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Distributed ledgers, EOP, and debt recovery mechanisms: a new technology for civil procedure

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Abstract: The delay of payments in commercial transactions persists as a pressing problem for small and medium-sized enterprises (SMEs). In the European Union, it increases financial costs, contributes to the lack of liquidity and can even lead to bankruptcy. While the EU took several steps in addressing this issue, results have been lacking so far. This article explores the implementation of a distributed ledger (DL) system based on blockchain technology to improve the standard of evidence for the European order of payment (EOP) and to pave the way to an automated assessment of claims under art. 8 of the Reg. 1896/2006. By leveraging a modular approach and combining the properties of distributed ledgers with smart contracts, such a system could lead to harmonization of redress procedures and move beyond the two models of payment order procedure in member states, and, ultimately, pave the way to an e-justice system at the European level. It is argued that such a system improves the standard of the evidence required for issuing EOP by providing formal control of the evidence submitted to the courts together with the form pursuant to

art. 7 Reg. 1896/2006. Lastly, this is the first step in establishing a system that could (a) reduce inefficiencies (b) reduce the risk of errors (c) reduce the costs of access to the judicial system (d) establish an automatic e-order of payment procedure (e) improve accessibility for SMEs thereby improving their competitiveness and (f) contribute to the establishment of the single market.

Keywords: blockchain; distributed ledger technology; debt recovery; European order of payment; smart contracts; payment procedures.

1. INTRODUCTION

The problem of late payment in B2B transactions has been widely recognized as a pressing issue in the context of the European Union for the establishment of the single market[1]. Late payment is a breach of contract whereby the creditor does not have the sum owed by the debtor at her disposal on the due date provided that she has fulfilled his obligations. This scenario has been made financially attractive to debtors in most Member States by low or no interest rates charged on late payments and slow procedure for redress[2].

In the context of debt recovery, where civil procedure plays a prominent role, several initiatives have been undertaken by the EU[3]. More precisely, the Regulation (EC) No 805/2004 established a European Enforcement Order (EEO) for uncontested claims, that is, it provided for the abolition of the exequatur procedure for uncontested claims judgments for the payment of due sums of money[4]. Improving on the conditions of enforceability only solved part of the problem. Thus, the Commission opted for the creation of a separate instrument: "a specific harmonized procedure for the recovery of debts that are presumed to remain uncontested, namely the European order of payment." Additionally, the EU regulators intervened on interest rates as a further mechanism to address the late payments issue[5]. Despite these initiatives recent statistics indicate at best, no improvements in the wake of the financial crisis[6].

1. The European Union has recognized the problem in several occasions, among which there are a recommendation adopted by the Commission on 12 May 1995, an opinion on the Commission's Green Paper on Public procurement in the European Union: Exploring the way forward by the Economic and Social Committee on 29 may 1997, a action plan for the single market adopted by the Commission on 4 June 1997, a report by the Commission issued on 17 July 1997.
2. See whereas n. 12 Directive 7/2011/EU.
3. See Aude Fiorini, "I. facilitating Cross-Border Debt Recovery—the European Payment Order and Small Claims Regulations," International and Comparative Law Quarterly 57, no. 2 (2008), http://dx.doi.org/10.1017/S0020589308000262.
4. If these judgments meet a number of conditions, see Study JLS C4/2005/ 03 (n 12) and ibid.
5. Directive 2011/7/EU
6. A study form the Asset Based Finance Association found that in 2015, despite the economic recovery, SMEs wait an average of 11 days longer for payment than they were at the peak of the recession.

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In particular, heavy administrative and financial burdens still weight on SMEs[7] as a result of excessive payment periods and – more importantly – late payments. As is known, late payments negatively affect liquidity and complicate the financial management of undertakings. They also affect the competitiveness and profitability of SMEs, especially when the creditor needs to obtain external financing due to late payments. The external evaluation of the Directive 7/2011/EU found that, for each day of reduction in payment delays, European companies save an estimated EUR 158 million in financial costs[8].

