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Civil Liability in the Era of New Technology: The Influence of Blockchain

Blockchain as the Backbone of a New Technology-based Civil Liability Regime

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Executive Summary

Blockchain regulation is still in its embryonic stage and the European Union is called upon to face this complex regulatory challenge. Although scholarly opinions vary, it must be acknowledged that the growth of blockchain could, at least within the framework of European private law, lead to the discarding of principles and rules traditionally considered as providing the default order. The increasing global investment in blockchain technology will demand the creation of a new private law, one in which principles and rules thus far considered recessionary could emerge and, in the near future, play a primary role.

The present work aims to evaluate the impact of blockchain on private law's civil liability sector, attempting to describe its future path and envisage future regulation. The need to identify the person responsible for either malfunction in the chains or illegal activities perpetrated against them, thereby causing economic damage to end users, clashes with the highly decentralised nature of this technology. On the basis of an activity risk analysis carried out on blockchain platforms, the paper argues that the strict liability of the relevant operators will increasingly become the reference paradigm for civil liability, definitively supplanting the fault-based rule. Meanwhile, the need to consider the introduction of a mandatory insurance scheme for blockchain platform operators is emphasised, with a view to not only protecting the assets of operators but also ensuring full compensation for end users in the event a malfunction or attack results in the loss of assets held on the decentralised network.

The renewal described will perhaps involve a new basic philosophy that will oblige the European Union to face the challenge of a regulation that will be increasingly intertwined with economic evaluations.

List of Abbreviations

CUP	Cambridge University Press
EBOLR	European Business Organization Law Review
ERPL	European Review of Private Law
ESMA	European Securities and Markets Authority
Geo L Tech Rev	Georgetown Law Technology Review
HUP	Harvard University Press
Ill L R	Illinois Law Review
JLPP	Journal of Legislation and Public Policy
MIT Tech Rev	MIT Technology Review
MLR	Modern Law Review
ODCC	Osservatorio di Diritto Civile e Commerciale
RBFL	Review of Banking & Financial Law
RDC	Rivista di diritto civile
SJLBF	Stanford Journal of Law, Business & Finance
SPCC	Supreme Court of California
TLCP	Transnational Law & Contemporary Problems
ULR	Uniform Law Review
YLJ	Yale Law Journal
YUP	Yale University Press

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1. Introduction: The New Technological Reality and the Future of European Civil Liability

The new reality posed by crypto-anarchy is an element with which European private law will progressively have to confront. The need to formulate adequate regulation for the algorithmic environment is becoming increasingly pressing.

Blockchain technology and, generally, distributed ledgers (understood as data storage systems and as value vectors) are having a disruptive impact in every sector of society.[1] It is now well known that the use of such technology, which can vary in light of the different types of blockchain, offers a number of advantages in terms of disintermediation, decentralisation, security and immutability.[2]

However, the specifics of blockchain technology demand painstaking reflection on the technical implications[3] that the future private law will have to address. Its underlying mechanisms seems to be profoundly trailblazing and different from what we have known so far.[4] It will therefore be necessary to inquire into whether certain rules that currently represent the exception may become the default in future. If the spread of blockchain technology seems to appear inevitable,[5] beginning to be the main reference for human operations, then the rules that are called upon to govern it must similarly adapt themselves to the new reality.

In light of blockchain's structure, one of the most convoluted problems that European private law will have to face is that of civil liability for damage caused to end users by an attack on the blockchain platform, by malfunctioning or by a bug.[6] The recent events involving

[1] Cf Martin Arnold, 'Davos: Blockchain can no longer be ignored' (Financial Times, 24 January 2018) <https://www.ft.com/content/c0794556-ff50-11e7-9650-9c0ad2d7c5b5> accessed 11 April 2019.

[2] See notably Primavera De Filippi and Aaron Wright, *Blockchain and the Law* (HUP 2018) 33-57; Michèle Finck, *Blockchain Regulation and Governance in Europe* (CUP 2019) 10-33.

