The Formation of *Smart* Contracts and Beyond: Shaking the Fundamentals of Contract Law?

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Abstract

This book chapter examines the formation of smart contracts. The term 'smart contract' is used to refer to a software programme which is often, but not necessarily, built on blockchain technology as a set of promises, specified in a digital form, including protocols within which the parties perform on these promises. It has continuously been pointed out that smart contracts are neither contracts in the traditional sense nor that they are smart and that, consequently, the term 'smart contract' itself is a misnomer. The fundamental question that this book chapter is aimed to answer is whether the traditional common law approach towards contract formation has been challenged by the rise of smart contracts. The issue is whether the development of smart contracts marks the end of traditional approach towards contract formation in case of smart contracts or it is, at the end, just much ado about nothing. Likewise, if the existing contract law is, at least in principle, suitable to regulate the formation of smart contracts, the related question is what are the smart contracts' features that might challenge the traditional contract law approach.

A. Introduction

This book chapter concentrates on the formation of (blockchain-based) smart contracts. The principal question to be answered here is whether the traditional common law concept of contract formation has been challenged by the rise of smart contracts. Therefore, the issue is whether smart contracts marking the end of contract formation as we know it or is it just much ado about nothing? And if contract law is in principle fit for governing the *formation* of smart contracts, do smart contracts have features that challenge the traditional contract law, and if yes, what are those features? These are some of the questions this contribution is trying to answer.

This book chapter will first analyze what smart contracts are at all. Subsequently, it will move on the examination of the relationship between the evolution of the blockchain technology and the rise of smart contracts. Subsequently, the blockchain-based smart contracts and the process of contract formation are discussed and exemplified, followed by the evaluation of the compatibility of smart contracts with the existing law of contract formation. Lastly, our contribution will examine possible conflict areas between smart contracts and traditional contract law in general before it ends with a short conclusion.

B. What are smart contracts?

The main thread of arguments and discussion regarding smart contracts seems to be whether or not they are contracts in the legal sense, whether they are a disruptive innovation in the legal system and what are their benefits and potential threats.[2] There is a multitude of documents on how smart contracts work or what they are, especially on blockchain or bitcoin-devoted forums. However, they normally do not offer an in-depth analysis of the legal issues.