This essay limits its analysis to payments made as remuneration for B2B transactions and does not deal with transactions with consumers (B2C), interests in connection with other payments and payments made as compensation for damages including payments from insurance companies. Furthermore, the European Commission emphasized[9] that a legal and business environment supportive of timely payments in commercial transactions should be developed and that public authorities have a distinct responsibility in this regard.

While this essay mainly deals with the EOP procedure, its underlying principles could be extended at the member states level with minor modification to fit the domestic legislation[10]. The mechanisms for debt recovery are also of paramount importance at the domestic level and drain significant resources from judicial systems. For example, between 2009 and 2012 the number of procedures for payment order was close to double the ordinary procedures in the Italian judicial system[11].

In light of these authoritative remarks, this essay explores a technological approach to the late payment problem by leveraging a technological innovation in the field of ICT, namely distributed consensus systems, based on blockchain and distributed ledger (DL) technology. The properties of DL improve the current landscape, as they enable a decentralized formal control of the evidence.

The article develops as follows: section 2 introduces the technological innovation of blockchains and DL; section 3 deals with the European Order of Payment and highlights its characteristics. Section 4 shows how a DL system can be applied to the procedure described in section 3; section 5 concludes.

The report is available here: http://www.abfa.org.uk/news/Documents/ABFA%20white%20paper%20-%20Payment%20days%20by%20sector.pdf

7. For a definition of SMEs, sse Commission Recommendation of 6 May 2003
8. http://bookshop.europa.eu/en/ex-post-evaluation-of-late-payment-directive-pbET0415875/ p.59.
9. European Commission, communication of 25th June 2008.
10. In particular for civil law countries see Section 3.
11. For a full statistical analysis of the civil actions divided by type see https://www.giustizia.it/giustizia/it/mg_1_14_1.page?facetNode_1=0_10&facetNode_2=0_10_37&contentId=SST993953&previsiousPage=mg_1_14

2. A BRIEF INTRODUCTION TO BLOCKCHAINS AND DISTRIBUTED LEDGERS

There are many definitions of blockchains and distributed ledger technologies[12]. For the purpose of this essay, it suffices to focus our attention on the main characteristics of this technological innovation, without delving too much into the technicalities[13]. The rest of this article adopts the term DL as a placeholder for the class of technologies of distributed consensus systems[14].

Primarily, DL enable the storage of data in a distributed fashion without resorting to a central authority (CA) or trusted third party (TTP)[15]. DL technologies ensure that participants agree on the order, validity, existence, and authenticity of the data stored in the system[16]. The most prominent examples of DL systems are cryptocurrencies, that is, peer-to-peer distributed virtual currencies whose functioning is not based upon a CA or a TTP in contrast to traditional online means of payments[17]. It is important to outline how this class of technologies enables participants to agree in a distributed way. This distributed agreement often referred to as consensus is the raison d'etre of DL.

Many experts in industry, governments, and academia contend that DL technologies can be successfully applied beyond the field of cryptocurrencies. On one hand, governments and companies have issued several reports on the topic exploring the potential of the technology[18]. On the other hand, in academia, some regard these

