

1 Smart Contracts and Contract Law

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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>.

In the end, the efficiency of smart contracts is an illusion since their self-sufficiency requires the ability to code complete contracts. Since the ability of contracts to reach completeness is hampered by cognitive limitations, lack of full information, and the fact that information is often asymmetrically distributed between the parties, the ability of the parties to reach a complete contract is impossible as well as being cost prohibitive. Mark Verstraete describes the problem of incompleteness for smart contracts:

Pure formalism and smart contracts both hinge their normative desirability on the belief that forming complete agreements is practicable. Empirically, this is not the case. Contracts are incomplete and the legal system provides implied terms to remedy this problem. In short, the costs of forming complete agreements would likely outweigh the supposed benefits from smart contracts.²⁶

In sum, coding agreements to create smart contracts do not make them any less incomplete than language contracts. Furthermore, the self-performing nature of smart contracts becomes problematic due to the incompleteness of the contract, at least at the current stage of technological development.

1.6 Coverage

Advances in technology continue to transform the nature of international contracting. Inherently, changes in contracting practice pose questions for contract law and its application. Smart contracts, based on distributed ledger or blockchain technology, have been touted as able to convert law (contracts) into self-executing computer code, and, thus, these contracts can function outside of contract law and the court system. This book's broad view of the subject suggests otherwise. In fact, smart contracts are not truly enforceable without contract law. The smartness of a contract may make it initially self-performing, but it is ultimately left to the courts to determine whether that performance should stand. The interesting challenge of smart contracts to contract law is that subsequent litigation or arbitration will be undertaken after performance and may not be based on a breach. Maybe contract law, just as it did in creating the principle of anticipatory repudiation or breach to proactively anticipate breach, will need to develop rules to retroactively deal with technically conforming performance. This type of structure is already in place through the retroactive nature of contract interpretation and through the application of contract law's policing doctrines – duress or coercion, mistake, misrepresentation, and unconscionability or hardship. The book discusses the many related issues pertaining to smart contracts and legal regulation of this new phenomenon.

1.6.1 *Law and Technology*

The first part of the book provides a “General Framework: Legal and Technological,” which discusses the legal meaning of smart contracts and the technology behind the evolution of smart contracting.²⁷ Dr. Riccardo de Caria describes a “smart contract” as a digital agreement written (or guided) by computer code, run on a blockchain or similar

²⁶ Verstraete at 42.

²⁷ This chapter review is partially based on the Conference Report written by and published in the ERPL, L. Tissaoui, J. Liu, and D. Marcotte Q. C. (2018) *European Review of Private Law* (ERPL).

distributed ledgers (decentralized), and automatically executed (or performed) without the need for an intermediary or human intervention. He concludes that there is no need to recognize smart contracts as a different type of contract in need of specialized rules. In sum, the smart contract is a technological development, not a legal one. Therefore, the existing general laws of contracts and sales law are applicable to them in the same way they apply to other types of contracts. In Chapter 3, “Technology of Smart Contracts,” a number of technology and computer engineering experts provide a descriptive review of distributed ledger or technology using the blockchain, including an explanation of relevant technological terms such as “nodes,” “mining,” “wallets,” “blocks,” and “oracles,” which provide the needed background to gain a basic understanding of smart contracts.²⁸

1.6.2 *Smart Contracts and Contract Law*

The second part of the book, “Contract Law and Smart Contracts,” examines the application of contract law to smart contracts. Mateja Durovic and André Janssen examine the rules of contract formation or conclusion of contract as they relate to smart contracts. They describe the process in which computer code is capable of monitoring, executing, and enforcing a legal agreement. Smart contracts can be seen as a vehicle for automating and enforcing legal rights. They examine the compatibility of smart contracts with existing contract law distinguishing purely self-enforcing smart contracts from the notional complete smart contracts. For the purely self-enforcing smart contract (where only the performance is smart), most issues would be governed by existing contract law. However, the application of certain areas of contract law, such as mistake, duress, or incapacity, will prove problematic. For example, there is a problem when a court voids a smart contract, but the performance of the contract, such as transferring of title, remains in existence on the blockchain due to its immutability.

