1 Introduction

Contracts help to solve some of the basic challenges of cooperation for humans. One of the insights of economics, since the time of Adam Smith, is that a great deal of human productivity comes from cooperation and collaboration. In the eighteenth Century that astounding Scottish polymath published the foundational book for economics: *An Inquiry into the Nature and Causes of the Wealth of Nations*. He opens Chapter 1 of *The Wealth of Nations* by pointing out the importance of the division of labor in human prosperity:

> The greatest improvement in the productive powers of labour, and the greater part of the skill, dexterity, and judgment with which it is anywhere directed, or applied, seem to have been the effects of the division of labour. (Smith 1776)

He uses the example of the benefits of specialization for the manufacture of a pin to illustrate how productivity increases with specialization and the application of technology:
To take an example, therefore, from a very trifling manufacture; but one in which the division of labour has been very often taken notice of, the trade of the pin-maker; a workman not educated to this business (which the division of labour has rendered a distinct trade), nor acquainted with the use of the machinery employed in it (to the invention of which the same division of labour has probably given occasion), could scarce, perhaps, with his utmost industry, make one pin in a day, and certainly could not make twenty. But in the way in which this business is now carried on, not only the whole work is a peculiar trade, but it is divided into a number of branches, of which the greater part are likewise peculiar trades. One man draws out the wire, another straights it, a third cuts it, a fourth points it, a fifth grinds it at the top for receiving the head; to make the head requires two or three distinct operations; to put it on, is a peculiar business, to whiten the pins is another; it is even a trade by itself to put them into the paper; and the important business of making a pin is, in this manner, divided into about eighteen distinct operations, which, in some manufactories, are all performed by distinct hands, though in others the same man will sometimes perform two or three of them. (Smith 1776)

If you scale up this kind of process, and add on the gains of trade that make this specialization possible, you get the modern, complex economy where human productivity has climbed exponentially and where want is receding, even in poor countries. The challenge of sustainability of resources in the face of so much activity is, of course, a real consequence of these gains, and one that urgently needs solutions. Nonetheless, the problems of success are generally preferable to the problems of failure, and those sustainability solutions will, in their turn, require our collaboration and cooperation to achieve.

As game theory helps us to model, however, collaboration and cooperation do not always come easily. In many game forms, defection and predation offer short-term advantage at the cost of long-term collaborative gains (Gintis 2000; Dixit and Skeath 2004). Game theory has identified many such structures, such as the first-mover problem, the Prisoners Dilemma, and the Stag Hunt game (Skyrms 2004; Goodenough 2007). For cooperation to prosper, the pathways to defection need to walled off in some way, sometimes by (i) altering the pay-off structure by means such as adding penalties to defection, and other times by (ii) creating execution structures that have enough automaticity to be reliable and resistant to defection once set in motion.

Classical contracting follows the former strategy. The parties lay out a pathway of behavior that they anticipate will create a mutually beneficial collaboration or exchange. Goods and money may change hands; rights and duties may be created, transferred or extinguished; labor and ideas may be contributed to some joint effort. To become a contract, a prose statement is developed that describes the expected events of execution. And then thanks to legal recognition, recourse and enforcement, the pay-offs from defection are to a large degree removed, through damages, penalties and specific performance. This change in probable pay-offs increases the reliability of the expected behavior sufficiently to allow the players to move forward with the necessary level of confidence in each other’s behavior.
Reliable execution structures, by contrast, can be created directly into the physical world. A classic example is the soda or candy vending machine—the armored case of the machine and its dispensing design makes it hard to break into. A money/credit card recognition device assures payment. And the recognition value of the brand on the machine increases reliability. While law helps the machine do its job, it requires no legally enforceable “contract” to create reliability—that is baked into the structure itself (Goodenough 2007).

