blockchain statutes¹⁷⁸ which combine law of contract issues with evidentiary standards. They refrain from explicitly addressing property law effects, assuming tacitly that digital assets constitute intangible property. The Arizona blockchain statute recognises that “the data on the ledger is protected with cryptography, is immutable and auditable and provides an uncensored truth.” Moreover, “[a] contract relating to a transaction may not be denied legal effect, validity or enforceability solely because that contract contains a smart contract term”.¹⁷⁹ A 2018 Wyoming law provides for ‘open blockchain tokens’ in exchange for goods, services or content, including of access thereto.¹⁸⁰ Delaware authorises the use of blockchain technology for replacing physical registers of shareholders.¹⁸¹

<<https://www.finma.ch/en/~media/finma/dokumente/dokumentencenter/myfinma/1bewilligung/finte-ch/wegleitung-ico.pdf?la=en>>.

¹⁷³ Hans Tjio & Ying Hu, “Collective Investment: Land, Crypto and Coin Schemes: Regulatory ‘Property’” (2020) 21 *European Business Organization Law Review* 171 at 172.

¹⁷⁴ IFRIC, *IFRIC Update June 2019: Committee’s agenda decisions*, London meeting 11/12 June 2019, online: IRFS <<https://www.ifrs.org/news-and-events/updates/ifric-updates/june-2019/>>.

¹⁷⁵ *Ibid.*

¹⁷⁶ *Ibid.* See also Ian Simpson, “EXPERTsuisse issues first Swiss ICO accounting guidelines for utility tokens”, *Crypto Valley* (10 December 2018), online: <<https://cryptovalley.swiss/expertsuisse-issues-first-swiss-ico-accounting-standard-for-utility-tokens/>>; KPMG, *Cryptoassets – Accounting and Tax* (April 2019), online: KPMG <<https://home.kpmg/content/dam/kpmg/xx/pdf/2019/04/cryptoassets-accounting-tax.pdf>>.

¹⁷⁷ For a detailed analysis see *Bal*, *supra* note 5 at 77 *et seq.*

¹⁷⁸ For a comprehensive survey see National Conference of State Legislatures, Heather Morton, “Blockchain State Legislation” (28 March 2019), online: National Conference of State Legislatures <<http://www.ncsl.org/research/financial-services-and-commerce/the-fundamentals-of-risk-management-and-insurance-viewed-through-the-lens-of-emerging-technology-webinar.aspx>>.

¹⁷⁹ See Arizona Statutes §44-7061(C) (Amending Section 44-7003, Arizona Revised Statutes; Amending Title 44, Chapter 26, Arizona Revised Statutes, by adding Article 5; Relating To Electronic Transactions), online: <<https://www.azleg.gov/legtext/53leg/1r/bills/hb2417p.pdf>>; see also the Tennessee statute: §47-10-201 *et seq* of the Tennessee Code Ann (2018), online: <<https://legiscan.com/TN/text/SB1662/2017/>>.

¹⁸⁰ §17-4-206(a)(3) of the Wyoming Statutes (2018), online: <<https://www.wyoleg.gov/2018/Engross/HB0070.pdf>>.

¹⁸¹ US, Delaware State Senate Bill no 69, *An Act to Amend Title 8 of the Delaware Code Relating to the General Corporation Law*, 149th Gen Assem, Del, 2017 (amending §151 (f) Title 8

In Europe, with the exception of France¹⁸² only some minor jurisdictions have passed blockchain statutes in order to improve their standing as an offshore centre for digitised finance. Gibraltar condones the use of distributed ledger technology “for storing and transmitting value belonging to others”.¹⁸³ ‘Value’ includes a piece of property, “rights or interests, with or without related information, such as agreements or transactions for the transfer of value or its payment, clearing or settlement”.¹⁸⁴ Malta’s Virtual Financial Assets Act authorises initial offerings of virtual financial assets on distributed ledgers, if accompanied by a ‘whitepaper’ with information on the offering.¹⁸⁵ A distributed ledgers asset is a virtual token, a virtual financial asset, electronic money or a financial instrument. Assets mean “... movable and any immovable property of any kind”.¹⁸⁶ Luxembourg’s blockchain codification¹⁸⁷ builds on an analogy: it extends the electronic registration mechanism for intermediated securities to the blockchain-based trading of securities.¹⁸⁸ Tokens have the same *erga omnes* quality as any other electronic security.¹⁸⁹ Under this regime, trading via blockchain technology constitutes a normal bank transfer, even if undertaken by smart contract.¹⁹⁰