Eric Tjong Tjin Tai further discusses the problematic relationship between smart contracts and certain areas of contract law, namely performance, force majeure, and excuse. He explains that the nature of the application of contract law rules will need to be adapted since the automated, self-performing nature of smart contracts shifts perspective from ex post assessment to ex ante programming. He emphasizes that memorialized contracts, whether in language or coded form, are greater than the written or coded form. In order to provide contextual support, contracts should not stand alone; instead, it is best if they are situated within a larger contractual framework or agreement. Noting that, in the context of the law of excuse, causality (or at least attributability) is always contextual, Professor Tai stresses the complications and challenges that contract law application in these areas will present. In sum, some contract law rules will need to be adjusted because of the characteristics of smart contracts. The end result will likely include adjustments to how certain contract law rules are applied and the evolution of best practices in smart contracting to either provide greater insularity from contract law or make smart contracts more easily receptive to contract law’s regularity function. In order to prevent injustices in performance, smart contracts will need to be made smarter, such as creating greater reliance on expert oracles in order to deal with change of circumstances. One rationale

²⁸ For example, the writers of Chapter 3 of this book work in the areas of computer engineering and technology.

for the recognition of smart contracts as contracts is that the contracting parties are willing to accept limited injustices for the security of performance. This is similar to the Scott-Schwartz thesis²⁹ that businesspersons prefer a formalistic approach to contract law where contextual evidence is excluded despite its probative value in showing the parties' real intent or meaning. However, they do not provide any evidence that shows that businesspersons abhor contextual interpretation. Does a businessperson really prefer to lose a dispute due to the literal meaning of a contract, instead of the intended meaning? This will also be the case for smart contract enforcement and interpretation.

Michel Cannarsa takes up the issue of "Contract Interpretation" in the context of smart contracts. Dr. Cannarsa refers to smart contracts as agreements based on code, able to enforce and execute themselves with no need for intermediaries or for reliance on trust, and well suited to machine-to-machine connections in the "internet of things." Because computer language is more reliable (assuming no errors or omissions in the code) than human language (which can be merely an expression of intent), interpretation can perhaps be easier, more systematic, and devoid of such presumptions as good faith. Dr. Cannarsa posited that smart contracts could conceivably contain interpretative rules coded within the smart contract that would leave less room for interpretative disputes.

Larry A. DiMatteo and Cristina Poncibò question whether smart contracts can be included within the traditional definition of contracts and its remedial structure given the limits of self-enforceability, the practical differences between self-enforcement, and traditionally conceived contract remedies due to their possible use of self-help remedies, and the immutability of coded contracts. Even though traditional contract remedies are (and will be) hard to apply to smart contracts, from a technological perspective and given that the blockchain is an ideologically driven technology committed to decentralization, traditional remedies may not be applicable. Instead, techno-legal measures are likely to fill the remedial gap. Remedies could be coded within the blockchain, and may include: community-based social repudiation and the use of consensus or voting as a means of dispute resolution.

1.6.3 *Electronic Platforms and Smart Contracts*

Piotr Tereszkiewicz discusses the economic notion of electronic platforms – describing them as two or more groups that need each other but which cannot capture the value of their mutual attraction on their own. He discusses the European Union's regulatory framework (E-Commerce Directive 2000/31 as an example) surrounding electronic platforms, a legal landscape that facilitates the commercial exchange and allows the operators to create, manage, regulate, and supervise the community through the Internet. The 2000/31 Directive qualifies a digital platform as a service provider, and the 2016 Discussion Draft on Online Intermediary Platforms deals with obligations and liabilities of intermediaries. Dr. Tereszkiewicz divides current regulation into two different approaches: general and sector specific. On the one hand, general provisions on platform liability are found in the Discussion Draft on Digital Platforms. On the other hand, sector-specific provisions that densely regulate platform-based business

²⁹ See Schwartz and Scott in note 16.

models are exemplified in the new EU Package Travel Directive. He concludes that sector-specific regulation (“a subject-matter approach”), guided by prior recognition of market failures, is a preferable approach for the immediate future.