2 Smart Contracts and Computable Contracts

“Smart contracts” look a lot like vending machines. In fact, Nick Szabo, widely regarded as one of the foundational thinkers of what has become cryptocurrency, used just that example in his short foundational paper on smart contracts, “Formalizing and Securing Relationships on Public Networks,” first published in 1997. He explains:

Within a limited amount of potential loss (the amount in the till should be less than the cost of breaching the mechanism), the machine takes in coins, and via a simple mechanism, which makes a freshman computer science problem in design with finite automata, dispense change and product according to the displayed price. The vending machine is a contract with bearer: anybody with coins can participate in an exchange with the vendor. The lockbox and other security mechanisms protect the stored coins and contents from attackers, sufficiently to allow profitable deployment of vending machines in a wide variety of areas. (Szabo 1997)

He goes on to posit a whole domain of “contracts embedded in the world.”

Building on this approach, the designers of blockchain systems have developed what they call “smart contracts.” These started out as relatively simple sets of if/then instructions for the transfer of cryptocurrency on the occurrence of some event or set of events (Levi and Lipton 2018; Cohn et al. 2017). In this they resembled relatively simple escrow arrangements or letters of credit. In these early stages, the critics of this approach said, with some justification, that smart contracts are neither smart nor contracts (e.g. Cohn et al. 2017, p. 276). Those businesses and researchers who have investigated the means for encoding more complex relationships of event and consequence have sometimes referred to their work as “computable contracting” or even “computational law” (e.g. Surden 2012; Love and Genesereth 2005; LSP Working Group 2019).

The past few years, however, have seen an increase in the contractual expressivity of languages growing out of the smart contract tradition, with Ethereum’s Solidity as an important early example (Solidity 2020). There has also been movement from the computable contracting side, which had aspired to greater capacity than the original smart contract scripts had permitted, toward building more complexity through a stack of smart contracts. Convergence is likely (LSP Working Group 2019).

One holdover from the smart contracting tradition, however, is the deeply held belief that smart contracts could exist largely outside any traditional or legacy legal
system. Just as the cryptocurrencies themselves were digital artifacts that were, at least in their supporters’ eyes, independent of government control, so too were the smart contracts, since they were able to provide extra-legal execution assurance. The crypto-libertarians who make up a significant part of blockchain world view this as a feature, not a bug (e.g., Staples et al. 2017).

While the automaticity of a “smart contract” may be part of its attraction, it does not necessarily remove it from scrutiny by traditional courts and regulators. The crypto-libertarians argue that a virtual currency, existing on a truly dispersed network of nodes, will resist direct interference by nation states and other legal authorities. This view is naive. The states don’t have to control the network—they just have to control the transaction parties. If a court can assert physical jurisdiction over a human party or a human executive of a corporate party, then it can force that human to take actions on the network to make payments, reverse transactions, cough up taxes, or otherwise conform the electronic transaction to the state-mandated outcome. The song made famous by Clash (1979) has resonance here: “I fought the law. and the law won.”

And as “smart contracting” bleeds over into more sophisticated “computable contracting,” law stops being an impediment and starts being a necessity. A complex contract, with terms more developed than “if X happens, transfer coins Y to party Z” lives in a context of execution and performance that involves the physical world, and will benefit from having recourse to legal enforcement to reinforce its reliability. The two streams of reliability—physical execution constraints and external enforcement through law—are converging again.

3 Ricardian and Mixed Text/Code Contracts

The “Ricardian Contract” is one example of this convergence. As originally envisioned by Ian Grigg (2004, 2015), this was intended to be a contract whose expression was both executable by a computer and understandable by a human reader. As the concept has grown, the term has also come to be applied to mixed text/code contracts, where part of the arrangement is set out in executable software and part is set out in a natural language original. While the mixed format is probably a way-station on the journey to a more fully realized computable contract, it will be an important intervening step. And such mixed format agreements will, by necessity, have some interaction with the legacy world of law.
4 The Legal Framework for Smart and Computable Contracts

Except for a fringe of anarchic transactions between anonymous actors dealing through code-based interactions that either never touch down in the physical world or remain hidden from traditional governments, smart and computable contracts will not be able to live solely in their own autonomous world independent of law, courts and tax collectors. Their automaticity, reliability and clarity of execution may diminish the role of the traditional justice system in most instances, but these advantages will not fully eliminate that role. And so there needs to be some kind of accommodation between the two—and that accommodation is in progress. The remainder of this paper will explore two elements in that accommodation process in the United States: (i) the recognition in the legacy legal system for contracts expressed in whole or in part in code, and (ii) the legal treatment of a “repository” for prose versions of standard clauses, such as most “boilerplate” provisions on choice of law and forum, notices, etc.