Liechtenstein’s new law on tokens aims at a legal regime that extends beyond tokens used predominantly for accelerating payment flows (including investments in initial coin offerings) via distributed ledgers.¹⁹¹ In view of current regulatory attitudes towards tokenisation, the Liechtenstein law introduces a comprehensive set of rules for exchange, security and utility tokens.¹⁹² From the perspective of a civil law jurisdiction, the law offers a property law solution for the commodification of blockchain-related rights and the regulatory oversight over trading in digital assets.

of the Delaware Code), (online: <<https://legis.delaware.gov/json/BillDetail/GenerateHtmlDocument?legislationId=25730&legislationTypeId=1&docTypeId=2&legislationName=SB69>>).

¹⁸² See section III.B.1 (above).

¹⁸³ *Gibraltar Financial Services (Distributed Ledger Technology Providers) Regulations 2017*, Schedule 1 Amendments to the Principal Act, LN 2017/204, online: <<https://www.triay.com/wp-content/uploads/2017/10/Financial-Services-Distributed-Ledger-Technology-Providers-Regulations-2017.pdf>>).

¹⁸⁴ *Ibid.*

¹⁸⁵ *Virtual Financial Assets Act*, 2018 (Malta), c 590, s 3 *et seq.*, online: <<http://www.justiceservices.gov.mt/DownloadDocument.aspx?app=lom&itemid=12872&l=1>> in force since 1 November 2018. Camilleri Preziosi, “The Virtual Financial Assets Act enters into force” *Times of Malta* (4 November 2018), online: <<https://www.timesofmalta.com/articles/view/20181104/business-news/the-virtual-financial-assets-act-enters-into-force.693392>>.

¹⁸⁶ S 2(2) of Malta’s *Virtual Financial Assets Act* (c 590, Act XXX of 2018).

¹⁸⁷ Loi of 1 March 2019 portant modification de loi modifiée du 1er août 2001 concernant la modification la circulation de titres, Mémorial A no. 111 de 2019 (5 March 2019), online : <<http://legilux.public.lu/eli/etat/leg/loi/2019/03/01/a111/jo>>.

¹⁸⁸ Art 18bis of the Loi modifiée du 1er août 2001 concernant la circulation des titres, and the report for the Luxembourg parliament: Luxembourg Chambre de Députés, Session ordinaire 2017-2018, Projet de loi no. 7363 (6 November 2018), online: <https://www.chd.lu/wps/PA_RoleDesAffaires/FTSByteServletImpl?path=C9D0C9CB5AC1682F8AD1DC36175252FF26530FBAB20F896BDECD2D74A3FBAB31A3C2CAC62A625123D0A0B697273B03BC6S7517CFC69E1CF4D4FAD36945BC69A3E3>[*Luxembourg parliament report*].

¹⁸⁹ See the *Luxembourg parliament report* (*ibid.*).

¹⁹⁰ *Ibid.*

¹⁹¹ Liechtensteinisches Landesgesetzblatt (Liechtenstein Gazette) 2019 no 301 of 2 December 2019 [*Liechtenstein law*]. See also *Liechtenstein government report*, *supra* note 43 at 58.