[3] See EU Blockchain Observatory & Forum, 'Blockchain Innovation in Europe' (Thematic Report; 27 June 2018, revised 21 August 2018); EU Blockchain Observatory & Forum, 'Scalability Interoperability and Sustainability of Blockchains' (Thematic Report; 6 March 2019).

[4] For instance, the impact of blockchain technology on international securities transactions is interesting. Cf Philipp Paech, 'Securities, intermediation and the blockchain: an inevitable choice between liquidity and legal certainty' (2016) 21 ULR 612. Cf also ESMA, 'The Distributed Ledger Technology Applied to Securities Markets' 2016/773 (Pp, 2 June 2016).

[5] See European Parliament Resolution of 16 February 2017 with recommendations to the Commission on Civil Law Rules on Robotics P8_TA-PROV(2017)0051, which stresses in its introduction that 'between 2010 and 2014 the average increase in sales of robots stood at 17% per year and in 2014 sales rose by 29%, the highest year-on-year increase ever, with automotive parts suppliers and the electrical/electronics industry being the main drivers of the growth; [and] annual patent filings for robotics technology have tripled over the last decade'. Cf also the Communication of the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions 'Building a European Data Economy', 10.1.2017 COM (2017) 9 final.

[6] Cf para 49 of European Parliament Resolution of 16 February 2017 with recommendations to the Commission on Civil Law Rules on Robotics (n 5).

Ethereum, Bitcoin and Nem (Xem) constitute the starting point in the attempt to regulate[7] 'algorithmic' civil liability.[8]

2. Private Law Questions in View of Blockchain Technology

Despite the substantial hype surrounding blockchain technology, which fosters everywhere its character of immutability,[9] the recent history of Ethereum and NEM has unfortunately shown exactly the opposite.[10] The most notorious and surprising change occurred on the Ethereum platform in 2016. An attacker exploited a bug in the code allowing division of the DAO, ie 'decentralised autonomous organisation', which operates on Ethereum blockchain, thereby creating a derivative that manages to get more Ether[11] than what was originally assigned to the attacker's account. In this way the DAO attacker was able to siphon from the DAO over 3.6 million Ether, corresponding to just under 60 million dollars.[12] The ensuing hard-fork countermeasure adopted by Ethereum community members[13] shows how the censorship resistant feature of blockchain can easily be altered, creating a very dangerous precedent that could justify other future actions aimed at blocking transactions.[14] Ultimately, the hard fork attests to reality being different from what is commonly advertised: blockchain does not bypass all meddling humans and code is not law.[15]

[7] Recently, see the financial regulation proposed by William Magnuson, 'Financial Regulation in the Bitcoin Era' [2019] 23 SJLBF 159.

[8] For a comparative assessment of this concept, see Marta Infantino and Weiwei Wang, 'Algorithmic Torts: A Prospective Comparative Overview' (2019) 29 TLCP (forthcoming). This article was discussed with one of the two authors in a seminar held in Bocconi on 11 April 2019.

[9] Reference to immutability is made also in Arizona House Bill 2417: <https://www.azleg.gov/legtext/53leg/1r/bills/hb2417p.pdf> accessed 28 March 2019. See also the definition provided by the State of Vermont: <https://legislature.vermont.gov/assets/Legislative-Reports/2019-Blockchain-Legislative-Report-VSARA.pdf>.

[10] See Angela Walch, 'The Path on the Blockchain Lexicon (and the Law)' (2016) 36 RBFL 713.

[11] Ether is the name of the cryptocurrency circulating on the Ethereum platform.

[12] E J Spode, 'The Great Cryptocurrency Heist' (Aeon, 14 February 2017) <https://aeon.co/essays/trust-the-inside-story-of-the-rise-and-fall-of-ethereum> accessed 25 March 2019.