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[2] The following contributions are dealing exclusively or at least partly with the legal aspects of smart contracts: A. Börding, T. Jülicher, C. Röttgen & M. von Schönfeld, 'Neue Herausforderungen der Digitalisierung für das deutsche Zivilrecht: Praxis und Rechtsdogmatik' (2017) *Computer und Recht (CR)*, 134-140; S. Bourque & S. Fung Ling Tsui, *A Lawyer's Introduction to Smart Contracts* (Lask: Scientia Nobilitat, 2014), p. 4-23; C. Buchleitner & T. Rabl, 'Blockchain und Smart Contracts' (2017) *ecolex*, 4-14; A.J. Casey & A. Niblett, 'Self-Driving Contracts' (2017) 43 *Journal of Corporation Law*, 1-33; P. Catchlove, 'Smart Contracts: A New Era of Contract Use', ssrn.com/abstract=3090226; A. Djazayeri, 'Rechtliche Herausforderungen durch Smart Contracts' (12/2016) *jurisPR-BKR*, no. 1; M. Finck, 'Blockchains: Regulating the Unknown', (2018) 19 *German Law Journal*, 665-691; N. Guggenheim, 'The Potentional of Blockchain for the Conclusion of Contracts', in R. Schulze, D. Staudenmeyer & S. Lohse (eds.) *Contracts for the Supply of Digital Content: Regulatory Challenges and Gaps* (Baden-Baden: Nomos, 2017), p. 83-97; J. I-H Hsiao, 'Smart Contract on the Blockchain-Paradigm Shift for Contract Law' (2017) 14 *US-China Law Review*, 685-694; C. Jacobs & C. Lange-Hausstein, 'Blockchain und Smart Contracts: zivil- und aufsichtsrechtliche Bedingungen' (2017) *IT-Rechts-Berater (ITBR)*, 10-15; M. Jünemann & A. Kast, 'Rechtsfragen beim Einsatz der Blockchain' (2017) *Kreditwesen*, 531-536; M. Kaulartz & J. Heckmann, 'Smart Contracts – Anwendung der Blockchain-Technologie' (2016) *Computer und Recht (CR)*, 618-624; M. Kaulartz, 'Herausforderungen bei der Gestaltung von Smart Contracts' (2016) *Zeitschrift zum Innovations- und Technikrecht (InTeR)*, 201-206; M. Kaulartz, 'Die Blockchain-Technologie: Hintergründe zur Distributed Ledger Technology und zu Blockchain' (2016) *Computer und Recht (CR)*, 474-480; E. Mik, 'Smart Contracts: Terminology, Technical Limitations and Real World Complexity' (2017) 10 *Journal of Law, Innovation and Technology (JLIT)*, 269-300; R. O'Shields, 'Smart Contracts: Legal Agreements for the Blockchain' (2017) 21 *North Carolina Banking Institute*, 177-194; P. Paech, 'The Governance of Blockchain Financial Networks', (2017) 80 *Modern Law Review*, 1072-1100; M.L. Perugini & P. Dal Checco, 'Smart Contracts: A Preliminary Evaluation', ssrn.com/abstract=2729548; M. Raskin, 'The Law and Legality of Smart Contracts', (2017) 1 *Georgetown Technology Review*, 305-341; C.L. Reyes, 'Conceptualizing Cryptolaw', (2017) 96 *Nebraska Law Review*, 384-445; P. Ryan, 'Smart Contract Relations in e-Commerce: Legal Implications of Exchanges Conducted on the Blockchain' (2017) 7 *Technology Innovation Management Review*, 10-17; A. Savelyev, 'Contract Law 2.0: «Smart» Contracts As the Beginning of the End of Classic Contract Law', ssrn.com/abstract=2885241; J. Schrey & T. Thalhofer, 'Rechtliche Aspekte der Blockchain' (2017) *Neue Juristische Wochenschrift (NJW)*, 1431-1436; L.H. Scholz, 'Algorithmic Contracts' (2017) 20 *Stanford Technology Law Review*, 101-147; J.M. Sklaroff, 'Smart Contracts and the Cost of Inflexibility' (2017) 166 *University Pennsylvania Law Review*, 263-303; T. Söbbing, 'Smart Contracts und Blockchain: Definitionen, Arbeitsweise, Rechtsfragen' (2018) *IT-Rechts-Berater (ITBR)*, 43-46; T.F.E. Tjong Tjin Tai, 'Juridische aspecten van blockchain en smart contracts' (2017) 54 *Tijdschrift voor Privaatrecht*, 563-608; T.F.E. Tjong Tjin Tai, 'Smart contracts en het recht' (2017) 93 *Nederlands Juristenblad*, 176-182; K. Werbach & N. Cornell, 'Contracts Ex Machina' (2017) 67 *Duke Law Journal*, p. 313-382; K. Werbach, 'Trust, But Verify: Why the Blockchain Needs the Law', *Berkley Technological Law Journal* (forthcoming, 2018), ssrn.com/sol3/papers.cfm?abstract_id=2844409.

Smart contracts raise interesting questions about their legal nature. It is often only said that the existing smart contracts are neither particularly smart nor they are even strictly speaking legally binding contracts at all.[3] Any discussion about smart contracts and their impact on today's contract law must begin with identifying the definition of the concept to avoid it being purely a buzzword. Therefore, what is a smart contract? The question, rather ironically considering all of the proponents' of blockchain technologies' praises of the end in ambiguity and confusions caused by natural language, is more contentious than one could expect.