¹⁹² See *Liechtenstein government report*, *supra* note 43 at 62 *et seq.*

Contrary to the approach chosen by the *Quoine II* court and by current blockchain statutes, the law adds a new element to current property law concepts.¹⁹³ Liechtenstein law shall be applicable to any emission or creation of tokens by a service provider domiciled in the principality.¹⁹⁴ Alternatively, the parties to a token-related transaction may choose the application of Liechtenstein law.¹⁹⁵ In this context, a token shall be regarded as a movable asset.¹⁹⁶ The token operates as a place-holder for the right behind it.¹⁹⁷ Ownership of the key to the blockchain system constitutes a rebuttable presumption that the owner is also entitled to conclude transactions over the token.¹⁹⁸ A transaction for the transfer of the token via a distributed ledger is valid if activated by the transferor prior to the enforcement of a judgment.¹⁹⁹ It would seem that this provision also includes transactions triggered by a smart contract. The law replicates the *bona fide* rules on the acquisition of movable property against payment: the transferee is under no obligation to return the token to the owner if he was unaware that the transferor had no right to secure the transfer.²⁰⁰ Infringements of the rights represented by the token can be policed like any other violation of property right to a movable asset. The law attempts to solve private international law problems in a cross-border context by relying on regulatory competition. It is hoped that investors will opt for Liechtenstein law and its protection of tokenised transactions where other jurisdictions do not offer a viable solution.

Liechtenstein's new law paves the way for reconciling digital assets and tokens with traditional civil law concepts on property. But the new law adds also a twist to the ongoing debate on offshore jurisdictions in the age of digitalisation and cryptoassets.²⁰¹ Securities litigation in the US has demonstrated that Swiss and Liechtenstein banks²⁰² and foundations²⁰³ play an active role in orchestrating cross-border bitcoin-based transactions.²⁰⁴ In *re Tezos Securities Litigation*, the US District Court for the Northern District of California held that a token-based initial coin offering based is not exempt from US securities law even if the intermediaries were Swiss companies or foundations respectively.²⁰⁵ In this context, legislative efforts to recognise tokens and cryptoassets as domestic creatures of property might constitute an attempt to establish a second line of defence against the extraterritorial reach of securities regulation and seizure laws if the foreign nationality of the issuer or intermediary does not guarantee immunity. On the other hand, there is a growing trend in non-offshore

¹⁹³ See *Liechtenstein government report*, *supra* note 43 at 62 *et seq.*

¹⁹⁴ Art 3 of the *Liechtenstein law*, *supra* note 191.

¹⁹⁵ *Ibid.*

¹⁹⁶ Art 4 of the *Liechtenstein law*, *supra* note 191.

¹⁹⁷ Art 7 (1) of the *Liechtenstein law*, *ibid.*

¹⁹⁸ Art 5 (2) of the *Liechtenstein law*, *ibid.*

¹⁹⁹ Art 7 (3) of the *Liechtenstein law*, *ibid.*

²⁰⁰ Art 9 of the *Liechtenstein law*, *ibid.*

²⁰¹ For a detailed analysis see J Cole in Grinhaus, ed, *supra* note 11 at 41 *et seq* [Cole].

²⁰² *US v 2013 Lamborghini Aventador*, 2018 WL 3752131 (E D Cal, 2018).

²⁰³ *In re Tezos Securities Litigation*, 2019 WL 2183448 (N D Cal, 2019); *Macdonald v Dynamic Ledger Solutions, Inc*, 2017 WL 6513439 (N D Cal, 2017).

²⁰⁴ See *Cole*, *supra* note 201 at 41 (para 49) *et seq* (analysing bitcoin-related transactions emanating from Switzerland, the Cayman Islands, Barbados and Bermuda).

²⁰⁵ *In re Tezos Securities Litigation*, 2018 WL 4293341 (N D Cal, 2018), see also *GGCC, LLC, et al v Dynamic Ledger Solutions, Inc*, 2018 Fed Sec L Rep 100,054 (N D Cal, 2018) and *Cole*, *supra* note 201 at 46.

jurisdictions to expand traditional concepts of property law in order to escape the latecomer syndrome in digitalisation.²⁰⁶