[13] The Ethereum community members, in order to remedy the situation, have opted for a hard fork, rolling back its immutable ledger to erase the cryptocurrency theft and dividing the platform into two different records; accordingly, there are those who have continued to operate with the original record, claiming that the code should be considered as a law, and those instead relying on the revised record, accepting the division.

[14] Particularly, in the case in which that aims that are not acceptable to the majority operating on a given decentralised network.

[15] Consequently, those end users who were convinced that the code constituted law have seen their expectations – based on the advertised qualities of blockchain platforms – disregarded.

The incident – which is not isolated[16] – poses a serious problem concerning the characterisation of the potential liability of the founder-operators of blockchain platforms[17] in the event of an attack, tampering with the nodes or bugs.

Although blockchain operates through decentralised platforms or networks, this does not automatically mean that the liability of the relevant operators is similar to that of internet providers,[18] who also manage (online) platforms. In fact, with reference to smart contracts,[19] the highly decentralised nature of blockchain prevents the possibility of controlling illegal activities carried out by end users; the operators of this technology – unlike internet providers that are obliged to remove illegal content from their platform if they know of its existence – cannot intervene to remove an illicit contract from the nodes: in fact they are not (and must not be) empowered to intervene or change another's legal relationship. It is certainly true that, at least on the 'permissioned' blockchain platform, the relevant operator has the power to control it, being theoretically able to take action to remove illegal content reported by users. However, this fundamentally clashes with the principle that third parties (in this case, the blockchain platform's operator) cannot intervene to autonomously erase the contents of a contract stipulated by others (ie by two or more end-users on the decentralised platform). Furthermore, whether a contract is unlawful is – frequently – neither easy nor unambiguous; consequently, assigning such evaluative discretion to the platform operator would be an enormous transfer of determinative power normally resting exclusively with the judicial authority.

With reference to the transactions that take place on it, a blockchain platform, understood as 'a shared and synchronised digital database that is maintained by an algorithm and stored on multiple nodes',[20] can perhaps be more straightforwardly qualified as a product or service made available to the community by some platforms or protocols. A potential malfunction of this peer-to-peer database, causing economic loss to users, requires identification of the relevant liable party.

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[16] An in-depth analysis of Bitcoin's March 2013 hard fork was carried out by Angela Walch, 'The Bitcoin blockchain as Financial Market Infrastructure: A Consideration of Operational Risk' (2015) 18 JLPP 837.

[17] Philipp Paech, 'The Governance of Blockchain Financial Networks' (2017) 80 MLR 1073, 1085, opted for the following definition: 'software platform providers'.

[18] See Piotr Tereszkiewicz, 'Digital Platforms: Regulation and Liability in the EU Law' (2018) 26 ERPL 903.

[19] For a depiction helpful in understanding just what smart contracts are, cf Max Raskin, 'The Law and Legality of Smart Contracts' (2017) 1 Geo L Tech Rev 305; Mateja Durovic and André Janssen, 'The Formation of Blockchain-Based Smart Contracts in the Light of Contract Law' (2018) 26 ERPL 753. For an overview of their role with regard to potential future regulation, see Roger Brownsword, 'Regulatory Fitness: Fintech, Funny Money, and Smart Contracts' (2019) 20 EBOLR 5.

[20] Finck, *Blockchain Regulation and Governance in Europe* (n 2) 6.

Therefore, the questions we should ask are: How should blockchain technology be characterised legally? Who has to bear the damage that occurs on advanced blockchain-based protocols? What are the criteria for the apportionment of risk?

3. The Legal Characterisation of Blockchain Platform Activity and the Strict Liability of Operators as a New Paradigm for Civil Liability

In identifying the party liable for damage caused on a blockchain platform, the activity of the platform needs to be characterised in a manner consistent with how it actually functions.