Smart contract are often defined as a special protocol intended to contribute, verify or implement the negotiation or performance of the contract without the interference of third parties in a traceable and irreversible manner.[4] One could perhaps go back to *Szabo* (the creator of the concept of smart contracts in the 1990s), who defined a smart contract as a 'computerized transaction protocol that executes the terms of a contract. The general objectives of smart contract design are to satisfy common contractual conditions (such as: payment terms, liens, confidentiality, and enforcement etc.), minimize exceptions both malicious and accidental, and minimize the need for trusted intermediaries like banks or other kind of agents.'[5]

The economic goals of smart contracts also include reducing potential loss by fraud, enforcement costs, other transaction costs, etc. Smart contracts are presumed to be able to provide full transparency of the transaction and to grant a high degree of privacy contemporaneously.[6] *Szabo*'s definition can be simplified to a computer code that is created to automatically execute contractual duties upon the occurrence of a trigger event,[7] or agreements wherein execution is automated, usually by a computer programme.[8] A consensus definition can be distilled: a smart contract is a sort of computer code which is operated by a computer and is self-executing and self-enforcing.[9]

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[3] Bourque & Fung Ling Tsui, 'A Lawyer's Introduction to Smart Contracts', p. 4; O'Shields, 'Smart Contracts: Legal Agreements for the Blockchain', 177-178.

[4] See Bourque & Fung Ling Tsui, 'A Lawyer's Introduction to Smart Contracts', p. 4; Söbbing, 'Smart Contracts und Blockchain: Definitionen, Arbeitsweise, Rechtsfragen', 43.

[5] N. Szabo, 'Smart Contracts', http://www.fon.hum.uva.nl/rob/Courses/InformationInSpeech/CDROM/Literature/LOTwinterschool2006/szabo.best.vwh.net/smart.contracts.html

[6] Buchleitner & Rabl, 'Blockchain und Smart Contracts', 5; Guggenheim, 'The Potentional of Blockchain for the Conclusion of Contracts', 94; Kaulartz, 'Herausforderungen bei der Gestaltung von Smart Contracts', 202; Szabo, 'Smart Contracts'.

[7] Paech, 'The Governance of Blockchain Financial Networks', 1082.

[8] Raskin, 'The Law and Legality of Smart Contracts', 306; Söbbing, 'Smart Contracts und Blockchain: Definitionen, Arbeitsweise, Rechtsfragen', 44.

[9] Börding, Jülicher, Röttgen & von Schönfeld, 'Neue Herausforderungen der Digitalisierung für das deutsche Zivilrecht: Praxis und Rechtsdogmatik', 138; Kaulartz, 'Herausforderungen bei der Gestaltung

It has become apparent that there are many debates and confusions on the concept of smart contracts. For blockchain-based smart contracts, a useful dichotomy can be drawn between the 'smart contract code', which is the computer code stored, verified and executed in a blockchain, and the 'smart legal contract', which is a complement (or maybe even a substitute) for a legal contract to apply such technology.[10] In essence, a 'smart legal contract' is a combination of the 'smart contract code' and traditional legal language.[11] A smart contract is a computer code that specifies in 'if this happens that shall happen' language, in a way understandable to a computer, on a blockchain platform. Once verified, it will self-execute and self-enforce by recognizing an occurred triggering event and dispensing the assets accordingly.[12]

What has become evident is that the term smart contract is a misnomer.[13] A smart contract as we know it right now is independent from the applicable law in which it is not a contract in the legal meaning. The choice of such name for the concept of a self-executing and computer-coded agreement is unfortunate as it exacerbates confusion. Some theoretical similarities, however, exist between smart contracts and legal contracts insofar as both 'are frameworks for regulating the interaction between different entities.[14]

As for the question regarding how a smart contract works in practice and how it is concluded, *Szabo* (and other legal writers also follow his example) uses a famous simple vending machine analogy.[15] A vending machine takes coins and dispenses change and product according to the displayed price. Once the coins are inserted, there is no further human intervention required to conclude and later execute the contract. Similar to a smart contract, a contract concluded through a vending machine is also in principle immutable and self-enforcing. Even if a person was forced to buy something from the vending machine, the machine would still give the product the person, even if the

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von Smart Contracts', 203; Mik, 'Smart Contracts: Terminology, Technical Limitations and Real World Complexity', 269; O'Shields, 'Smart Contracts: Legal Agreements for the Blockchain', 179. A slightly different definition offers Kaulartz, 'Herausforderungen bei der Gestaltung von Smart Contracts', 203.

[10] J. Stark, 'Making Sense of Blockchain Smart Contracts', *Coindesk*, Jun 4 2016, www.coindesk.com/making-sense-smart-contracts/

[11] Djazayeri, 'Rechtliche Herausforderungen durch Smart Contracts', no. 1; Kaulartz, 'Herausforderungen bei der Gestaltung von Smart Contracts', 205.