3. Tokens and digital assets: Discovery and subpoena

The classification of digital tokens as property impacts the law of discovery and subpoenas.²⁰⁷ In order to police securities fraud under US law, the SEC may move for a temporary restraining order freezing the assets of the delinquent company, including virtual currency and other digital assets.²⁰⁸ A blockchain asset trading platform is entitled to expedited discovery to identify a hacker who had stolen cryptocurrency: this includes disclosure of the hacker's account, a freeze of the stolen values and the duty to preserve digital evidence that might altered or destroyed.²⁰⁹ In spite of the property nature of digital assets under US law, a plaintiff in a misappropriation case may also request a cryptoasset exchange company to supply records on digital assets accounts to trace dissipated assets.²¹⁰ This may extend to the complete disclosure of all Bitcoin and other (electronic) wallet addresses in order to monitor the path of misappropriated funds.²¹¹ The US Internal Revenue Service ("IRS") is entitled to require a virtual currency exchange to disclose the account holders' identity and (electronic) transaction records to enforce tax law.²¹² However, at the beginning of an investigation, the IRS is not yet entitled to disclosure of all wallet addresses and of all public keys for all accounts and wallets.²¹³ It should be noted that US data protection law comes into play when an electronic communication service or remote computing is provided to the public: civil subpoenas are proscribed under the Stored Communications Act.²¹⁴

IV. NEGATIVE EXTERNALITIES OF DISTRIBUTED LEDGERS AND LIABILITY

Blockchain-based transactions build on trust in technology and algorithms.²¹⁵ They also build on the quality of the consensus protocols²¹⁶ which lay down the ground

²⁰⁶ See, eg the new blockchain strategy by the German government: Germany, Bundesministerium für Wirtschaft und Energie, *Blockchain Strategy of the Federal Government* (18 September 2019), online: <https://www.bmwi.de/Redaktion/EN/Publikationen/Digitale-Welt/blockchain-strategy.pdf?__blob=publicationFile&v=2>.

²⁰⁷ See SD Levi *et al.*, "Emerging Discovery Issues in Blockchain Litigation" (3 April 2019), online: Skadden <<https://www.skadden.com/insights/publications/2019/04/emerging-discovery-issues-in-blockchain-litigation>>.

²⁰⁸ *Securities and Exchange Commission v Plexcorps et al.*, 2017 WL 6398722 (E D N Y, 2017).

²⁰⁹ *ZP Top Technology Co Ltd v Doe*, 2019 WL 917418 (W D Wash, 2019).

²¹⁰ *Symphony FS Ltd. v Thompson*, 2018 WL 5023638 (E D Pa, 2019).

²¹¹ *Page v Bitconnect International PLC et al.*, 2018 WL 2085214 (W D Ken, 2018).

²¹² *United States v Coinbase*, 2017 WL 5890052 (N D Cal, 2017), online: <https://casetext.com/free-trial?download_redirect=united-states-v-coinbase-inc&utm_source=casetext&utm_medium=email&utm_campaign=case-page-download>.

²¹³ *Ibid.*

²¹⁴ See *Stored Communications Act*, 18 USC §2702 (a) and *PPG Industries Inc v Jiangsu Tie Mao Glass Co Ltd et al.*, 273 F Supp (3d) 558 at 560 (W D Pa, 2017).

²¹⁵ *Finck*, *supra* note 2 at 12.

²¹⁶ *Cf Jiménez*, *supra* note 12 at 283.

rules for a software for “a shared method of validating information”.²¹⁷ Nonetheless, blockchain technology is not immune from transparency problems, cyber risks and operational risks in the context of data security, insider trading and data abuse. The decentralised ubiquity of distributed ledgers²¹⁸ and the anonymity of core developers of a software programmer greatly frustrate litigation against blockchains.²¹⁹ In order to facilitate litigation of claims against blockchains two basic models for liability have been proposed. A more conventional approach focuses on the actions of the operators of a blockchain.²²⁰ This appears to include permissioned blockchains organised by an individual and consortia of banks.²²¹ In this respect, corporate law and organisational thinking inspires the approach chosen by Zetzsche, Buckley and Arner.²²² They emphasise the importance of control over servers and computers steered by the distributed ledger software.²²³ Participation in a distributed ledger—they argue—can trigger liability as a consequence of ‘shared control’. If developers of the software and the participants’ computers, the nodes, cooperate, they may be jointly liable for breach of contract with respect to third parties.²²⁴ Zetzsche, Buckley and Arner undertake a comprehensive comparative law survey before they establish tort liability for the ‘members’ of a blockchain scheme. Tortious liability is based on an analogy with the law on general partnerships and joint ventures.²²⁵ Zetzsche, Buckley and Arner envisage an increasing risk of liability as a member’s integration into the blockchain organisation deepens. They assume that control and corresponding liability are correlated with the ability of one or several actors to devise, influence or change the organisational structure of a blockchain scheme, refined by smart contracts and artificial intelligence.²²⁶ This constitutes a subtle departure from established causation theories which resembles attempts to accommodate negative externalities by third generation robots with artificial intelligence: under these circumstances, the enquiry becomes controlling on who stands to reap the maximum rents from a blockchain scheme without assessing agency costs.²²⁷