From a European perspective, the boundary between the liability for harmful products and that deriving from the supply of services must be specified. If advanced blockchain-based protocols are characterised as a product, European instruments on product liability and the relevant national implementation Acts should be applied.[21] However, it seems awkward to characterise blockchain as a good, albeit an immaterial good, in that it is not susceptible to appropriation or economic exploitation by consumers or end users. Rather, blockchain represents a usable and accessible service for users that is achieved through decentralised platforms. Namely, it is a tool that 'serves' to facilitate certain operations or transactions conducted by man. If so, it must be pointed out how the liability for the supply of services is not currently regulated at the supranational level, although the European Commission had presented, in 1990, a proposal for a directive[22] which, however, was not pursued in subsequent legislation.[23]

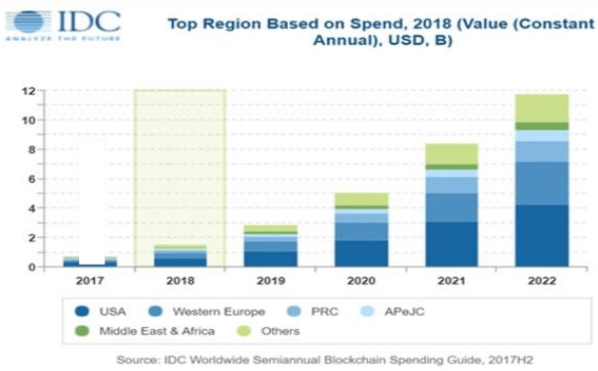
In such way, the question arises as to whether or not there is a need for European legislation on the liability of suppliers of 'algorithmic' services, something currently lacking, so as to provide adequate discipline to the new technological reality. The answer should be given in the

[21] Council Directive 85/374/EEC of 25 July 1985 on the approximation of the laws, regulations and administrative provisions of the Member States concerning liability for defective products [1985] OJ L210/29. Francesco P Patti, 'The European Road to Autonomous Vehicles' (forthcoming), offers an in-depth analysis about the novelty and value of such a directive in relation to the latest technological developments in the automotive field.

[22] Commission, 'Proposal for a Council Directive on the liability of suppliers of services of 20 December 1990' [1990] COM (1990) 482 final. Cf in this regard the critical remarks by Carlo Castronovo, 'La responsabilità del prestatore di servizi nella proposta di direttiva comunitaria' in (1994) 117 Foro it V 273-286. The 'Proposal for a Directive of the European Council on the Supply of Digital Content' [2015] COM (2015) 0634 final, whose article 2 provides a definition of 'digital content' which could perhaps also encompass the service provided by blockchain platform operators, raises a great deal of interest.

[23] Although Directive 2006/123/EC of the European Parliament and of the Council of 12 December 2006 on services in the internal market, OJ 2006, L 376/36, has been issued, it is not applicable to many different kinds of services (art 2[2] of the Directive provides for a list of services excluded by its scope: non-economic services, financial services, electronic communication services and networks, services of temporary work agencies, private security services and others), and it does not discipline the contractual relations between the service provider and the client. Overall, such a directive is not adequate to govern the present phenomenon manifested by blockchain.

affirmative. Considering that the investments in blockchain technology are expected to increase exponentially in the near future (see graphic below),[24] we can hypothesise that it will become the reference system for any human transaction.



Since the possibility of damage occurring will tend to increase in proportion to the growth and spread of the service (or product) put into circulation, the lack of a European regulation on liability for the supply of algorithmic services becomes a pressing and not a deferrable demand.

Although the proposed directive of 1990 provided for fault-based liability for a supplier of services,[25] the decentralised operation of blockchain platforms does not seem today to allow the reception of that same rule as a default approach in a future European regulatory Act on the subject. The functioning of blockchain would be better suited by means of discipline that imposes strict liability on the founder-operator of a blockchain-based platform, an individual who knows the potential and the limits of his instrument in depth. Notwithstanding his not having any control over operations that take place on his platform – a characteristic which already excludes a fault-based rule[26] – due to its decentralised nature, it seems right that any damage suffered by end users due to a malfunction of the blockchain platform (or due to some other harmful event, such as a theft of cryptocurrency) falls on those who could avoid it.[27] This is the fundamental rationale of strict liability. If we value the concept that, in some cases, the