[12] Tjong Tjin Tai, 'Smart contracts en het recht', 177.

[13] Buchleitner & Rabl, 'Blockchain und Smart Contracts', 6; Djazayeri, 'Rechtliche Herausforderungen durch Smart Contracts', no. 1; Söbbing, 'Smart Contracts und Blockchain: Definitionen, Arbeitsweise, Rechtsfragen', 46.

[14] C. Lim, T.J. Saw & C. Sargeant, 'Smart Contracts: Bridging the Gap Between Expectation and Reality', 11 July 2016, *Oxford Business Law Blog*, www.law.ox.ac.uk/business-law-blog/blog/2016/07/smart-contracts-bridging-gap-between-expectation-and-reality.

[15] N. Szabo, 'Formalizing and Securing Relationships on Public Networks', (1997) 2(9) *First Monday*, http://firstmonday.org/ojs/index.php/fm/article/view/548/469-publisher=First

court later sets aside the transaction due to duress. Furthermore, in theory, anybody with coins can participate in an exchange with the vendor regardless the legal capacity of the contracting parties. What smart contracts go further is 'in proposing to embed contracts in all sorts of property that is valuable and controlled by digital means'.[16] Essentially, once both parties agree on a smart contract, its execution is taken from their control. Human discretion in performance and enforcement are deemed to be excised.[17]

C. The evolution of the blockchain technology and the rise of smart contracts

It is important to note that there are smart contracts which function without blockchain technology.[18] However, there is little doubt that the main reason for the actual rise of smart contracts is the recent rise of the blockchain technology. This technology allows smart contracts to use their full potential for automation and this is the type of smart contracts this article is going to focus on. Bitcoin, which proliferated this technology, led to the establishment of *Ethereum*, which is a more sophisticated blockchain platform allowing more complicated transactions beyond just transfers of currency, or bitcoins.[19] Ethereum even developed its own coding language called *Solidity*.[20] The blockchain technology demonstrates how a network could be set up so that once a transaction is set in motion, the network can produce outputs autonomously without the direct intervention of any party or any intermediaries.[21] Because of this feature, participants do not need to trust each other, they can rely on the system as a whole to carry out transactions knowing that the parties cannot frustrate the intended outcome.[22] Blockchain not only allows verification of each transaction through the nodes (the computers in the chain), but it also, by storing the contract in a 'block' and sending it to each node, makes the execution automatic and, in principle, *immutable*. Thus, it allows the 'digitization of

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[16] N. Szabo, 'Formalizing and Securing Relationships on Public Networks'.

[17] Paech, 'The Governance of Blockchain Financial Networks', 1077.

[18] Blockchain (technology) is sometimes also referred to as distributed ledger (technology) or shared ledger (technology). While these three notions still remain in flux (and some authors consider them to designate different forms of technology), we will refer to them interchangeably for the sake of simplicity. However, mainly the term blockchain (technology) will be used in this contribution.

[19] Scholz, 'Algorithmic Contracts', 120; Tjong Tjin Tai, 'Smart contracts en het recht', 177.

[20] See: https://solidity.readthedocs.io/en/develop/

[21] Clifford Chance, 'Smart Contracts. Legal Agreements For the Digital Age', November 2017, 2, www.cliffordchance.com/briefings/2017/06/smart_contracts_-legalagreementsforth.html.

[22] This has led some authors to the convinction that only 'the code is the law' and that law is obsolet for smart contracts (see L. Lessig, *Codes and Other Laws of Cyberspace* (New York: Basic Books, 1999), p. 24). However, this opinion did not gain sufficient support as it is obvious that (contract) law remains to play an important role for smart contracts. See: Kaulartz & Heckmann, 'Smart Contracts – Anwendung der Blockchain-Technologie', 618-623; Tjong Tjin Tai, 'Smart contracts en het recht', 179.

trust through certainty of execution' and the 'creation of efficiency through removal of intermediaries and the costs they bring to the transactions'.[23] These characteristics are perhaps the greatest appeal of smart contracts making use of blockchain technology.

