Part I

General Framework

Legal and Technological

1 Smart Contracts and Contract Law

Larry A. DiMatteo, Michel Cannarsa, and Cristina Poncibò

1.1 Introduction

Innovation is all pervasive in this day and age.[1] While new business development and innovative entrepreneurship are appreciated and encouraged, policy-makers foster innovation as well. The European Commission has declared: "We need to do much better at turning our research into new and better services and products if we are to remain competitive in the global marketplace and improve the quality of life in Europe."[2] Innovation is seen as an economic driver and has led to political efforts to remove rules and regulations that limit or restrain its development. The economic perspective of the role of innovation in economic growth is also embraced at the firm level. As one commentator argues, "not to innovate is to die."[3]

While the concept of innovation originally concerned novelties in the broadest sense of the word – including imitation, invention, creative imagination, and social change – its current use is directed mainly at technological innovation.[4] The complexity of technological innovation poses a great challenge to the law. Catalina Goanta notes that disruption of the law is "a phenomenon through which law becomes decrepit in the face of modernity."[5]

Indeed, law mostly seems to be more reactive than proactive in dealing with fast technological and societal changes.[6] As the rapidity of innovation increases, academics and practitioners are persistently confronted with new technologies that may not align with existing legal frameworks, while governments are trying to address these challenges by determining how to best regulate or not regulate new technologies. In fact, stringent

[1] The word "innovation" has several meanings dependent upon context. "The introduction of something new" is the *Merriam-Webster* definition. In business, "innovation" is applying ideas to satisfy the needs and expectations of customers. Uber, Amazon, and Apple are three among numerous innovative companies that have disrupted industries during the past decade. Each has displaced dominant providers by expanding access, making purchasing easier and more transparent, providing customers more choice, reducing cost, and offering a platform for buyers and sellers to evaluate each other.

[2] European Commission, cited from http://ec.europa.eu/research/innovation-union/index_en. cfm?pg=why (last accessed October 15, 2018).

[3] C. Freeman, *The Economics of Industrial Innovation* (Cambridge, MA: MIT Press, 1982).

[4] B. Godin, "'Innovation Studies': The Invention of a Specialty" (2012) 50:4 *Minerva* 397–421. The author documents the origins and the scope of innovation studies.

[5] C. Goanta, "How Technology Disrupts Private Law: An Exploratory Study of California and Switzerland as Innovative Jurisdictions," TTLF Working Papers No. 38, Stanford-Vienna, *Transatlantic Technology Law Forum* (2018) at 1.

[6] See Professor Brownsword, "Smart Transactional Technologies, Legal Disruption, and the Case of Network Contracts," Chapter 17, in this book.

regulation of emerging industries can result in major setbacks for technological development. For this reason, governments often refrain from regulating innovative industries, like applications of blockchain technology, at early stages of development.[7]

Recently, there has been a profusion of articles and reports on blockchain technology. Some commentators argue that it could spark a revolution in many sectors of the economy, just as the Internet had done at an early time. It should be emphasized that the blockchain was developed as the result of a venture driven by libertarian ideas of eliminating the need for intermediaries, such as central banks, courts, and other governmental bodies. Central to this revolution is the idea of "contracting without the state" by entering smart contracts based on blockchain technology. This escape from the law is mere illusion, as law will continue to play a vital role in private transactions. This book provides a focused analysis of the place of blockchain technology, smart contracts, and digital platforms within the realm of contract law, as well as privacy and property law. It is the result of a broader research agenda aimed at exploring the impact of technological innovation on contract law in a comparative perspective.

The idea of smart contracts originated in the mid-1990s, when programmers and legal scholars published a series of papers explaining their potential.[8] Smart contracts are literally computer code that is placed on a blockchain, an open, distributed ledger that runs on the computers of thousands of users, and which has no central authority. "Smart" refers to the self-performing, self-enforcing quality of smart contracts. These so-called contracts are immutable, meaning that the code by default cannot be changed, thusly ensuring performance. However, for programmers, immutability presents a special challenge. Code contains bugs (coding errors), and code that cannot be altered needs to be written carefully to try to minimize the mistakes in the coding, since the bugs cannot be fixed after the fact.