[24] The figures presented in the International Data Corporation graphic are particularly interesting, depicting future blockchain investments that will be carried out in various parts of the world. See also European Parliament resolution of 16 February 2017 with recommendations to the Commission on Civil Law Rules on Robotics, which stresses that 'between 2010 and 2014 the average increase in sales of robots stood at 17% per year and in 2014 sales rose by 29%, the highest year-on-year increase ever, with automotive parts suppliers and the electrical/electronics industry being the main drivers of the growth; [and] annual patent filings for robotics technology have tripled over the last decade'.

[25] Art 1 of Commission, 'Proposal for a Council Directive on the liability of suppliers of services of 20 December 1990' (n 22).

[26] Recently, for an in-depth comparative analysis of fault and no-fault liability, see Reinhard Zimmermann, 'Damages and Interest' in Nils Jansen and Reinhard Zimmermann (eds), *Commentaries on European Contract Law* (OUP 2018) 1432, 1436-1442.

[27] Carlo Castronovo, *Responsabilità civile*, 4th edn (Giuffrè 2018) 439.

liable person could be 'the one who has created a risk which materialises in some manner of damage',[28] it consequently seems logical to assume the contractual liability of the founder-operators of blockchain platforms, individuals who will have promoted the platform by advertising it as highly secure but whose malfunction resulted in the materialisation of damage.

This would bring about a definitive reversal of the European paradigm of liability. It is traditionally based on fault liability,[29] which would retreat behind the standard of strict liability. The more blockchain spreads, the more strict liability will be strengthened.[30] The process of secularisation of civil responsibility would thus reach its definitive fulfillment:[31] a transition from an ethical paradigm (centered on fault)[32] to a legal criterion that can be summarised in the formula of Benedetto Croce according to which 'one is not responsible; one is instead made responsible',[33] thus conforming to his idea of the amoral character of the law and the perfect coincidence of the legal activity with the economic one.[34]

4. The Allocation of Risk

Significantly, despite the 'alleged' tamper-proof and immutable nature of blockchain that is very often asserted by operators[35] – as well as in parts of academic literature[36] – as a groundbreaking feature of this new technology, when a customer decides to download a program allowing the exploitation of a blockchain platform, the customer is confronted with a liability exemption clause (in favor of the relevant operator)[37] warning the user of the risk she/he

[28] Patti, 'The European Road to Autonomous Vehicles' (n 21), who recalls such principle, applying it to a different case based on tort law.

[29] Franz Werro, 'Liability for Harm Caused by Things' in Arthur Hartkamp and others (eds), *Towards a European Civil Code*, 4th edn (Wolters Kluwer 2011) 921, points out that almost the entire legal tradition of European legal systems is based on fault liability; on the contrary, strict liability tends to be confined to the regulation of residual cases. Paradigmatically, Rudolf V Jhering, *Das Schuldmoment im römischen Privatrecht. Eine Festschrift* (Verlag Von Emil Roth 1867) 199, reprinted with additions in 1879: *Vermischte Schriften juristischen Inhalts* (Breitkopf und Härtel 1879): 'ohne Schuld keine Verantwortlichkeit ... d. g. keine Verpflichtung zum Schadensersatz'.

[30] The concept of risk liability has been in-depth analysed by German juridical literature'. Recently, cf Othmar Juaernig and others, BGB, 17th edn (CH Beck 2018), vor § 823 II 1.

[31] Castronovo, *Responsabilità civile* (n 27) 406, 425.

[32] See notably V Jhering, *Das Schuldmoment im römischen Privatrecht. Eine Festschrift* (n 29).

[33] Benedetto Croce, *Etica e politica* (Laterza 1945) 127: translation by author.