A last precursor to this exploration is a reminder that the law of these encoded contracts will not always look like the current law applied to natural language agreements. That law has evolved over the past centuries to meet the needs and capacities of word-based formulations of event and response. It is worth noting that these, too, are “computational” in the formal meaning of that term (Flood and Goodenough 2015). When the automobile replaced the horse as the primary means of personal transportation, the well-developed principles of horsemanship needed to be drastically revised—if not outright abandoned—to develop the principles of driving. In the same way, while many of the goals of contract law will remain the same, the way in which those goals are met in a digital framework may look quite different from the rules for paper-based agreements.

5 Legal Recognition of Contracts Expressed in Code

A simple starting point for contracts expressed in code is whether the law will even recognize them as enforceable instruments. Many traditional laws require bargains, at least of a certain value or duration, to be in writing. This is based on a legacy concept that writing is the most formal and permanent mode for expression and recordation of information. Times have changed, however. I am composing this “paper” through a keyboard attached to a digital machine which can display words on a screen. You may be reading it through similar means. The expectation that tangible pieces of paper with writing on them are the apex form of recordation, even with respect to natural language statements, needs to be questioned, and the laws that saw writing as such an apex for embodying an agreement need to be changed.

In the United States, we were lucky to have had this principle addressed over two decades ago in the Uniform Electronic Transactions Act (UETA). It was proposed by
the National Conference of Commissioners on Uniform State Laws (Uniform Law Commission) in 1999 and has since been adopted (with mostly minor variation) on a state level (where most American contract law exists) in 47 of the 50 states, as well as the District of Columbia and the US Virgin Islands. The holdout states are Illinois, New York and Washington, although they do have somewhat similar legislation, thanks in part to E-SIGN, discussed below. At this writing, Washington is considering adoption (Uniform Law Commission 2020).

The provisions of UETA were quite forward looking when it was drafted (Uniform Law Commission 2020). They were based, at least in part, on the UNCTRAL Model Law on Electronic Commerce (UNCITRAL - United Nations Commision on International Trade Law 1996, 1999; Uniform Law Commission 2019; Boss and Kilian 2008; Blythe 2012). The UNCTRAL model has either been adopted or provided inspiration in a number of countries. The European Union has issued directives and regulations supporting electronic commerce as well, most recently eIDAS (Electronic Identification, Authentication and Trust Services), promulgated in 2014 (European Union 2014, see generally Smits 2017). The member states have chosen to implement these ideas in a variety of ways, beyond the scope of this paper. The core take-away is that UETA has international ancestry, siblings, and cousins.

The core provision of UETA is Section 7, which, in its model version, provides:

**“SECTION 7. LEGAL RECOGNITION OF ELECTRONIC RECORDS, ELECTRONIC SIGNATURES, AND ELECTRONIC CONTRACTS.”**

(a) A record or signature may not be denied legal effect or enforceability solely because it is in electronic form.

(b) A contract may not be denied legal effect or enforceability solely because an electronic record was used in its formation.

(c) If a law requires a record to be in writing, an electronic record satisfies the law.

(d) If a law requires a signature, an electronic signature satisfies the law.

Definitions are set out in Section 2 of the act. Pertinent definitions include:

....

(5) “Electronic” means relating to technology having electrical, digital, magnetic, wireless, optical, electromagnetic, or similar capabilities.

....

(7) “Electronic record” means a record created, generated, sent, communicated, received, or stored by electronic means.

(8) “Electronic signature” means an electronic sound, symbol, or process attached to or logically associated with a record and executed or adopted by a person with the intent to sign the record.

....”
Taken together, these provisions remove many of the formal barriers that might have hindered giving legal recognition to a code-embodied contract (Cohn et al. 2017). The arrangement still needs to constitute a contract when evaluated by other legal criteria, but at least the use of software in its formation and recordation is no impediment to that recognition.

In addition to resolving these formal questions, UETA also goes a long way toward recognizing automated transactions:

“SECTION 14. AUTOMATED TRANSACTION.