12. The notion of a "modern" blockchain has been proposed by Satoshi Nakamoto, Bitcoin: A Peer-to-Peer Electronic Cash System (2008). Although the idea of cryptographically linking together data was first proposed in Stuart Haber and W Scott Stornetta, How to Time-Stamp a Digital Document, Conference on the Theory and application of Cryptography (Springer, 1990).
13. For a comprehensive introduction of the techological landscape see Arvind Narayanan et al., Bitcoin and Cryptocurrency Technologies: A Comprehensive Introduction (Princeton University Press, 2016). And for an outlook of the building blocks of the technology see Arvind Narayanan and Jeremy Clark, "Bitcoin's Academic Pedigree," Queue 15, no. 4 (2017).
14. Florian Glaser and Luis Bezzenberger, "Beyond Cryptocurrencies-a Taxonomy of Decentralized Consensus Systems" (paper presented at the 23rd European Conference on Information Systems (ECIS),, Münster, Germany2015). Xiwei Xu et al., A Taxonomy of Blockchain-Based Systems for Architecture Design, Software Architecture (ICSA), 2017 IEEE International Conference on (IEEE, 2017).
15. There are many more nuances that characterized different instantiation of these technologies, for an overview of several implementations see Diego Romano and Giovanni Schmid, "Beyond Bitcoin: A Critical Look at Blockchain-Based Systems," Cryptography 1, no. 2 (2017), http://dx.doi.org/10.3390/cryptography1020015. And for an analysis of the components of the data structure see Xiwei Xu et al., The Blockchain as a Software Connector, Software Architecture (WICSA), 2016 13th Working IEEE/IFIP Conference on (IEEE, 2016).
16. Victoria Lemieux, Blockchain and Distributed Ledgers as Trusted Recordkeeping Systems: An Archival Theoretic Evaluation Framework (2017).
17. For a critical perspective on the topic see Claus Dierksmeier and Peter Seele, "Cryptocurrencies and Business Ethics," Journal of Business Ethics (August 13 2016), http://dx.doi.org/10.1007/s10551-016-3298-0.
18. Reeson A. Hanson RT., Staples M., "Distributed Ledgers, Scenarios for the Australian Economy over the Coming Decades," Canberra (2017). UK Government Chief Scientific Adviser, Distributed Ledger

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technologies as a blueprint for a new economy[19]; while others hold it as an institutional technology.[20] Although this new technology is at the top of the Gartner hype cycle[21], some use-cases seem at hand.

The main properties of a DL information processing system are (a) append-only[22] (b) byzantine fault-tolerance[23] (c) resiliency[24] (d) tamper-proofness[25] (e) security[26] (f) immutability[27]. One can conceptualize a DL system as a distributed notary, albeit with one key difference, namely, the so-called last-mile problem[28]. Simply put, DL are truth-agnostic. This technology guards against alteration, modification, deletion, and hacking of data but it is not suited for establishing the truthfulness of the data

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Technology: Beyond Block Chain, by Ed Vaizey Matthew Hancock (London: Government Office for Science, 2016); Stephen Marshall Vimi Grewal-Carr, Blockchain, Enigma. Paradox. Opportunity (London: Deloitte LLP, 2016); Richard Thompson Ainsworth and Andrew Shact, "Blockchain (Distributed Ledger Technology) Solves Vat Fraud," (2016); LD Griggs et al., "Blockchains, Trust and Land Administration: The Return of Historical Provenance," Poperty Law Review 6 (2017). George Samman Sigrid Seibold, Consensus, Immutable agreement for the Internet of Value (KPMG LLP, 2016); Commitee on Economic and Monetary Affairs, Draft Report on Virtual Currencies, by European Parliament, 2016/2007(INI) (European Parliament, 2016).

19. Melanie Swan, Blockchain: Blueprint for a New Economy (" O'Reilly Media, Inc.", 2015); Melanie Swan, "Anticipating the Economic Benefits of Blockchain," Technology Innovation Management Review 7, no. 10 (2017).
20. Sinclair Davidson, Primavera De Filippi, and Jason Potts, "Blockchains and the Economics Institutions of Capitalism," Journal of Institutional Economics (2017); Sinclair Davidson, Primavera De Filippi, and Jason Potts, "Disrupting Governance: The New Institutional Economics of Distributed Ledger Technology," (2016).
21. See https://www.gartner.com/en/research/methodologies/gartner-hype-cycle for an overview of the methodology
22. This means that users of the system can only write data to the ledger. In database lingo a DL is a write/read only data structure.
23. That is, the network can tolerate erratic behavior of some of its nodes. In the classic paradigm of distributed computing erratic behavior is defined as nodes exiting and joinin the network randomly or nodes crashing. In DL systems it extends to arbitrary and adversary behavior. For an accessible overview of the matter see Ittai Abraham and Dahlia Malkhi, "The Blockchain Consensus Layer and Bft," Bulletin of EATCS 3, no. 123 (2017); Shehar Bano et al., "Consensus in the Age of Blockchains," arXiv preprint arXiv:1711.03936 (2017). For the first formalization of the Byzantine General Problem see Leslie Lamport, Robert Shostak, and Marshall Pease, "The Byzantine Generals Problem," ACM Transactions on Programming Languages and Systems (TOPLAS) 4, no. 3 (1982).
24. The ledgers is replicated across all the nodes participating in the network.
25. Once added to the ledger data is very difficult to modify since the systems links chunks of data together, this means that modifying an entry into the systems entails necessarly re-compute all the entry after it. This mechanism was first described in Haber and Stornetta.
26. This technology is at the foundation of the Bitcoin network which is considered highly reliable by security experts and has not been compromised in 10 years, even if there are billions at stake.
27. More precisely, DL systems are immutable from the user's side while simply hard-to-change for the gatekeepers of the system. See Angela Walch, "Blockchain's Treacherous Vocabulary: One More Challenge for Regulators," (2017).
28. See supra 15.