Currently, there are various ideas on how to make use of blockchain-based smart contract in today's practise and in the future. One frequently mentioned example is the distribution of compensation for suffered damages resulting from the exercise of flight passenger rights.[24] An example would be a right exercised under the EU Flight Compensation Regulation 261/2004.[25] These cases normally take place in a business to consumer relationship. It includes a large number of potential claimants for relatively small compensation sums. The criteria for the validity of the consumers' claims (delay or cancellation) are in principle purely objective and the conditions which trigger the compensation can be verified reliably by oracles, which means by external sources. However, as mentioned correctly by *Guggenheim*, this example also shows that there is no claim simple enough to be determined only by simple objective criteria since in specific circumstances, an airline does not need to pay a compensation in case of force majeure (see Art. 5(3) of the EU Flight Compensation Regulation 261/2004). This essentially challenges the automation of contracts.[26] Besides the well-known smart refrigerator example (the refrigerator orders the food automatically),[27] 'the pay as you drive-principle', which is discussed in the insurance industry, is another potential sphere of applicability of blockchain-based smart contracts.[28] Here the policyholder concludes a car insurance contract with the insurance company. The contract contains a 'pay as you drive-provision', which means the riskier you drive, the higher the premium the policyholder will pay. For data collection, the policyholder's car has a blockchain interface and the blockchain-based smart (insurance) contract, which adjusts the amount of the payable premium automatically according to the way the insured car is driven.[29]

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[23] Hsiao, 'Smart Contract on the Blockchain-Paradigm Shift for Contract Law', 687.

[24] Buchleitner & Rabl, 'Blockchain und Smart Contracts', 7.

[25] Regulation (EC) No 261/2004 of the European Parliament and of the Council of 11 February 2004 establishing common rules on compensation and assistance to passengers in the event of denied boarding and of cancellation or long delay of flights, and repealing Regulation (EEC) No 295/91.

[26] Guggenheim, 'The Potentional of Blockchain for the Conclusion of Contracts', 95.

[27] Djazayeri, 'Rechtliche Herausforderungen durch Smart Contracts', no. 1.

[28] Buchleitner & Rabl, 'Blockchain und Smart Contracts', 7; Djazayeri, 'Rechtliche Herausforderungen durch Smart Contracts', no. 1; Jacobs & Lange-Hausstein, 'Blockchain und Smart Contracts: zivil- und aufsichtsrechtliche Bedingungen', 12; Kaulartz & Heckmann, 'Smart Contracts – Anwendung der Blockchain-Technologie', 618.

[29] For further examples, see: Börding, Jülicher, Röttgen & von Schönfeld, 'Neue Herausforderungen der Digitalisierung für das deutsche Zivilrecht: Praxis und Rechtsdogmatik', 137; Buchleitner & Rabl, 'Blockchain und Smart Contracts', 6; Kaulartz & Heckmann, 'Smart Contracts – Anwendung der Blockchain-Technologie', 619; Kaulartz, 'Herausforderungen bei der Gestaltung von Smart Contracts',

D. Blockchain-based smart contracts and the process of contract formation

The way and method smart contracts are, and will be created in the future, can differ significantly. This depends on three different aspects:

- the level of automation of the execution of the smart contract;
- the extent of separation between the actual agreed terms and the executed code; and
- the custodial rights and/or discretion of the smart contract and its execution from the parties.[30]

Considering the three mentioned aspects, one can distinguish roughly between two kinds of smart contract.[31] The first category of smart contract is concluded 'unsmart' and only executed 'smart'. In other words, they are 'purely' self-enforcing smart contracts. They can be concluded either off-chain or on-chain. However, even in the latter case, the algorithms are exclusively employed as mere tool in contract formation.[32] When describing the actual process of formation of *on-chain* smart contracts, the concept can be well explained through the Ethereum's process.[33] This process is as follows: The user first types out the contract in coding language, which the user has to download the Ethereum software and be part of its network. Then he will 'propose' a specific contract by making it available in the system. The contract will have its own identification number and 'function as an autonomous entity within the system, somewhat similar to how a website may operate on Internet'.[34] Another user may then 'accept the proposed contract' by communicating to it. For instance, he communicates by making a payment.