Smart contracts also present a particular challenge to contract law and regulation in general. As automatization entails lack of human involvement, stringent questions relating to the validity of consent and intention to be legally bound arise. The genuineness of consent is also questionable in cases of fraudulent behavior. Moreover, recognizing smart contracts as legal contracts is not simply a policy objective to enable more innovation, but it is a policy objective that requires a lot of self-reflection about the nature and future of contractual relationships and business practice.

Smart contracts represent mechanisms for enforcing promises, allowing us to make credible commitments with each other on a blockchain. The fundamental question becomes whether we can trust the technology and the people using it without the support of the law and the courts. The answer is that law and government authorities will continue to remain relevant because market certainty demands an external mechanism to enforce promises and ensure that people can depend on the commitments of others. In the words of Hobbes, we tend to assume that the government's coercive power is the only way to create contracts.[9] This Hobbesian view has been labeled as "legal centralism," the

[7] While there is no precise definition, a regulatory sandbox is, broadly speaking, a framework within which innovators can test business ideas and products on a "live" market, under the relevant regulator's supervision, without fear of enforcement actions in case it is determined that their business model does not comply with existing regulations.

[8] One of the primary pieces is N. Szabo "Formalizing and Securing Relationships on Public Networks" *First Monday* (September 1, 1997), available at https://firstmonday.org/ojs/index.php/fm/article/view/548/469 (accessed January 5, 2018).

[9] T. Hobbes and J. C. A. Gaskin, *Leviathan* (Oxford: Oxford University Press, 1998).

assumption that "the legal system enforces promises in a knowledgeable, sophisticated, and low-cost way."[10] In many instances, the court system is costly and time-consuming. Moreover, people are often surprisingly able to enforce promises and maintain order in their own communities without government intervention.[11]

In this Hobbesian worldview, there is little trust, constant suspicion, and insecurity. In reality, although humans pursue their own self-interests and act opportunistically, most business relationships are heavily dependent on trust. For example, reputation is extremely important in small communities of traders characterized by repeat transactions. Negative reputational effects decrease the ability of a party to continue to transact business within that community.[12] In internet transactions, reputation is more difficult to foster because pseudonyms are often used instead of real names. When a person breaks a promise, she can simply erase her history by creating a new pseudonym with a clean reputation.[13] The power of blockchain technology is that it overcomes the shortage of trust in internet transactions between strangers. It also shows potential in overcoming transborder legal issues relating to applicable law and the ability to pursue a defendant in a foreign jurisdiction.

This book provides a focused analysis of the place of blockchain technology and smart contracts within the realm of contract law. The core questions asked include: (1) Are smart contracts legal contracts or a means to form and perform or enforce contracts? (2) If they are not "real" contracts, should they be regulated by contract law or otherwise? (3) If deemed to be a type of contract, how does contract law apply to this new form of contracting? (4) Can a form of contracting be truly autonomous, self-enforcing, and independent of the legal system? (5) Is general contract law sufficiently adaptable to regulate smart contracts or will specialized rules be needed? These questions are inherently overlapping because of the novelty of smart contracts, which are currently effective due to their narrow functional focus, but there are efforts to expand their applications to more and more types of use. The uncertainty of where the evolution of smart contracts may lead increases the uncertainty of how contract law will adapt to them. Contract law has proved to be sufficiently flexible and malleable in adapting to new technologies and transaction types. In the end, with advances in artificial intelligence (AI), a top-down regulatory framework may be needed. This book takes the initial step in discussing whether smart contracts fit into the existing framework of contract and regulatory law regimes.

The contracting world has entered an exciting period of innovation and research. In the diversity of presentation styles and author backgrounds, we hope this book will inspire

[10] O. E. Williamson, *The Mechanisms of Governance* (New York: Oxford University Press, 1996).