In an automated transaction, the following rules apply:

(1) A contract may be formed by the interaction of electronic agents of the parties, even if no individual was aware of or reviewed the electronic agents’ actions or the resulting terms and agreements.

(2) A contract may be formed by the interaction of an electronic agent and an individual, acting on the individual’s own behalf or for another person, including by an interaction in which the individual performs actions that the individual is free to refuse to perform and which the individual knows or has reason to know will cause the electronic agent to complete the transaction or performance.

(3) The terms of the contract are determined by the substantive law applicable to it.”

In the definitions:

“(2) “Automated transaction” means a transaction conducted or performed, in whole or in part, by electronic means or electronic records, in which the acts or records of one or both parties are not reviewed by an individual in the ordinary course in forming a contract, performing under an existing contract, or fulfilling an obligation required by the transaction.”

UETA is complemented by a federal law, the E-SIGN Act (see, generally, Williston and Lord 2012 §4:4). In a reverse of the normal pattern, ESIGN’s federal provisions recognizing electronic signatures gives way to UETA’s broader enactment for states and transactions where UETA applies.

The drafters of UETA were intentionally platform-neutral in their approach. In early 2019, the Uniform Laws Commission approved a Guidance Note Regarding the Relations between the Uniform Electronic Transactions Act and Federal ESIGN Act, Blockchain Technology and “Smart Contracts”. This was prompted by the enactment, in a few states, of some UETA supplements that specifically mentioned Blockchain. The legislative intent of these mentions was to make these states appear attractive for blockchain commerce. The Note expresses concern that these modifications might be interpreted as restricting other approaches.

Recently, a variety of states enacted or considered legislation that amends the Uniform Electronic Transactions Act (UETA) to specifically address “blockchain” or “smart contracts.” Such amendments directly contravene the technology-neutral
principles that have enabled the UETA to remain effective over the course of nearly two decades of technological change. In fact, rather than improve the UETA, these blockchain or smart contract amendments undermine the efficacy of the UETA going forward (Uniform Law Commission 2019).

The Note expresses further concern that in their simplest form as mere execution scripts, smart contracts may not, in fact, meet the general idea of contracts, involving at least two parties and some meeting of the minds over a course of conduct. That said, to the extent they do rise to the level of a “contract” in the legal sense, UETA should ensure that the use of code in all or part of the specification of the obligations will not deprive them of legal recognition.

Although a full review of UETA is outside the province of this paper, those interested in smart and computable contracting may wish to study it in greater detail. Practice oriented and scholarly treatments include Williston and Lord (2012 §4:5), Dively (2000), Boss (2001), and Norwood (2006). The application of UETA to blockchain and smart contracting is explored further by Cohn et al. (2017), and the international context around UNCITRAL in Boss and Kilian (2008) and even more broadly in Blythe (2012).

In litigated cases involving electronic contracting, the provisions of UETA and E-SIGN have been applied broadly to support legal recognition and enforcement for transactions entered into and recorded using electronic means (Williston and Lord 2012 §§4:4 and 4:5 and the cases referenced therein, Cohn et al. 2017; Owens 2018). The law has also sparked several commercial ventures that provide platforms for electronic signatures on traditional natural language contracts exchanged and executed via the Internet. One of these, the U.S. based company, DocuSign Inc. had achieved a pre-Covid-19 market capitalization level in early 2020 of more than $14 billion by helping to remove some of the friction in classic text-based contract formation (Market Watch 2020). The potential financial worth of code-enabled contracting would appear to be even greater once the practice matures. The distancing requirements of the Covid-19 crisis have made e-commerce solutions even more attractive in many contexts.

6 Mixed Format Contracting

UETA also resolves some of the concerns around recognizing mixed-format contracting. The portion of the agreement embodied in code will be deemed a “writing.” The remaining challenge is: will the law allow a contract to exist with parts in more than one location? Happily, under traditional US law, the doctrine of “incorporation by reference” allows such a division. A contract formed in one writing can make reference to material set out in other writings and “incorporate” that other text into what is interpreted and applied as a unified contract. Similar concepts exist in many other legal systems.