it stores. In other words, what matters in a DL is the form, not the content. Yet, this technological innovation fits hand to glove the peculiar standard of evidence required for the payment procedure in member states, and, therefore for the indication of evidence[29] required by the EOP procedure. The next section outlines the different procedural mechanisms of debt recovery at the member state level upon whose grounds the EOP instrument stands.

3. DOMESTIC AND CROSS-BORDER DEBT RECOVERY IN THE EU: A PRIMER

There are different mechanisms for debt recovery among the member states[30]: ex parte mechanism, small claims procedures, and payment order procedures.

In the UK, for instance, the summary judgment introduced in 1855 with the Summary Procedure on Bills of Exchange Act, later included in Order n. 14 of the Rules of the Supreme Court in 1937, enables creditors to reach an order of payment without instantiating a judicial procedure inaudita altera parte. Conversely, most civil law countries[31] provide a procedure to allow creditors of a defined sum of money to obtain a court order of payment without prior notification to the debtor. Two models exist: the evidence model and the no-evidence model. The former requires claimants to produce evidence of the claim[32]. For example, in Italy[33] judges must issue the order if the claimant provides written proof of the right[34]. On the contrary, the latter model, that is the no-evidence one, requires no evidence of the claim[35].

EU regulators struck a compromise between these two models with the EOP. As such, the regulation requires a description of the available evidence. This article suggests an improvement to the EOP model by requiring the evidence to be submitted in a DL system to increase the quality of justice and pave the way to an automatic assessment of EOP claims.

While this article focuses on the EOP procedure, many of the following remarks can be extended at the domestic level. For instance, under Italian law, the so-called

29. Regulation 1896/2006 art. 7(e)
30. E Serverin, CNRS ENS-Cachan, 'Des proce´dures de traitement judiciaire des demandes de faible importance ou non conteste´es dans les droits des Etats-Membres de l'Union europe´enne' (9 July 2001) 6
31. Some examples include: book 7 of the German Z.P.O., arts. 448 and ff. of the Austrian Z.P.O. and arts. from 1405 to 1425 of the French Civil Procedure Code.
32. As in Belgium, France, Greece, Luxembourg and Spain.
33. For an in depth analysis of the Italian procedure see Alberto Ronco, I Procedimenti Sommari E Speciali. 1: Procedimenti Sommari (633-669 Cpc). Procedimento Per Decreto Ingiuntivo (UTET Giuridica, 2005).
34. Pursuant to art. 633 of the c.p.c.
35. As in Austria, Germany, Finland, Sweden and Portugal.

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"procedimento monitorio" is summarily defined as the procedure by which a claim concerning the payment of a specific amount of money is deferred to a court to obtain a payment order. The law does not require a strict standard for the evidence submitted by the claimant[36], in that, evidence necessary for emitting an order of payment would not be considered enough in an ordinary trial. The primary assumption is that the payment orders are issued when there is a high probability that the claim is, and will remain, uncontested.