[34] Benedetto Croce, *Riduzione della filosofia del diritto alla filosofia dell'economia* (Carlo Nitsch ed, Giuffrè 2016) 35-85.

[35] See, for instance, the main page of the Ethereum website: <https://www.ethereum.org/#cancel>.

[36] See Marc Pilkington, 'Blockchain Technology: Principles & Applications' in Francisco Xavier Olleros and Majlinda Zeghu (eds), *Research Handbook on Digital Transformations* (Edward Elgar 2016) 15; Christoph Van der Elst and Anne Lafarre, 'Blockchain and Smart Contracting for the Shareholder Community' (2019) 20 EBOLR 111.

[37] Through such clauses the operators of blockchain platforms warn the end users of a series of risks that the former aim to remain unscathed from.

can incur by using this technology. Beyond the doubtful validity of these clauses, the concern of their drafters[38] shows that the use of the platform involves a series of risks allocated to end users.[39] However, it is logical and fair that such risks be assigned instead to the blockchain operator,[40] for it is the operator that is obliged to guarantee the maximum security of the technological service made available to the users and, in a cost-efficient manner, to prevent the service from being harmful.[41] If the malfunction or the attack harms end users, the latter must be adequately compensated.

Precisely the historical events surrounding the attacks on the Ethereum or Bitcoin platforms prove how only the relevant operators are in a position to manage the risk,[42] prevent damage and possibly compensate it.[43] Although, in some cases, end users have been involved in the remedial choice of opting for a hard or soft fork in blockchain platforms, this cannot constitute a valid reason for exempting the relevant operator from liability where there are – as discussed below[44] – crypto-economic losses to the detriment of the end users. Recourse to the concept of remedy, which has the function of repairing the damage suffered, presupposes the existence of liability. There is still someone who, by putting the algorithmic service into circulation,[45] decides to assume the risk that in spite of adopted precautions (in terms of safety and immutability), the activity will materialise in damage.[46] Paradoxically, a total absence of responsibility would also weaken the incentive to take the abovementioned precautions,

[38] Ie, the operators of the blockchain platform.

[39] Cf <https://www.ethereum.org/#cancel>. Immediately after clicking on the Download or Install Command Tools section on the first page, several disclaimer clauses appear, and they must be accepted by the user in order to complete the download itself.

[40] Cf Jacques Moury, 'Le droit confronté à l'omniprésence du risque' (2012) n 16 D (Recueil Dalloz) 1020.

[41] This opinion, therefore, contrasts with the idea of those who, conversely, claim the impossibility of identifying a person liable for the service provided by blockchain platforms. See Angela Walch, 'The Bitcoin Blockchain as Financial Market Infrastructure: A Consideration of Operational Risk' (n 10).

[42] The principle has been also stated in Escola v Coca-Cola Bottling Co of Fresno 150 SPCC P.2d 436, 436, 440ff (1944).

[43] See the different theory proposed by Josef Esser, *Grundlagen und Entwicklung der Gafährdungshaftung*, 2nd ed (CH Beck 1961) 109. According to Esser, the conscious and voluntary exposure to the risk by the damaged party would always impede strict liability of the latter.

[44] See para 5 of this paper in relation to the theft of NEM (XEM) and its consequences.

[45] See Tom Simonite, 'The Man Who Really Built Bitcoin' [2014] MIT Tech Rev <https://www.technologyreview.com/s/527051/the-man-who-really-built-bitcoin/> accessed 3 April 2019, who argues that only the core developers have the power to 'change the code behind Bitcoin and merge in proposals from other volunteers'.