The Zetzsche, Buckley and Arner proposal might help to develop liability concepts where the investments to be made by a decentralised autonomous organisation are exclusively triggered by a combination of blockchain technology, smart contracts and artificial intelligence. Once an investment with a decentralised autonomous organisation falls below this threshold, it is unclear under what conditions control

²¹⁷ UK, The Law Society, *Blockchain: The Legal Implications of Distributed Systems* (August 2017), online: The UK Law Society <<https://www.lawsociety.org.uk/support-services/research-trends/horizon-scanning/blockchain/>>.

²¹⁸ See Jiménez, *supra* note 12 at 285.

²¹⁹ Webster & A Charfoos, *supra* note 62 at 8; O Lasmole, “La difficile appréhension des *blockchains* par le droit” (2018) 32:4 *Revue internationale de droit économique* 453 at 463 *et seq* [Lasmole].

²²⁰ Jiménez, *supra* note 12 at 287.

²²¹ Cf Lasmole, *supra* note 219.

²²² D A Zetzsche, R P Buckley & D W Arner, “The Distributed Liability of Distributed Ledgers: Legal Risks of Blockchains” (2018) *University of Illinois Law Review* 1361 at 1389 *et seq* [Zetzsche, Buckley & Arner].

²²³ *Ibid.*

²²⁴ *Ibid* at 1391 *et seq.*

²²⁵ *Ibid* at 1399 *et seq.*

²²⁶ *Ibid* at 1391, 1440. On this analytical approach see also Jiménez, *supra* note 12 at 287 *et seq.*

²²⁷ See Zetzsche, Buckley & Arner, *supra* note 222 at 1400: “As a rule of thumb, the risk of liability associated with DLT participation based on partnership law increases ... the more a server owner benefits from participating in the distributed ledger through profits (as long as there others who benefit in the same way).”

will turn into a liability. In the context of the European General Data Protection Regulation,²²⁸ ‘control’ means control over data. It might therefore be argued that only control over data and the calculations triggers liability.²²⁹ In a permissionless blockchain setting, interference with somebody else’s data is likely to happen if a majority of participants agrees to a new consensus, thereby creating a fork to the detriment of the minority.²³⁰ In ascertaining initial coin offerings under US securities laws, the US SEC favours a case-by-case approach.²³¹ When the SEC published its Investor Bulletin on Initial Coin Offerings in 2017, it opined that limited ownership and voting rights were too limited to “exercise meaningful control”.²³² Thus, the right to vote on an investment project does not constitute control.²³³ The chances to organise voting strategies with other investors are small, since blockchain technologies frequently render identification processes burdensome.²³⁴ This indicates the role of the organisers of a blockchain-based decentralised autonomous organisation is still crucial for turning control into a liability to third parties.²³⁵ He who decides on the conditions of processing data controls. Due to the multitude of blockchain solutions, it is useful to focus on the identity of who decides on the conditions of processing.²³⁶ If a consortium of banks organises a centralised platform, internal rules on the distribution of liability are apposite.²³⁷

V. THE EU’S DATA PROTECTION LAW AND BLOCKCHAIN TECHNOLOGY

The General Data Protection Regulation of the European Union (“GDPR”) attempts to strike a balance between the “free flow of personal data ... while ensuring a high

²²⁸ EU, *Regulation (EU) 2016/679 of 27 April 2016 on the protection of natural persons with regard to the processing of personal data and on the free movement of such data and repealing Directive 95/46/EC (General Data Protection Regulation)*, [2016] OJ, L 119/1.

²²⁹ See Baker & McKenzie, *Blockchains and Laws. Are They Compatible?* (31 July 2017), online: Baker & McKenzie <https://www.bakermckenzie.com/en/-/media/files/expertise/fig/br_fig_blockchainsandlaws_jul17.pdf>.