The users may then communicate with the contract. For instance, to let the user know that the package has been delivered after which the contract will automatically execute the payment.[35] Because a decentralized, permission-less (meaning anyone with the right hardware and software can get on it) platform needs to avoid spam, Ethereum will charge a user *gas* (their currency) as a fee for contracts, which will increase based on the complexity of the contract. Sometimes, as already

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203; O'Shields, 'Smart Contracts: Legal Agreements for the Blockchain', 181; Raskin, 'The Law and Legality of Smart Contracts', 330; Tjong Tjin Tai, 'Smart contracts en het recht', 182.

[30] Bourque & Fung Ling Tsui, A Lawyer's Introduction to Smart Contracts, p. 4 ff.

[31] For the following differentiation see Buchleitner & Rabl, 'Blockchain und Smart Contracts', 7; Scholz, 'Algorithmic Contracts', 108.

[32] Scholz, 'Algorithmic Contracts', 108.

[33] https://ethereum.org/

[34] Tjong Tjin Tai, 'Force Majeure and Excuses in Smart Contracts', *Tilburg Private Law Working Paper No. 10/2018*, 4, ssrn.com/abstract=3183637, p. 4.

[35] Tjong Tjin Tai, 'Force Majeure and Excuses in Smart Contracts', p. 4.

mentioned before, a smart contract will need information from the outside world to enable it to carry out the transaction (an example would be if the smart contract is a stock option, it will need to know the stock price). Blockchains are not connected to the Internet[36] and therefore, the contract cannot by itself check the prices. It needs an external source, which is an 'oracle'. Oracle is a service called *Oraclize,* for example, to bridge between Ethereum and the Internet. It allows more complexions for the contracts but at the same time it also undermines the decentralization. Furthermore, it introduces the requirement of trust in the third party, who obtains the information from the outside source.

The blockchain technology and its applicability is developing quickly and in the near future, another category of smart contracts will probably see the daylight. These are smart contracts which are not only executed 'smart', but also are concluded 'smart' through blockchain. In other words, both the contract formation *and* the contract execution are smart. Contrary to the first category of smart contracts, the blockchain technology will also be used to *find* a (previously unknown) contracting party and *conclude the contract* that will be executed automatically.[37] Here the algorithms are not only employed as a mere tool like before, but also they act as a sort of 'artificial agent' in the context of the formation of a contract between two or more contracting parties.[38] The legal questions can be quite different from the first category of smart contracts, including but not limited to the formation of contracts. For instance, can the provider of the blockchain platform legally be considered as an agent? Or can the algorithm in this scenario already *de lege lata* be considered as an independent (electronic) agent itself? Or should we at least consider introducing the concept of an electronic agent which is legally independent from its creator for this kind of technology *de lege ferenda*?[39]

E. The compatibility of smart contracts with existing contract law: the requirements of contract formation

Having established the concept of smart contract, we would move our discussion to the formation of smart contracts. It must be noted that the discussion exclude the potential Private International Law problems in finding the applicable domestic law to determine the precise

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[36] The reason for that is that for blockchains to function at each node the result of an equation must be the same. If, using our example of a stock price as a variable in an equation, the result at each node would be different, because they would be able to verify the price of the stock in real time, the blockchain would not be able to function.

[37] Buchleitner & Rabl, 'Blockchain und Smart Contracts', 7.

[38] Scholz, 'Algorithmic Contracts', 108.

[39] For more details about the electronic agent discussion see Börding, Jülicher, Röttgen & von Schönfeld, 'Neue Herausforderungen der Digitalisierung für das deutsche Zivilrecht: Praxis und Rechtsdogmatik', 139; Scholz, 'Algorithmic Contracts', 141.

requirements for contract formation.[40] It is duly noted that numerous legal systems have different elements for a completed contract (e.g. the existence of 'consideration' in (English) Common Law and (German) Civil Law), we have chosen the English legal system as a focal point for this contribution. Hence, we will discuss whether a smart contract conforms with the common law requirements for formation of a valid and legally binding contract. However, we will also take the Acquis Communautaire into consideration if necessary (e.g. for the inclusion and validity of standard contract terms). Each 'requirement' for a concluded, valid and legally enforceable contract will be discussed separately: (1) offer and acceptance; (2) consideration; (3) intention to create legal relations; and (4) capacity.[41]