[46] Victor Mataja, *Das Recht des Schadenersatzes vom Standpunkte der Nationalökonomie* (Verlag Von Duncker & Humblot 1888) 19. The theory evokes that developed later by Guido Calabresi, 'Optimal Deterrence and Accidents' (1975) 84 YLJ 666, in which the author describes some modifications to his original theory contained in his monograph *The Costs of Accidents* (YUP 1970).

imposing a net cost on society, which would ultimately become a burden for the victims of the damage.[47]

Therefore, the basic conceptual approach to be adopted establishes that the damage, once occasioned, cannot be erased by society; compensation does not serve to ontologically annul the harm, instead simply transferring it from those who have suffered it to those who must compensate it.[48]

5. Mandatory Third-Party Insurance for Blockchain Platform Operators and the Benefits for European Regulatory Private Law

Future European legislation should carefully assess the possibility of imposing the risks associated with blockchain's service on the platform operator: he is, among all the relevant actors, the one who can avoid the damage and address it in the most cost efficient manner from an economic point of view.[49] Moreover, economic analysis helps to demonstrate that only the blockchain platform operator is able to translate risk into cost,[50] thus allowing it to be subject to a cost-benefit analysis through the mechanism of insurance.[51]

In this perspective, the European Parliament Resolution on civil law on robotics arouses interest, representing the opportunity to introduce an 'insurance system' for robotics which should 'take into account all potential liability in the chain'.[52] The need for a blockchain platform operator to be insured stems from the circumstance that he has a constant and not occasional relationship with the associated risks.[53] In this sense, if blockchain transactions or smart contracts are destined to grow in the future, it is plausible that the magnitude of the risk will proportionately increase.

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[47] Gerhard Wagner, 'Robot liability' [2018] *Münster Colloquium on EU Law and Digital Economy, Liability for Robotics and the Internet of Things* 12.3.2018, <https://ssrn.com/abstract=3198764> accessed 3 April 2019.

[48] Pietro Trimarchi, *Rischio e responsabilità oggettiva* (Giuffrè 1961) 16, whose thought can be compared to that expressed years before by Victor Mataja, *Das Recht des Schadenersatzes vom Standpunkte der Nationalökonomie* (n 46) 19. From the perspective of European legislators, therefore, the problem must not only be the discovery of the true perpetrator of the damaging act; what needs to be established are also the damage's legally significant conditions and the procedures for imposing the obligation. A path-breaking work on this topic was carried out by Stefano Rodotà, *Il problema della responsabilità oggettiva* (Giuffrè 1967) 73.

[49] See Matthew Dyson and Sandy Steel, 'Risk and English Tort Law' in Dyson (ed), *Regulating Risk through Private Law* (Intersentia 2018) 23.

[50] Rene Demogue, 'Fault, risk, and apportionment of loss in responsibility' (1918) 13 Ill L Rev 308.

[51] The idea that the risk is to be considered a production cost of the service supply activity, balanced by the profit that the platform manager derives from the same activity that he offers to the users, would appear to emerge from an economic analysis perspective.

[52] Para 57 of European Parliament resolution of 16 February 2017 with recommendations to the Commission on Civil Law Rules on Robotics (n 5).

[53] Trimarchi, *Rischio e responsabilità oggettiva* (n 48) 50.

Paradigmatically, the recent NEM (XEM) cyber-heist from a cryptocurrency exchange platform managed by Choincheck,[54] resulting in a loss of about $ 534 million, demonstrates the urgency in this regard. The Choincheck management has publicly stated that there is no possibility of recovering all the lost cryptocurrency, and it is not clear whether customers can be fully compensated. Even if, hypothetically, the victims were fully compensated, this would not eliminate the need to prudently consider the introduction of a mandatory insurance at European level for blockchain (or cryptocurrency) platform operators against damages caused by theft or system malfunctions.[55] In fact, where the value of cryptocurrency stolen by a hacker on a decentralised platform would be greater than the financial resources of the relevant operator, the risk borne by the end users of not being fully compensated would be enormous and unjustified. It is true that the amount of the insurance premium payable by the blockchain operator would be sizeable in monetary terms, but it would never be equal to the immensely higher value of each theft that has occurred over the last few years on decentralised platforms.[56] From a medium-term perspective, third-party insurance would unfold positive effects both on the blockchain operator, which can transform the risk associated with the service it offers into a predictable cost of its activity (ie payment of an insurance premium scheduled *ex ante*), and on end users, who would not incur the risk of under-compensation.[57] This would yield, as a consequence, a collective benefit in terms of user (or customer) confidence in this type of market, also encouraging its correct functioning.[58] It would be a decisive element for strengthening and consolidating uncertain European regulatory private law in the future.