²³⁰ See S Lujan, “Crypto Schisms and Psychology” *Bitcoin News* (17 December 2018), online: <<https://news.bitcoin.com/the-psychology-of-forking/>>; P Rizzo, *Fork Fallout? A Bitcoin Split Could Become a Legal Mess* (23 March 2017), online: Coindesk <<https://www.coindesk.com/fork-fallout-a-bitcoin-split-could-become-a-legal-mess>>; N Webb, “A Fork in the Blockchain: Income Tax and the Bitcoin/Bitcoin Cash Hard Fork” (2018) 19 *North Carolina Journal of Law & Technology* 283 at 299 *et seq.*

²³¹ See survey by S Blemus, “Law and Blockchain: a legal perspective on current regulatory trends worldwide” (2017) 4 *Revue trimestrielle de Droit Financier* 1 at 5 *et seq* [Blemus].

²³² US SEC, “Report of Investigation Pursuant to Section 21(a) of the *Securities Exchange Act of 1934*: The DAO” News Release, Release No. 81207 (25 July 2017) at 14, online: SEC <<https://www.sec.gov/litigation/investreport/34-81207.pdf>>. The SEC applies the criteria for investment contracts as defined in *SEC v Howey*, 66 S Ct 1100 at 1102 *et seq* (1946). See also analysis by Blemus, *supra* note 231 at 6.

²³³ See, however, Zetzsche, Buckley & Arner, *supra* note 222.

²³⁴ Cf Finck, *supra* note 2 at 29.

²³⁵ Cf Lasmoles, *supra* note 219 at 463, see also Bacon *et al*, “Blockchain Demystified: A Technical and Legal Introduction to Distributed and Centralised Ledgers” (2018) 25:1 *Richmond Journal of Law & Technology* 1 at 65 [Bacon].

²³⁶ Bacon, *supra* note 235 at 63 *et seq.*

²³⁷ Cf J Salmon & G Myers, *Blockchain and Associated Legal Issues for Emerging Markets* (January 2019) at 7, online: International Finance Corporation <<https://www.ifc.org/wps/wcm/connect/da7da0dd-2068-4728-b846-7cfffcd1fd24a/EMCompass-Note-63-Blockchain-and-Legal-Issues-in-Emerging-Markets.pdf?MOD=AJPERES&CVID=mxocw9F>>.

level of the protection of personal data”.²³⁸ As modern technology and globalisation allow “... both private companies and public authorities to make use of personal data in an unprecedented scale”, a “... coherent data protection framework ... backed by strong enforcement” ensures that natural persons have control of their own personal data.²³⁹ Thus, the ‘data subject’ is entitled to information from the data controller whether personal data are processed.²⁴⁰ Personal data sovereignty requires a right to rectification and to data erasure.²⁴¹ At first sight, blockchain technology and distributed ledgers and the EU’s new data protection law look irreconcilable.²⁴² Data storage is the essence of a technology which has ushered in digital assets, tokens representing electronic signals and cross-border payments via the internet.²⁴³ In the Bitcoin scenario, any participant can gain access to the system. Although the Bitcoin software envisages anonymity for those whose transactions are registered in the ledger, additional identifiers can be so devised that blockchains will be marked by “pseudo-anonymity”.²⁴⁴ As the new Data Regulation focuses on ‘personal data’, data blocks that can be traced back to an identifiable natural person qualify for the protective regime of the new law.²⁴⁵ Currently, computer specialists are working on blockchains where private data are outsourced, but only the validity proof stays on the blockchain.²⁴⁶ Such an off-chain data storage architecture would consist of distributed or cloud-based servers which contain sensitive information.²⁴⁷ The ‘traditional’ blockchain would then only store the hashes, serving as control pointers to the real data stored in another database.²⁴⁸ If a consumer requests erasure, the ‘linkability’ of the blockchain pointer will be terminated.²⁴⁹ This is a solution which the French Commission Nationale Informatique et Libertés seems to accept as a device to give effect to and protect the ‘right to be forgotten’.²⁵⁰

The multitude of blockchain and distributed ledger technology systems defies a ‘one-size-fits-all’ approach, and a more contextualised approach escapes the potential conflict between digital innovation and protection of personal data. Public blockchains pose different data protection problems than permissioned blockchains

²³⁸ See recital (6) of the EU, *Regulation (EU) 2016/679 on the protection of natural persons with regard to the processing of personal data and on the free movement of such data, and repealing Directive 95/46/EC (General Data Protection Regulation)*, [2016] OJ, L 119/1 [GDPR].