Eliza Mik focuses on blockchain technology as an ideology with proponents viewing it as anarchical and “above the law.” She poses the question of whether the technology will adapt to commercial needs or vice versa. She observes that there is a duality in blockchain technology – on the one hand, there is permissionless blockchain “public ledgers,” which are open to everyone and, on the other, there are permissioned blockchain “private ledgers” with restricted access. Some attributes of a predefined processing transaction or unrestricted public blockchain are that ledgers are open, transparent, and visible. The downside is that privacy is not assured, and the required decentralization and resultant immutability means that no one is in control, responsible, or liable, and therefore, governance is difficult. By contrast, private blockchains, which are less ideologically oriented, can be designed for specific (usually commercial) purposes. The ledger becomes only as immutable and as confidential or transparent as its design allows.

Mik further discusses the shortcomings of public blockchains to illustrate that certain technological features that seem attractive from an ideological perspective may be detrimental to commercial transactions. She concludes that public blockchains and smart contracts have limited suitability for the needs of commerce and emphasizes that marketplaces, whether centralized or not, cannot rely on technology alone but require a solid, legal infrastructure that regulates their functioning. She expands the analysis to include the suitability of electronic platforms as contract substitutes. She asserts that there is more hope for the expanded use of platforms if they are secure, resilient, and adaptable – capable of continually and swiftly accommodating legal requirements.

1.6.4 *Smart Contracts as Legally Disruptive*

Roger Brownsword discusses how technology is disruptive to existing legal rules and the need for a balanced response to such disruption. He describes three approaches to the creation of rules to achieve a desired effect: coherent, regulatory, and technocratic. He suggests that a technocratic approach would more appropriately achieve a desired effect by the way technology is conceived and designed, not by the imposition of external rules (for example, through online specified conditions and terms). In this elegant chapter, Brownsword takes a broad “from the balcony” perspective of the relationship of technology and law as a general matter. He discusses the disruptive impact that technology has had on the traditional role of law – “the idea of law (and regulation) as an enterprise of rules (and standard setting).” New technologies challenge law’s regulatory function involving the setting of rules – both facilitative and restrictive.

Brownsword asserts that lawyers, judges, and regulators will need to take a more technocratic approach to the regulation of new technologies – one that looks to the regulation of product design and the automation of processes. In short, law will need to achieve regulatory effects (such as protection of privacy) by requiring that the application of technology incorporate protections *ex ante*. He sees a future debate centering on the traditionalists seeking to maintain the coherency of legal doctrine and regulators seeking to co-opt new technologies as regulatory instruments. Thus, purity and coherency of law

will often conflict with the eschewing of legal coherency in favor of the instrumental use of technological tools to prevent the abuse of technology by one party in relationship to another.

1.6.5 *Technology in China*

Angelia Wang and Lei Chen note that the blockchain and smart contracts are widely used in China in the areas of finance, banking, and industries within both the public and private sectors. This chapter acts as a case study of technology and law in one of the most important economies in the world. They provide examples in the form of copyright registration and the tracking of trademark usage. Wang and Chen highlight the challenges to smart contract implementation: understandability, rigidity of code, and rigidity by decentralization. They propose that the legal framework surrounding the technology should focus on monitoring rather than regulation – “the answer to the machine is in the machine.”

They further examine the role of online intermediaries and assess the regulatory framework for the online platforms. They argue that despite the claim that intermediaries will be eliminated due to the decentralized architecture and the trustless relationship enabled by blockchain technologies, intermediaries will still exist and continue to play an important role socially and legally. In sum, Wang and Chen conclude that existing contract and regulatory law is sufficient to police smart contracts, but adjustments need to be made to the regulatory framework on platforms to deter platforms’ rent-seeking behaviors by overlooking signals of infringements while ensuring that the regulation is not too excessive to stifle innovation.