[11] For a more elaborate example, consider the New York diamond industry, as described in a classic article by Lisa Bernstein (Bernstein 1992, quoted by DiMatteo and Poncibò, Chapter 7). At one point, somewhat before the time she studied it, the industry had been mostly in the hands of orthodox Jews, forbidden by their religious beliefs from suing each other. They settled disputes instead by a system of trusted arbitrators and reputational sanctions. If one party to a dispute refused to accept the arbitrator's verdict, the information would be rapidly spread through the community, with the result that he would no longer be able to function in that industry.

[12] See Chapter 7, "Smart Contracts: Contractual and Noncontractual Remedies," on "Remedies."

[13] For a discussion of the term "whitewashing," see N. Nisan, T. Roughgarden, É. Tardos, V. V. Vazirani, and C. H. Papadimitriou, *Algorithmic Game Theory* (New York: Cambridge University Press, 2008) at 682. There are various ways to handle the problem of whitewashing. One is to distrust all newcomers, since they may have created a new identity to hide a bad reputation. Another possibility is to ensure that any pseudonym is tied to a real person or business, so that a bad reputation cannot be escaped.

greater understanding and collaboration between scholars and practitioners from different jurisdictions, as well as between the legal and tech communities, in approaching the intersection of law and technology.

1.2 Rush to Judgment: Is Additional Regulation Needed?

People are often enamored with new things; the shining new things today relate to the ever-growing menu of technological devices and services.[14] The new gadgets are often overhyped and their impact overestimated. One needs only to look back at the early stages of the internet age to see a tortured debate between those who believed the internet's freedom would be hindered by regulation and those who believed such innovation was subject to abuse and, thus, needed specialized rules to protect contracting parties. It turned out that both protagonists were correct. In the area of contract law, existing constructs were found to be easily adaptable to internet contracting, as well as long-standing torts such as trespass. However, more recently, the uses of social media as a weapon to breed hatred and misinformation in society suggest that greater regulation of such activities may be in order.

Smart contracts represent a much narrower domain than the creation of the Internet, but such technological innovations cause a great deal of uncertainty and panic, especially when coupled with prognostications about the capabilities of advanced AI in the future. The angst of futuristic surrender to an AI and robotically controlled world, alongside gene-edited humans, warrants caution at this early stage. But the current inquiry into the path to this future world is more of a philosophical inquiry, than the issues being posed by smart contracts and blockchain technology at the present state of development. This book looks at the role of contract law in the regulation of first-generation smart contracts and online platforms (using decentralized ledger technology) to determine if there is a sufficient fit to stave off the need for additional regulation. Max Raskin notes that "Innovative technology [often] does not necessitate innovative jurisprudence, and traditional legal analysis can help craft simple rules as a framework for this complex phenomenon."[15]

1.3 Formalism and Contextualism

There are two dynamics at work in contract law symbolized by the long-standing debate between formalists and contextualists. Formalists see the best form of law as consisting of fixed and hard rules. Contextualists see the best form of law as a blend of fixed rules and standards or open-textured rules. The formalists hope to make certainty and predictability the singular focus of law. The contextualists see the importance of tempering the written word with the context in which that word is used to ensure a degree of fairness or justice. The contextual approach to the interpretation of contracts and the application of contract law rules is considered to be mainstream view. In sum, firm or hard rules are needed to ensure certainty in law, but standards or principles are needed to provide flexibility to

[14] S. Ratcliffe (ed.) "Roy Amara 1925–2007, American Futurologist," *Oxford Essential Quotations* (4th edn. Oxford University Press 2016).

[15] M. Raskin, "Law and Legality of Smart Contracts" (2017) 1 *Georgetown Law Technology Review*. 305, 306, available at https://georgetownlawtechreview.org/wp-content/uploads/2017/05/Raskin-1-GEO.-L.-TECH.-REV.-305-.pdf.

allow rule adjustments in order to avoid injustice caused by the formulaic application of fixed rules.