²³⁹ See recitals (6) and (7) of the GDPR, *ibid.*

²⁴⁰ See art 12 *et seq* of the GDPR, *ibid.*

²⁴¹ See M Finck, “Blockchains and Data Protection in the European Union” (2018) 1 EDPL 17 at 20 *et seq* [*Finck Blockchains in the EU*].

²⁴² *Finck*, *supra* note 2 at 110.

²⁴³ *Finck Blockchains in the EU*, *supra* note 241 at 18.

²⁴⁴ *Ibid* at 29.

²⁴⁵ See art 5 of the GDPR (*supra* note 238) on the “principles relating to processing of personal data”.

²⁴⁶ *Finck Blockchains in the EU*, *supra* note 241 at 23.

²⁴⁷ *Bacon*, *supra* note 235 at 63 *et seq*; *Ibid.*

²⁴⁸ C Lima, *Blockchain-GDPR Privacy by Design: How Decentralized Blockchain Internet will Comply with GDPR Data Privacy* (June 2018), online: IEEE <<https://blockchain.ieee.org/images/files/pdf/blockchain-gdpr-privacy-by-design.pdf>>. See also IBM Security, *White Paper, Blockchain and GDPR – How blockchain could address five areas associated with GDPR compliance* (March 2018), online: IBM <<https://www.ibm.com/downloads/cas/2EXR2XYP>>.

²⁴⁹ *Ibid.*

²⁵⁰ Commission Nationale Informatique et Libertés, *Blockchain – Solutions for a responsible use of the blockchain in the context of personal data* (November 2018), online: Commission Nationale Informatique et Libertés <<https://www.cnil.fr/sites/default/files/atoms/files/blockchain.pdf>>.

and blockchain types where access is administered by a consortium.²⁵¹ As permissioned and consortium blockchains control access, unrestrained access to stored data is excluded.²⁵² What comes into play instead is a clear definition of the duties owed by the data controller under article 26 of the GDPR. In consortia, an agreement between those who exercise joint controllership will allocate responsibilities. In view of the US litigation on financial institutions failing to avert scams,²⁵³ it remains to be seen whether failure to comply with the duties as a controller or data protection offer may trigger liability for insufficient protection from data hackers.

VI. CONCLUSION

Blockchain technology is the cornerstone for establishing new governance structures for online platforms. Blockchains stand to revolutionise FinTech. Distributed ledger technology will bring change to production processes, public services and the protection of intellectual property rights. As legal structures for blockchain applications are beginning to emerge, the potential of private ordering and regulatory intervention is tested. Regulators are currently pursuing a regulatory sandbox approach, so lacunae will have to be filled by private law instruments.²⁵⁴ It is too early to declare whether, in turn, government regulation will be capable of coining standard contractual structures for blockchain-related transactions.²⁵⁵

In the context of international derivatives trading, a private effort for standardisation is made.²⁵⁶ Cross-border blockchain schemes will have to reinforce private contracting schemes by introducing ‘blockchain constitutions’ which would include choice-of-law and arbitration clauses. Nonetheless, private contracting will not completely overcome private international law problems. This is due to the role of national mandatory laws which are prevalent in capital market regulations and consumer protection laws. A survey over blockchain law is therefore confined to identifying the major challenges common to national legal orders, from both a substantive and procedural law perspective.

FinTech and electronic trading undergo ‘commodification’. Electronic signals stored on a ledger represent value. They highlight the potential of advanced electronic trading, once a property-like status has been conferred on digital assets. In some

²⁵¹ J Moser, *The Application & Impact of the European General Data Protection on Blockchains* (February 2017), online: R3 Reports <https://www.r3.com/wp-content/uploads/2018/04/GDPR_Blockchains_R3.pdf>.