1.6.6 *Blockchain Technology: Privacy, Security, and Data Protection Issues*

Lokke Moerel explores the issue of legal jurisdiction given that members of a blockchain are scattered throughout the world. She poses that if each node is considered a data controller, then they all must comply with the privacy protections required by the General Data Protection Regulation (GDPR). The alternative is to treat nodes simply as data subjects. This duality of controller-subject presents a dilemma for purposes of regulation. Sjef van Erp questions whether private law principles and concepts are adaptable to a digital environment or whether we need updated private law concepts or even a new type of private law. Louis-Daniel Muka Tshibende posits that the expression “smart contract” merely designates a corpus of automated modalities for the conclusion, performance, and termination of preexisting categories of contracts. Lauren Henry Scholz distinguishes algorithmic contracts from smart contracts. She asserts that algorithmic contracts present little problems for contract law, especially in business-to-business transactions. Scholz notes, however, that consumer privacy has not been protected under traditional contract law, and therefore, in the area of algorithmic contracts, the law needs to recognize nondisclaimable privacy rights.

Moerel discusses the unfitness of distributed ledger technology (DLT) for protecting personal data relative to the European Union’s GDPR, which is designed and focused on the processor of data, who is required to ensure that data processing is set up to ensure that privacy requirements are met. DLT decentralizes data but it is not a data controller.

Lacking a better alternative, all nodes should be treated as controllers; independent from one another or that none of them are controllers (no-controller ecosystem). Considering all nodes are controllers implies the application of different national laws because the nodes are scattered around the world.

Alternatively, nodes could be considered as data subjects instead of data controllers, or as both? But then, is it possible for the nodes (as controllers) to control themselves (as subjects), and then how would we protect data subjects from themselves? A double-bind problem will arise, known as the Collingridge dilemma. When the technology erupts, the need for change is not apparent, whereas when the need for change does become apparent, the capabilities for it become limited by the complexity of the technology. It implies that if we don't know how to regulate, we should impose measures on companies to self-regulate until best practices are sorted out.

Van Erp notes that human beings "live in a world in which other people perceive us on the basis of the data thus assembled about us" and "because of this humans are in the process of losing their personhood and are becoming subjects of data instead of data subjects." The law needs to respond to this new digital reality – a hybrid world of the physical and data-based dimensions. Van Erp suggests that the law needs to reframe traditional property law and create a data property law system that transcends national legal regimes. He concludes that a differentiated property law approach will be required in today's digital reality.

Muka Tshibende focuses on the field of blockchain technologies and considers its impact on property and security rights. Law will need to focus on the interface between the virtual and transnational dimensions of transactions on the blockchain. He takes the perspective of a continental lawyer analyzing the validity of transactions – the validity and integrity of property title electronically created and transferred. In doing so, he relies not only on traditional legal tools but also on the most recent legislative initiatives, especially in France. He introduces a legal framework encompassing new ways of transferring property (based on blockchain technologies) and new types of titles (tokens in the context of initial coin offerings). Through this analysis, the core issue becomes whether these new transactions and these new property titles can be effective, in a national and an international context. Muka Tshibende raises concerns about the legal uncertainty and the best (local and global) regulatory responses to these technological challenges.

Scholz argues that algorithms should be understood as contractual agents, analogically to the lawyers working for a company. Her argument is permissive in that algorithms should not be perceived as contracts in and of themselves. It is important, she stresses, to preserve the term "contract" for legally enforceable matters. As long as the algorithm is a legally compliant agent, the algorithm should be enforceable as an "algorithm contract," with a self-enforcing feature. However, privacy concerns create a problematic definitional situation in consumer transactions. Even if we use specific elements (for example, social security numbers) to limit private data uses, the system will often still allow the collection of other data (metadata). She notes that remedial policy approaches differ. France and the United Kingdom have put in place privacy compliance checklists, whereas Germany put in place adopted general provisions to be followed by companies. If companies are given a checklist, they will try to check off the policing costs for themselves. When presented with general objectives, they will try to look into what they are doing and will seek to internalize the compliance processes. The latter has the most promise as a regulatory approach.