In the area of contract law, rules pertaining to certain types of contracts are more formalistic in their constitution and application and others less so. In the areas of financial or banking transactions, as well as in letter of credit and secured transactions, fixed rules, with little discretion left to the courts, are dominant since they provide the needed security and trust required to make such transactions functional. However, in general contract and sales law, both certainty and flexibility are needed. In some areas of contract-sales law, such as in the area of contract formation where parties need to be able to rely on the enforceability of their contracts, the formulaic application of fixed offer-acceptance rules is essential. However, in other areas of contract law, such as in performance, breach, and remedies, more open-ended rules that allow context to be considered, such as trade usage and prior dealings, is required to moderate the words of the contract that lead to irrational or unjust outcomes. This is seen in policing doctrines, such as unconscionability and hardship. In remedies, the causal connection between breach and damages is moderated by the need to prove with certainty foreseeable damages and to determine whether the non-breaching party complied with its duty to mitigate.

The formalist-contextualist debate is replicated in the area of contract interpretation. This debate provides an analogy to the usefulness of smart contracts set within the complexity of contracts and contract law. Formalists possess absolute faith in the (potential) clarity in the written word. Their mantra is that freedom of contract dictates that meaning only resides in the four corners of an agreement. For them, real meaning informed by context has no place in the interpretation of contracts. In this world, contracts are pseudo self-enforcing. Despite the debacle of litigation, courts serve a merely perfunctory role of reiterating the plain meaning of the words of the contract. Some formalists have gone as far as to assume that businesspersons prefer the narrow objectivity of plain meaning interpretations of fully actuated written contracts.[16] There is no empirical evidence that this is true – that businesspersons prefer losing based on a formalist interpretation of their contracts when the true meaning of the contract is provable by using contextual evidence. In fact, contracts are never fully actuated or complete; thus, the ability of closing off the real world is limited due to the incompleteness of contracts. The formalist retort is that if a formalist approach to interpretation is accepted, parties will write clearer contracts that are susceptible to formal interpretation. This fails to recognize that such clarity is an illusion in complex contracts, strategic ambiguity provides the needed flexibility in such contracts, and some level of incompleteness will remain due to limited cognitive abilities, use of less than full information, and the prohibitive transaction costs of attempting to negotiate a complete contract.

Contextualists argue that there is no plain or singular meaning of words in that words in a contract can only be understood against the background of the words used. It is tempting to assert that the contextualists seek the intersubjective intent of the parties – what they assumed each other meant by a certain contract provision and not the purely objective interpretation of the plain meaning rule. But, a better understanding is that extrinsic evidence is no less objective than the written contract. The use of negotiations,

[16] A. Schwartz and R. Scott, "Contract Theory and the Limits of Contracts" (2003) *Yale Law Journal* 543. ("What contract law do business firms want the state to provide? A contract law for firms, we answer, would be narrower and more deferential to contracting parties than the contract we now have.")

prior dealings, course of performance, and trade usage evidence allows for the best objective interpretation of the meaning of the contract. When done properly it comes close to merging objective with subjective intent.

The importance of context to interpreting a contract or to understanding a contractual relationship varies among contract types and across different industries. Lisa Bernstein's majestic work on the American cotton industry showed that cotton contracts are completely ensconced in context.[17] Application of contract law is preempted by internal customs and dispute resolution structures. The premier remedy between cotton dealers is the nonlegal remedy of negative reputational harm. Under such a contract system, "vagueness and ambiguity likely have far more utility when transactors govern themselves by custom rather than law."[18] In such incidents, contracts separated from context are meaningless and therefore not subject to coding.

1.3.1 *Form and Context: Smart Contract*

The relevancy of the above discussion of the nature of contract law (rules-standards) and the different approaches to contract interpretation (formalism-contextualism) is to assess smart contracts ability to replace word contracts. The scope and recognition of smart contracts as contracts is mostly dependent on the formal nature of a specific type of contract and the contract law rules that apply to that specific type of contract. Thus, it is no surprise that the dawn of the smart contracts era has focused on simplistic payment, financial and transfer of title transactions. These are the most formalized areas of law populated by if-then rules that lend themselves to translation into computer code.[19] However, in more complex, long-term, relational, and ambiguous contract types coding is highly problematic. Such contracts generally allow some degree of party discretion by provisions that are vague and ambiguous. Such vague, standard-like contract provisions are necessary to provide the flexibility to manage such long-term commitments. For example, reopener or renegotiation clauses provide the parties future opportunities to adjust the contract to reflect real-world developments. Current technology is far from being able to convert complex contracts into code. To attempt to do so would be a disaster.