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[54] See <https://www.bloomberg.com/news/articles/2018-02-01/hackers-in-500-million-heist-targeted-obscure-cryptocurrency> accessed 26 March 2019. NEM (XEM) is the tenth global electronic currency for value.

[55] On the prerequisites that a certain risk or class of risks must have in order to be insured, see Gerhard Wagner, 'Tort Liability and Insurance: Comparative Report and Final Conclusions' in Id (ed), *Tort Law and Liability Insurance* (2005), 309, 314-315. Cf also Stefan Perner, 'Compulsory Liability Insurance and European Union Law' in Attila Fenyves and others (eds), *Compulsory Liability Insurance from a European Perspective* (De Gruyter 2016) 285.

[56] The statistical rarity of malfunctions or theft on blockchain platforms is likely to generate a willingness in insurance companies to conclude insurance contracts protecting blockchain platform operators from loss.

[57] Michael Faure, 'Compulsory Liability Insurance: Economic Perspectives' in Fenyves and others (eds), *Compulsory Liability Insurance from a European Perspective* (n 55) 319, 321, 331.

[58] This idea represents a part of the broader concept of a regulatory private law aimed at preventing or neutralising the risks deriving from the structural information asymmetry between contracting parties, as well as the irrationality that can guide the negotiation choices of a person who enters a contract outside of his professional activity. See notably Pietro Sirena, 'Diritto privato e diritto pubblico in una società basata sulle libertà individuali' [2017] RDC 101, 113; Sirena, 'L'europeizzazione degli ordinamenti giuridici e la nuova struttura del diritto privato' (2014) 1 ODCC 3, 10-13.

6. Concluding Remarks: The Law-Economy Binomial as the Foundation of the EU's Future

The growing global investments in blockchain technology call for a progressive regulatory adaptation to the changing reality.[59] Civil liability and the insurance sector represent two areas of law in which considerable effort will be required to adapt and govern an ever more pressing techno-economic evolution. The proposed European regulation of these two spheres of law would be beneficial not only for the individual protection of the parties involved (blockchain platform operators and end users) but also for the general market, stimulating its correct functioning.

These are mandatory changes needed to avoid a flattening of technology law.[60] Supranational legislators, facing the dichotomous alternative of 'code *of* law'[61] and 'code *as* law',[62] will be called upon to opt for one of the two formulas, under the awareness that economic and legal reasoning can no longer be separated[63] in creating the future of the EU.

[59] The problem of regulatory adaptation to the change in reality is addressed by da David Harvey, *Collisions in the Digital Paradigm. Law and Rule-Making in the Internet Age* (Hart Publishing 2017).
[60] Anthony Allott, *The Limits of Law* (Butterworths 1980) 161, 168.
[61] This theory was formulated by Lawrence Lessig, *Code and Other Laws of Cyberspace* (Basic Books, 1999), whose ideas were then developed in his later work, *Code v2*, 2nd ed (Basic Books, 2006), 1-9.
[62] Karen Yeung, 'Regulation by Blockchain: The Emerging Battle for Supremacy between the Code *of* Law and Code *as* Law' (2019) 82 MLR 207, who identifies the heterogeneous modes of interaction between 'code of law' and code as law', differentiated on the basis of 'the intended motives and purposes of network participants when engaging in transactions upon the network', these including hostile evasion, efficient alignment and supporting novel forms of peer-to-peer coordination and cooperation to reduce transactional friction.
[63] Benedetto Croce, *Riduzione della filosofia del diritto alla filosofia dell'economia* (n 34) 35-85.

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