1.6.7 *Smart Contracts: Courts, Lawyers, and Consumers*

Judge Marc Clément of the Lyon Administrative Appeals Court notes that an automatically self-performing smart contract can truly exist in a pure virtual world but becomes more complex when connecting to the real world – necessitating interfaces between the software and reality. This interface starts with “oracles” providing real-world parameters for coded self-performance and extending to other links to ensure contract content validation, contract legality, lawfulness of contract purpose, and measurement of contract results. This complexity will have two significant results. The first is more, not less, work for lawyers and judges. The second will be an enhanced reliance on burden of proof, enhanced advantage to party expertise, and an enhanced significance for party asymmetry. Judge Clément stresses the need for more “experimental law” within law schools using moot court cases to connect legal research to concrete cases.

Mathieu Martin, a practicing attorney discusses practical and ethical issues facing legal practitioners when confronting smart contracts. The issues addressed include the following: (1) How can one advise on a smart contract unless one is conversant with the underlying code? (2) How can code be created that can discern degrees of reasonableness? (3) Does the creation of smart contract templates render legal advice less important? Martin concludes that it is difficult to qualify smart contracts as legal contracts. Instead, they should be viewed as a tool and not as a replacement for language contracts. Nonetheless, smart contracts present opportunities for the lawyer in terms of contract solutions, where simplicity of management and self-enforceability are highly valued.

Oscar Borgogno notes that the tech community portrays smart contracts as infallible software able to carry out the entire contract cycle, from formation to enforcement. His chapter focuses on the potential areas, which could effectively benefit from smart contracts implementation. It argues that smart contracts can be a useable tool to effectively counteract consumers’ inertia in triggering and enforcing their rights, which are standardized and easily verifiable. Smart contracts also have the potential to foster commercial relationships by lowering transaction costs arising from lack of trust. Thus, smart contracts are likely to provide better alternatives to traditional tools of business practice, such as letters of credit and escrow agreements. Lastly, the chapter notes that businesses already have commercial incentives to implement smart contracts. However, when it comes to consumer protection, regulators must take the lead by testing, through regulatory sandboxes, the potential of smart contracts for protecting consumer rights.

1.6.8 *Observations and Visions of Technology and the Law: Smart Contracts, Blockchain, and Artificial Intelligence*

Diana Wallis asserts that self-driving law, law informed by big data, and predictive technology can be seen as a flight from law and democracy. She emphasizes the importance of legislatures as guardians of law and democracy, of serving their oversight function in the face of rapid technological change. Advancement in technology has many positive effects (greater legal certainty, more precision and consistency, and more transparent and impartial decision-making), but it is the task of governments to monitor and regulate its negative ramifications. These negative effects include undercutting of party autonomy, moral atrophy, law as command rather than counsel, and the disappearance of

the appearance of justice. In the end, the pure efficiency of technological advancement may prevent a normative assessment of its propriety.

1.7 Conclusion

It is important to note that the research in this book represents a moment in time. The interface between blockchain technologies and their future applications, as well as variations, continues to evolve at a rapid pace. Therefore, the interface between this technology and contract law, as well as government regulation, is fluid. This fluidity cautions against too quick of a response in adjusting contract law or enacting new regulations. However, given the tremendous economic potential of these new technologies or methods of doing business, regulators may feel compelled to intervene prematurely with new regulations. This would be a mistake unless certain types of abuses become evident. It is likely that the popularity of the notion of smart contracts means that blockchain technology is at an early phase of a hype cycle famously captured in Amara's law – "we tend to overestimate the effect of a technology in the short run and underestimate the effect in the long run."³⁰ This book attempts to make a first effort of presenting a detailed analysis of smart contracts not as a general phenomenon but in the light of the different faces of contract law and regulation in general.

³⁰ See note 14.