1.4 Enforceability of Smart Contracts

As with earlier internet contracting, is the smart contract simply a means to contract or a contract in and of itself? It may be both. In very simplistic contracts, such as the

[17] L. Bernstein, "Private Commercial Law in the Cotton Industry: Creating Cooperation through Rules, Norms, and Institutions" (2001) 99 *Michigan Law Review* 1724.

[18] Jeffery Lipshaw, "The Persistence of 'Dumb' Contracts," (2019) 2 *Stanford Journal of Blockchain Law & Policy*, https://stanford-jblp.pubpub.org/pub/persistence-dumb-contracts.

[19] "Legal automators tend to focus on . . . formalism (which defines 'the ideal if not necessary form of "law" [as] that of a "rule," conceived as a clear prescription that exists prior to its application and that determines appropriate conduct or legal outcomes')." F. Pasquale, "A Rule of Persons, Not Machines: The Limits of Legal Automation" (2019) 87 *George Washington Law Review* 1, 44, partially quoting Richard H. Fallon, Jr., "The Rule of Law as a Concept in Constitutional Discourse" (1997) 97 *Columbia Law Review* 1, 11 &14. It should be noted that there are simple rules and more complicated ones and that coding currently is able to accommodate the former and not the latter: "The complicated structure of legal rules may prove an obstacle to formalization." Eric Tjong Tjin Tai, "Formalizing Contract Law for Smart Contracts," Tilburg Private Law Working Paper No. 06/2017, 8, www.ssrn.com/link/Tilburg-Private-Law.html.

execution of a payment for goods delivered or repayment on a loan, the parties can agree on the contract, but instead of going to a lawyer to write the contract they go to automators (lawyer or nonlawyer) to code the agreement. In this case, the coded contract is the equivalent to a written contract. In more complicated agreements, the smart contract is best described as a smart function of the contract.[20] In long-term contracts that include multiple payments over a prolonged period of time, it is unlikely that the paying party will encumber funds far in advance of future payments, thus diluting the self-enforcing nature of the smart contract.

Future AI-connected smart contracts will likely only result in smart contracts serving a supporting role than being an outright replacement of word contracts and the human management of contracts. Frank Pasquale has noted that AI relating to complex contracts is more likely to be reflected as "intelligence augmentation."[21] AI is unlikely to transplant human know-how and intuition, which is at the center of most business transactions. Further, law has been and will always be indeterminate (no single right answer). Law remains somewhere "between the crystalline clarity of rules and the chaos of unconstrained discretion." It is in this middle area that one finds "articulable standards that help us formulate convincing explanations and justifications of legal decisionmaking."[22] Contract law is inherently flexible in nature, which is its defining virtue and vice. Flexibility is open to various interpretations and applications, but it is also the genesis for innovation (creation of new types of contracts, methods of doing business, and so forth).

1.5 "Dumb, Smart Contracts" to "Smart, Smart Contracts": Issues of Completeness and Normativity

It is important to distinguish between different types of smart contracts. As some commentators have stated, smart contracts are actually "dumb contracts."[23] They are dumb because they are, at this point, only able to perform simplistic types of contracts involving financial transactions, such as transferring money or title to property. They are also dumb because of their lack of flexibility. Flexibility built into contracts through terms that are vague or standard-like, such as a duty to renegotiate due to a change of circumstances, cannot be replicated in code. The beauty of contract law is found in its malleability to respond to innovative contract types and still serve its facilitation and regulatory functions.