In the case of commercial transactions, this standard results in the mere allegation of the existence of the right being claimed. Therefore, an invoice (a document solely produced by the creditor) is considered sufficient by the Italian Court of Cassation for the issuance of a court payment order[37]. Regardless of art. 634 of the Code of Civil Procedure (also, c.p.c.) which requires notary certification of the accounting books[38]. One can start to see why a DL system to manage this kind of procedures seems a perfect fit.

It follows that the standard of evidence (both at the Italian and European level) is quite peculiar. Under art. 7(e) the description of the evidence in the Regulation n. 1896/2016 concerns "[the] possible types of evidence that are usually produced in support of pecuniary claims[39]". Consequently, a document – or no document at all - produced by the creditor is sufficient. Following the previous remarks, this article contends that there is an opportunity to experiment with a DL-based distributed system to assess the claims for the European Order of Payment.

Further, according to the regulation "the examination should not need to be carried out by a judge" and "the examination [of applications for a court order of payment] may take the form of an automated procedure"[40]. Therefore, in this trend towards automation, also shown by recent developments in the digitalization of the justice systems[41], and given the peculiar standard of evidence required for the order of payment procedures, the blueprint for an information system to manage the "possible types of evidence that are usually produced in support of pecuniary claims" is put forward. Primarily, this system can and should be designed to allow judges (and then software agents) to assess formally the document submitted as evidence, and then to manage semi-autonomously the whole procedure, from the creation of the documents presented as evidence to the issuance of the EOP.

36. As exceptions to the common standard for evidences dictated for the ordinary trial by art. 2699 and subsequent of the civil code and arts. 191 and ss. of the c.p.c.
37. See, ex multis Court of Cassation n. 5071 of 2009.
38. Which applies if the claimant is a commercial operator - as defined by art. 2195 of the civil code – and consists in the authentication by a notary of the accounting books of the claimant.
39. Whereas n. 14 Regulation 1896/2016/EU
40. Art. 8 reg. 1896/2006.
41. A slow process started in the Italian legal system with the law n. 59 of 15 March 1997.

4. TOWARD AN AUTOMATED DEBT RECOVERY PROCEDURE

Is it possible to improve the standard of evidence required by the EOP procedure? Which benefits would derive from the adoption of an information system to manage evidence for the EOP? This section explores these issues by exploring the adoption of an EU-level system to manage evidence in the context of the EOP. This article contributes to the literature at the intersection of law and blockchains by showing how the properties of this information systems fit the procedure established by the Regulation 1896/2006.

The proposed architecture is modular, as such different parts should be implemented as the experimentation with the system progresses, and feedback is gathered from stakeholders. Module n. 1 pegs the invoice (or the possible types of evidence that are usually produced in support of pecuniary claims) to a data container in a DL along with the EOP module, the claimants submit the evidence and the form using a web-interface to the competent court. Pegging the evidence as well as the EOP form to a DL enables the whole procedure to benefit from the properties of such systems as described in section 2.

Subsequently, module n. 2 adds smart capabilities and enables the creation of a persistent scripts environment (formerly known as smart contracts)[42]. The evidence becomes the object of a function whose parameters are: due date, amount, recipient, creditor, and location along as the inputs of the EOP form. Persistent scripts, then, enable the trusted execution of the automatic validation of the claim for the EOP as suggested by art. 8 of Reg. 1896/2006. That is, the issuance of the payment order is executed in a transparent, distributed fashion, by the nodes of the network and can be checked by the creditor as well as the debtor. In this scenario, human intervention may be considered superfluous.