The fourth edition of the Treatise Williston on Contracts sets out the principle from a US perspective:
As long as the contract makes clear reference to the document and describes it in such terms that its identity may be ascertained beyond doubt, the parties to a contract may incorporate contractual terms by reference to a separate, noncontemporaneous document including a separate agreement to which they are not parties and including a separate document which is unsigned. (Williston & Lord §30:25 at pp. 296–301, references omitted)

If this is accomplished, “that other document, or the portion to which reference is made, becomes constructively part of the writing, and in that respect the two form a single instrument” (Id at p. 304).

Taking the UETA position that an electronic expression of a contract counts as a writing and can be the “signed” portion of the agreement, making reference in that electronic contract to provisions in a traditional writing portion will be an effective way of marrying the two sets of provisions, provided that the reference is specific and clear enough. A challenge for mixed format contracts will be satisfying these requirements for clarity of reference.

As a practical matter, incorporation by reference can be applied to give legal “depth” to blockchain-based “smart contracts.” As discussed above, currently most smart contracts are simple scripts that embody execution but which make no specification about non-execution matters like choice of law and venue. If a dispute arises and the traditional mechanisms of the law are invoked around a specific smart contract, many questions central to that process will be left up in the air. An entry level example is the choice of the law that should be applied. As we have seen, while many jurisdictions recognize electronic contracting generally and blockchain contractual evidence specifically; others do not. Selecting and effectively specifying a smart contract-friendly jurisdiction would be a very useful step in making use of a mixed format contract.

The blockchain field could benefit from the development of short boilerplate attachments that would specify desirable answers for these kinds of questions and that could be linked up in a smart contract and incorporated by reference. More complex standard terms could be handled similarly. In order to satisfy the specificity requirements of incorporation by reference, the other critical element would be some kind of broadly recognized repository or repositories for the attachments and a standardized means for making reference to such a repository.

7 Elements of a Repository

Practically, such an effort would require three steps:

---
1The discussion of a Blockchain Text Repository in this chapter draws, in part, on material included in a proposal prepared by the author for use by the Digital Ledger Governance Association, Inc. (DLGA), and those portions are used with the permission of the DLGA.
• Establishing a widely used format for such an identifier.
• Establishing a secure repository for the clauses themselves, so that specific versions, with their identifier, can be accessed reliably by users and, in the case of a dispute, by the forum.
• Populating the repository with intelligent and usable options that could be readily used by smart contract creators.

Some fields of use are particularly susceptible this approach, particularly those where high volume and repeat players already support standardized forms with little negotiation of boilerplate terms. These areas include finance, transportation contracts, intellectual property licensing, and supply chain verification.

A short hash-based format could be used for the identifier. Such a format could start with a generic identifier, recognized in custom as suggesting both the incorporation step and the registry. If the registry were called the Blockchain Term Repository, for instance, the identifier could be “#BTR”. Then there should be a short designator for the origin of the suggested clause, much like a financial ticker symbol. If the terms were promulgated by Stanford’s CodeX center, for instance, the designator could be “SCX”. The promulgation of suggested terms under a particular sourcing label would need to be subject to some security/curation to ensure that attribution is correct.

A short identifier for the version itself could then follow. If, for instance, it invoked California law (a UETA State), that could be mentioned in compressed form, along with a short characterization, such as “BOILERPLATE” and a version number. This element would be up to the clause provider to determine. Putting these together, the identifier could be:

#BTR.SCX.CA.BOILERPLATE.4

Obviously, a number of different approaches could be adopted as the standard; this approach is provided by way of illustration.

Adoption and use would be facilitated by a secure repository that would record the identifier together with the standard text that it is meant to represent. There could, in theory, be several such repositories, with examples perhaps attached to a particular chain or software approach. The host of such a repository should be a respected neutral party with a reasonable expectation of organizational durability. Possible examples include a trade association, a foundation with interest in blockchain, a university, or a governmental agency. The repository itself would require some thought in its implementation. For instance, it should include a way to register and verify the source of each entry, along with local storage for the entries and some kind of periodic posting to a distributed ledger that can provide long-term verification. Good coding will be necessary. An alternative approach could be to piggyback onto an existing repository, such as GitHub.