In the near future, the expanded use of smart contracts, beyond the simplest forms of transactions, is likely to come by way of the use of oracles and as part of or ancillary to

[20] Although, in long-term contracts, one commentator has noted that even the payment function may not be self-enforcing: "If the party owing amounts under the smart contract fails to fund the wallet on a timely basis, a smart contract looking to transfer money from that wallet upon a trigger event may find that the requisite funds are not available." S. Levi and A. Lipton, "An Introduction to Smart Contracts and Their Potential and Inherent Limitations" (May 26, 2018), https://corpgov.law.harvard.edu/2018/05/26/an-introduction-to-smart-contracts-and-their-potential-and-inherent-limitations (last accessed June 22, 2018).

[21] Note 19 above; Pasquale at 51.

[22] *Ibid*. at 56.

[23] Lipshaw, See note 18 above, *Stanford Journal of Blockchain Law & Policy*, 2019 (forthcoming), https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3202484. https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3202484 (last accessed November 18, 2018); K. Levy, "Book-Smart, Not Street-Smart: Blockchain-Based Smart Contracts and The Social Workings of Law" (2017) 3 *Engaging Science, Technology, and Society* 1.

word contracts. The simplest approach is to have specified oracles as definitive "sources of truth," though this may only be suitable for certain scenarios, such as the use of a market's official stock prices feed. Another approach is to have a number of oracles whereby the data are validated by consensus between them.

This book concludes that smart contracts are a means to the formation of a contract found in computer code. But, like other contracts, the courts are free to imply terms into the contract, such as the duty of good faith, and to void or adjust such contracts under policing doctrines such as duress, misrepresentation, mistake, unconscionability, and hardship. Additionally, courts and arbitral tribunals will continue to look at context outside of the computer code in the interpretation of smart contracts. Trade usage and business customs will continue to play a role in the interpretation and enforcement of smart contracts. The legal arbiters will also recognize changes in circumstances occurring subsequent to contract formation and not embedded in the computer code. The issue here is that if smart contracts are fully self-performing, then there cannot be a breach for which to apply the hardship principle or excuse doctrines. In response to automated performance, the courts may use hardship and excuse offensively to allow one of the parties to claw back certain unexpected costs incurred or profits bestowed on the other party (disgorgement or restitution damages). However, this response is more likely to occur in civil law rather than common law systems because the common law does not recognize hardship and the duty of good faith in some common law countries (England and Wales) is not an accepted principle. If the smart contract were of a longer-term nature involving multiple performances, the best way to adjust or terminate it would be through injunction. How a temporary restraining order or preliminary injunction would be enforced needs to be answered by the technologists.

From a descriptive perspective, smart contracts may or may not be enforceable legal contracts. This poses the normative question of whether they should or should not be recognized as legal contracts. One scholar has asserted: "A system of smart contracts is normatively suspect."[24] The answer, as with other types of contracts, is much more granulated than a yes or a no proposition. Smart contracts may meet the elements of a fully enforceable contract and others may not. As noted previously, a similar debate happened a few decades ago during the advent of internet contracting. First, there was the debate over whether the Internet should be unregulated or regulated. Second, should internet contracts be recognized as legally enforceable contracts? After much haranguing, it became clear that very little regulation, at least in the area of contract formation, or changes in contract law were needed. The Internet and other forms of electronic communications provided more efficient means to form contracts and the existing rules of contract law were easily applicable. The core changes that needed to be made related to contract formalities. Thus, national laws were amended to recognize electronic records as equivalent to written instruments and attribution replaced the need for a physical signature in countries with writing or statute of fraud requirements.[25] In the end, the creation of specialized contracts rules for internet contracts were deemed to be unnecessary; the old rules fit just fine!

[24] M. Verstraete, "The Stakes of Smart Contracts'" Ariz. Legal Studies Paper No. 18–20 (May 2018), https://ssrn.com/abstract=3178393, 6.

[25] See the U.S. Uniform Electronic Transactions Act (UETA), http://uniformlaws.org/Act.aspx?title=Electronic%20Transactions%20Act.