This article holds that DL technology is well-suited to enable an e-justice system as it possesses several characteristics that are of paramount importance in this domain. Further, the automatic generation of the order of payments could be added on top of the smart contract module if one aspires to a fully autonomous system of issuance of enforceable orders of payments. Arguably, an automated system for the issuance of EOPs improves cross-border debt recovery, increases efficiency, and contributes to addressing the problem of late-payments in the EU. Lastly, the properties of such systems improve the current paradigm of e-justice systems by enabling the trusted

42. Persistent scripts (also known as smart contracts) are software program that run on a distributed DL system. As such, they share the properties of DL systems as described in section 2. For an overview of smart contracts see Eliza Mik, "Smart Contracts: Terminology, Technical Limitations and Real World Complexity," Law, Innovation and Technology (2017). Also on the topic see Karen EC Levy, "Book-Smart, Not Street-Smart: Blockchain-Based Smart Contracts and the Social Workings of Law," Engaging Science, Technology, and Society 3 (2017). For an outlook of current implementations see Massimo Bartoletti and Livio Pompianu, "An Empirical Analysis of Smart Contracts: Platforms, Applications, and Design Patterns," arXiv preprint arXiv:1703.06322 (2017).

execution of the specific procedure of the EOP; this could lead to a new paradigm for the civil procedural law, namely, a fully automated, trusted and transparent issuance of an enforceable order of payment.

5. CONCLUSION AND DISCUSSION

The late payment in commercial transactions in a pressing problem in the European Union, especially for SMEs. This short working paper took the first step toward the implementation of a DL system to automate the issuance of EOPs. Such a system arguably has the same properties and functions as the notary authentication pursuant, for example, to art. 634 of the c.p.c., and improves on the standard of evidence required by the regulation.

Additionally, the system improves the transparency and efficiency of the procedure. This, in turn, should lower the costs of legal assistance in the application process and speed up the issuance of EOP. It is also possible that some of the properties of this system (i.e. timestamping and tamper-proofness) could have spill-over effects on other civil procedures. Moreover, this article aims to probe the civil procedure community attitude toward the DL technology and tries to establish a discussion to promote a righteous path for the automation of specific legal procedures. Lawyers and legal experts should lead the project of judicial automation and not be the victims of it. Lastly, taking into account the innovative and experimental nature of the proposed solution, it is desirable that its implementation should be carried out in a regulatory sandbox[43].

In light of the recent opening to digitalization and automation of specific procedures made by the EU legislators, the combination of a DL system with persistent scripts functionalities, seems apt to streamline and automate the process of issuance of orders of payments, thereby contributing to addressing the issue of late payment in commercial transactions in the Union as well as, eventually, member states.

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BIBLIOGRAPHY

Abraham, Ittai and Dahlia Malkhi. “The Blockchain Consensus Layer and Bft.” Bulletin of EATCS 3, no. 123 (2017).

Ainsworth, Richard Thompson and Andrew Shact. “Blockchain (Distributed Ledger Technology) Solves Vat Fraud.” (2016).

43. Mark Fenwick, Wulf A Kaal, and Erik PM Vermeulen, “Regulation Tomorrow: What Happens When Technology Is Faster Than the Law?,” (2016).

Bano, Shehar, Alberto Sonnino, Mustafa Al-Bassam, Sarah Azouvi, Patrick McCorry, Sarah Meiklejohn, and George Danezis. "Consensus in the Age of Blockchains." arXiv preprint arXiv:1711.03936 (2017).

Bartoletti, Massimo and Livio Pompianu. "An Empirical Analysis of Smart Contracts: Platforms, Applications, and Design Patterns." arXiv preprint arXiv:1703.06322 (2017).

Davidson, Sinclair, Primavera De Filippi, and Jason Potts. "Disrupting Governance: The New Institutional Economics of Distributed Ledger Technology." (2016).

Davidson, Sinclair, Primavera De Filippi, and Jason Potts. "Blockchains and the Economics Institutions of Capitalism." Journal of Institutional Economics (2017).

Dierksmeier, Claus and Peter Seele. "Cryptocurrencies and Business Ethics." Journal of Business Ethics (August 13 2016). http://dx.doi.org/10.1007/s10551-016-3298-0.

Fenwick, Mark, Wulf A Kaal, and Erik PM Vermeulen. "Regulation Tomorrow: What Happens When Technology Is Faster Than the Law?" (2016).

Fiorini, Aude. "I. facilitating Cross-Border Debt Recovery—the European Payment Order and Small Claims Regulations." International and Comparative Law Quarterly 57, no. 2 (2008): 449-65. http://dx.doi.org/10.1017/S0020589308000262.