The population of the repository could either be done via some central, curated body, or could be left to bottom-up proposals, with the goal of allowing the most useful to emerge through industry use. The bottom-up approach would probably create a more diverse and successful set of options, although some light curation will be necessary to eliminate nonsensical proposals, mis-identification of sources, or attempts at sabotage. As to format, the content of particular entries could include:
The hash identifier described above.

A statement of the text or other matter to be the contents incorporated into the smart contract by reference to the hash identifier

A field in which the source of the text can provide ancillary material about itself, its intentions with the text, and legal references and citations which may be useful.

The contents, once posted, would be put in the public domain.

Topics that could be addressed through a BTR attachment could include such traditional boilerplate matters as:

- Choice of law
- Choice of Dispute Resolution Forum
- Arbitration/Courts
- Location/Venue
- Remedies
- Injunction
- Indemnification
- Damages
- Amendments/Complete Agreement

Any blockchain-specific considerations could also be addressed (e.g., the smart contract would be subject to the rules and actions of the chain on which it is recorded).

Where to direct notices is not included on this list. This area could raise privacy and identity concerns that would require additional care as a repository is established, and any repository project should seek additional input before suggesting a standard. More complex issues like representations and warranties or bankruptcy and defaults could also be incorporated via models posted to the repository as common, standardized approaches emerge.

8 Conclusions

The use of executable code to specify and then perform contractual agreements is growing rapidly. Such approaches include the relatively simple scripts often called “smart contracts” as well as more developed examples frequently labeled “computable contracts.” Although some proponents of digital contracting have argued that the automaticity of machine-execution will remove such agreements from legal review, the more realistic view is that interaction with the legacy legal system is likely to remain a feature of contracting.

To make that interaction productive, law must integrate itself with the new formats and challenges of computational contracting. One entry level requirement is recognition of the format itself. In the United States, UETA provides such
recognition across a broad range of issues arising from the use of electronic means for contract formation and recordation.

A second issue is treatment of mixed-format or Ricardian contracts. In the near term, we can expect the widespread use of natural language text to supplement the code-embodied portions of an agreement. Such a mixture can be legally permissible in the United States under the doctrine of “incorporation by reference.” To be effective, the reference from the “signed” portion to the other material must be sufficiently explicit so that both the intention and the target text can be reliably understood. Developing a standardized approach for such a reference and one or more recognized repositories for material to be incorporated will help ensure both informed use and legal recognition.

References

Blythe SE (2012) An e-commerce law for the world: the model electronic transactions act. Xlibris, Bloomington

Boss A, Kilian W (eds) (2008) The united nations convention on the use of electronic communications in international contracts: an in-depth guide and sourcebook. Wolters Kluwer, Frederick

Boss AH (2001) The uniform electronic transaction act in a global environment. Idaho Law Rev 37:275

Clash (1979) I fought the law. Original music and lyrics by Curtis S (1958). Official video of the Clash version. Available at https://www.youtube.com/watch?v=AL8chWFuM-s

Cohn A, West T, Parker C (2017) Smart after all: blockchain, smart contracts, parametric insurance and smart energy grids. Geo Law Technol Rev 1:273–304. Available at https://perma.cc/TY7W-Q8CJ

Dively MJH (2000) The new laws that will enable electronic contracting: a survey of the electronic contracting rules in the uniform electronic transactions act and the uniform computer information transactions act. Duq Law Rev 38:209–254

Dixit A, Skeath S. (2004) Games of strategy, 2nd edn. W.W. Norton, New York

European Union (2014) Regulation (EU) No 910/2014 of the European Parliament and of the Council of 23 July 2014 on electronic identification and trust services for electronic transactions in the internal market and repealing Directive 1999/93/EC, available at https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=uriserv%3AOJ.L_.2014.257.01.0073.01.ENG

Flood M, Goodenough O (2015) Contract as automaton: the computational representation of financial agreements. OFR Working Paper, No. 15-04, revised (2017), available at https://www.financialresearch.gov/working-papers/files/OFRwp-2015-04_Contract-as-Automaton-The-Computational-Representation-of-Financial-Agreements.pdf