²⁵² *Ibid.* Cf Lokke Moerel, “Blockchain and Data Protection” in *Cambridge Handbook*, *supra* note 20, 213 at 219 (defining permissioned blockchains as a device to address the shortcomings of public blockchains).

²⁵³ See section II.A.1 (above).

²⁵⁴ See the plea by *Finck*, *supra* note 2 at 84 *et seq*, for a “necessary interoperability of on-chain and off chain-law”.

²⁵⁵ *Filippi*, *supra* note 1 at 185, suggests that governments should concentrate on influencing the underlying dynamics of blockchain-controlled markets.

²⁵⁶ See the efforts of the International Swaps and Derivatives Association (“ISDA”) to develop common standards for processing transactions with the help of blockchain technology and smart contracts: “ISDA Whitepaper: The Future of Derivatives Processing and Market Infrastructure” (September 2016), online: ISDA <<https://www.isda.org/a/UEKDE/infrastructure-white-paper.pdf>>. ISDA, and ISDA, “ISDA Appoints REGnosys to Develop Digital Common Domain Model”, ISDA Press Release (15 February 2018), online: ISDA <<https://www.isda.org/a/mgsEE/REGnosys-Appointed-to-Develop-Digital-CDM-Press-Release-FINAL.pdf>>.

jurisdictions, commodification will be achieved by developing existing case law. Others, especially in civil law countries, may require statutory intervention so that eventually damages for (economic) loss may be awarded. Introducing legislation for trading tokens is likely to solve private international law problems since investor-friendly codifications are capable of ‘pinning down’ tokenised contracts on a specific jurisdiction.

Blockchain technology appears to contradict the regulatory underpinnings of the EU’s GDPR as storing data is vital for the existence of a distributed ledger. On the other hand, the Regulation allows for an exemption from its stance on the right to erasure: according to article 17(3)(e) of the GDPR, the provisions on the right to be forgotten are inapplicable “to the extent that processing [of data] is necessary... for the establishment, exercise or defence of legal claims”. Commodification and the statutory recognition of tokens are vital for protecting owners’ rights and facilitating trading. Any meaningful protection of rights is predicated on data storage on a distributed ledger.²⁵⁷ This applies to FinTech schemes and to the new world of blockchain-based public services and protection of intellectual property rights.

Smart contracts and their sophistication by artificial intelligence solutions are thought to outmanoeuvre traditional private law principles. But algorithms are incapable of displacing mandatory law. Moreover, smart contracts are unhelpful where a value judgment is required.²⁵⁸ Admittedly, private law sanctions in a blockchain scenario will normally only generate damages. But the benefits from a combination of private law with smart contracts and relentless algorithmic processes lie elsewhere. Private law analysis (and gentle pressurising from capital market authorities)²⁵⁹ should translate into smart contracts which reinforce and deepen the legal standards of public and permissioned standards and hybrids.²⁶⁰ Private law matters for blockchains.

²⁵⁷ Cf L Moerel’s observation, in: *Cambridge Handbook*, *supra* note 20, 213 at 228, that the right to have personal erased is not absolute (against the backdrop of the CJEU (Second Chamber) judgment: *Camera di Commercio, Industria, Artigianato e Agricoltura v Salvatore Manni*, C-398/15, (9 March 2017), online: <<http://curia.europa.eu/juris/document/document.jsf?jsessionid=3291055DD97BD508959C149D474DBBA9?text=&docid=188750&pageIndex=0&doclang=EN&mode=lst&dir=&occ=first&part=1&cid=2687591>>.

²⁵⁸ Cf Filippi, *supra* note 1 at 74 *et seq.*

²⁵⁹ See Lokke Moerel, “Blockchain and Data Protection” in *Cambridge Handbook*, *supra* note 20, 213 at 222 (arguing that public blockchains will be subject to regulation whereas private ordering will accommodate the problems of private or consortium blockchain scenarios).

²⁶⁰ See Finck, *supra* note 2 at 43. For a sceptical approach towards translating law into digitised codes, see A Garapon & J Lassègue, *Justice digitale: Révolution graphique et rupture anthropologique* (Paris: Presses universitaires de France, 2018) at 219 *et seq.*