Glaser, Florian and Luis Bezzenberger, "Beyond Cryptocurrencies-a Taxonomy of Decentralized Consensus Systems." 23rd European Conference on Information Systems (ECIS),, Münster, Germany, 2015.

Griggs, LD, Rod Thomas, Rouhshi Low, and James Scheibner. "Blockchains, Trust and Land Administration: The Return of Historical Provenance." Poperty Law Review 6 (2017): 179-94.

Haber, Stuart and W Scott Stornetta. How to Time-Stamp a Digital Document. Conference on the Theory and application of Cryptography: Springer, 1990.

Hanson RT., Reeson A., Staples M. "Distributed Ledgers, Scenarios for the Australian Economy over the Coming Decades." Canberra (2017).

Lamport, Leslie, Robert Shostak, and Marshall Pease. "The Byzantine Generals Problem." ACM Transactions on Programming Languages and Systems (TOPLAS) 4, no. 3 (1982): 382-401.

Lemieux, Victoria. Blockchain and Distributed Ledgers as Trusted Recordkeeping Systems: An Archival Theoretic Evaluation Framework. 2017.

Levy, Karen EC. "Book-Smart, Not Street-Smart: Blockchain-Based Smart Contracts and the Social Workings of Law." Engaging Science, Technology, and Society 3 (2017): 1-15.

UK Government Chief Scientific Adviser. Distributed Ledger Technology: Beyond Block Chain, by Matthew Hancock, Ed Vaizey, 2016.

Mik, Eliza. "Smart Contracts: Terminology, Technical Limitations and Real World Complexity." Law, Innovation and Technology (2017): 1-32.

Nakamoto, Satoshi. Bitcoin: A Peer-to-Peer Electronic Cash System. 2008.

Narayanan, Arvind, Joseph Bonneau, Edward Felten, Andrew Miller, and Steven Goldfeder. Bitcoin and Cryptocurrency Technologies: A Comprehensive Introduction. Princeton University Press, 2016.

Narayanan, Arvind and Jeremy Clark. "Bitcoin's Academic Pedigree." Queue 15, no. 4 (2017): 20.

Commitee on Economic and Monetary Affairs. Draft Report on Virtual Currencies, by Parliament, European. 2016/2007(INI), 2016.

Romano, Diego and Giovanni Schmid. "Beyond Bitcoin: A Critical Look at Blockchain-Based Systems." Cryptography 1, no. 2 (2017). http://dx.doi.org/10.3390/cryptography1020015.

Ronco, Alberto. I Procedimenti Sommari E Speciali. 1: Procedimenti Sommari (633-669 Cpc). Procedimento Per Decreto Ingiuntivo. UTET Giuridica, 2005.

Sigrid Seibold, George Samman. Consensus. Immutable agreement for the Internet of Value: KPMG LLP, 2016.

Swan, Melanie. Blockchain: Blueprint for a New Economy. " O'Reilly Media, Inc.", 2015.

Swan, Melanie. "Anticipating the Economic Benefits of Blockchain." Technology Innovation Management Review 7, no. 10 (2017): 6.

Vimi Grewal-Carr, Stephen Marshall. Blockchain. Enigma. Paradox. Opportunity. London: Deloitte LLP, 2016.

Walch, Angela. "Blockchain's Treacherous Vocabulary: One More Challenge for Regulators." (2017).

Xu, Xiwei, Cesare Pautasso, Liming Zhu, Vincent Gramoli, Alexander Ponomarev, An Binh Tran, and Shiping Chen. The Blockchain as a Software Connector. Software Architecture (WICSA), 2016 13th Working IEEE/IFIP Conference on: IEEE, 2016.

Xu, Xiwei, Ingo Weber, Mark Staples, Liming Zhu, Jan Bosch, Len Bass, Cesare Pautasso, and Paul Rimba. A Taxonomy of Blockchain-Based Systems for Architecture Design. Software Architecture (ICSA), 2017 IEEE International Conference on: IEEE, 2017.