Gintis H (2000) Game theory evolving. Princeton University Press, Princeton

Goodenough O (2007) Values, mechanism design, and fairness. In: Zak PJ (ed) Moral markets: the critical role of values in the economy. Princeton University Press, Princeton, pp 228–257. Available at https://ssrn.com/abstract=933012

Grigg I (2004) The ricardian contract. Available at http://iang.org/papers/ricardian_contract.html

Grigg I (2015) On the intersection of ricardian and smart contracts. Available at https://iang.org/papers/intersection_ricardian_smart.html

Levi SD, Lipton AB (2018) An introduction to smart contracts and their potential and inherent limitations, Harvard Law School Forum on Corporate Governance https://corpgov.law.harvard.edu/2018/05/26/an-introduction-to-smart-contracts-and-their-potential-and-inherent-limitations/
Integrating Smart Contracts with the Legacy Legal System: A US Perspective

Love N, Genesereth M (2005) Computational law. Available at http://logic.stanford.edu/publications/love/computationallaw.pdf

LSP Working Group (Goodenough O Principle Author) (2019) Developing a legal specification protocol: technological considerations and requirements. Stanford CodeX Publication. Available at https://law.stanford.edu/publications/developing-a-legal-specification-protocol-technological-considerations-and-requirements/

Market Watch (2020) DocuSign. https://www.marketwatch.com/investing/stock/docu

Norwood JM (2006) A summary of statutory and case law associated with contracting in the electronic universe. DePaul Bus Commer Law J 4:415–450

Owens L (2018) 7 landmark electronic signature legal cases. Electronic Signature and Records Assoc. Available at https://esignrecords.org/2018/01/28/7-landmark-electronic-signature-legal-cases/

Skyrms B (2004) The stag hunt and the evolution of social structure. Cambridge, Cambridge

Smith A (1776) An inquiry into the nature and causes of the wealth of nations. Variously reprinted including Prometheus, Amherst, New York (1991)

Smits JM (2017) Contract law a comparative introduction, 2nd edn. Elgar Cheltenham

Solidity (2020) Solidity. Available at https://solidity.readthedocs.io/en/v0.6.6/

Staples M, Chen S, Falamaki S, Ponomarev A, Rimba P, Tran AB, Weber I, Xu X, Zhu J, (2017) Risks and opportunities for systems using blockchain and smart contracts. Data 61 (CSIRO), Sydney. https://assets.ctfassets.net/sdlntm3thp6/resource-asset-r297/58dd59299229647cf4196a69a796b3cae/0d843b74-ef95-4611-89de-6d18b8f53473.pdf

Surden H (2012) Computable contracts. UC Davis Law Rev 46:629–700. Available at https://lawreview.law.ucdavis.edu/issues/46/2/articles/46-2_surden.pdf

Szabo N (1997) Formalizing and securing relationships on public networks. Reprinted at https://nakamotoinstitute.org/formalizing-securing-relationships/

UNCITRAL – United Nations Commission on International Trade Law (2020) UNCITRAL model law on electronic commerce (1996) with additional article 5 bis as adopted in 1998. Available at https://unctral.un.org/en/texts/ecommerce/modellaw/electronic_commerce

UNCITRAL – United Nations Commission on International Trade Law (2020) UNCITRAL model law on electronic commerce (1999) UNCITRAL model Law on electronic commerce with guide to enactment 1996 with additional article 5 bis as adopted in 1998. United Nations, New York. Available at https://unctral.un.org/sites/unctral.un.org/files/media-documents/unctral/en/19-04970_ebook.pdf

Uniform Law Commission (2019) Guidance Note Regarding the Relation Between the Uniform Electronic Transactions Act and Federal Esign Act, Blockchain Technology and “Smart Contracts,” Electronic Transactions Act. Uniform Law Commission, available at https://www.uniformlaws.org/viewdocument/guidance-note-regarding-the-relation?CommunityKey=2c04b76c-2b7d-4399-977e-d5876ba7e034&tab=document&framework=uniform

Uniform Law Commission (2020) Electronic Transactions Act. Uniform Law Commission, available at https://www.uniformlaws.org/committees/community-home?CommunityKey=2c04b76c-2b7d-4399-977e-d5876ba7e034

Williston S, Lord RA (2012) Williston on contracts, 4th edn. West, St. Paul