I. Offer and acceptance

The initial stage of a contractual agreement is similar between smart contracts and traditional contracts. This is because before any contract-ware can operate, two parties must agree to some set of contractual terms.[42] The rules on offer and acceptance will not in principle pose an obstacle to smart contracts' recognition as legally binding. First of all, offer and acceptance, as well as the parties' conducts, are evaluated objectively.[43] This means the fact that parties submit their cryptographic private keys to commit resources to a blockchain-based smart contract is proof of a commitment.[44] Since one party must post his (on-chain smart) 'contract' on the blockchain on platforms (for example Ethereum) and the other party accepted by the cryptographic key, such communication (the posting of the on-chain smart 'contract' on the blockchain) will likely be held as to be an offer. Depending on the circumstances, it is argued that it is conceptually not different from an advertisement and therefore, it is only an invitation to treat.[45] However, as the 'offeror' posts his 'contract' on the blockchain in a

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[40] See for the Private International Law aspects of smart contracts Bourque & Fung Ling Tsui, A Lawyer's Introduction to Smart Contracts p. 4, 13; Buchleitner & Rabl, 'Blockchain und Smart Contracts', 12; Djazayeri, 'Rechtliche Herausforderungen durch Smart Contracts', no. 1.

[41] The basic elements for a contract conclusion under German Law are (of course with the important exception of consideration) quite similar. See for German Law in the context of smart contracts Kaulartz, 'Herausforderungen bei der Gestaltung von Smart Contracts', 201-204.

[42] Raskin, 'The Law and Legality of Smart Contracts', 322.

[43] *Smit v Hughes* (1871) LR 6 QB 597, 607 (Blackburn J).

[44] Werbach & Cornell, 'Contracts Ex Machina', 368.

[45] Kaulartz & Heckmann, 'Smart Contracts – Anwendung der Blockchain-Technologie', 621.

binary computer code which specifies precisely the terms of the transaction, it will regularly be held to constitute an offer not an invitation to treat.[46]

Once the proposed smart contract is posted on the blockchain and fulfilled the requirements of being an offer (especially the identification of the *essentialia negotii* of the contract), it is capable of an acceptance by the offeree.[47] This acceptance can also be done by conduct. In the example on transferring control over a digital asset to the smart contract, that digital asset can be money, cryptocurrency or a digital representation of an offline asset. The action of uploading that asset to the smart contract provides an unequivocal communication of acceptance.[48] It is perhaps best to exemplify this point. The offeror can write a smart contract stating that for 10 *Ether* (Ethereum's digital currency), offeror will transfer ownership of a car. Offeror writes the contract, including the terms he wants, and upload it to blockchain together with the digital token that represents the car, and 'gas', which is payment for uploading the contract. This constitutes an offer. Subsequently, the offeree, who is willing to accept, will upload the 10 Ether to the smart contract, which constitutes an acceptance. The smart contract will detect the upload of 10 Ether and automatically transfer that to the offeree's wallet, while at the same time transferring the token to the offeror who uploaded the 10 Ether. The offeror does not need to vouch that he received the 10 Ether, the token for car is transferred without the offeror's further verification or discretion.

Therefore, the acceptance can occur either by performance, as is argued by some scholars, or by the authorization of transfer by putting in the special cryptographic key (password).[49] In either case, there is a clear act of acceptance, which can be a performance of the terms in a unilateral contract[50] or a signature by inputting the personal cryptographic key. Another argument arises here, namely on-chain smart contracts for now are unilateral contracts, promises that if X happens I will give you Y, and thus capable of being accepted by performance. Overall, it is evident that the rules on

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[46] Cf *Partridge v Crittenden* [1968] 2 All ER 421; cf *Carlill v Carbolic Smoke Ball Co Ltd* [1892] 1 QB 296.
[47] Doubtful however Söbbing, 'Smart Contracts und Blockchain: Definitionen, Arbeitsweise, Rechtsfragen', 46.
[48] Catchlove, 'Smart Contracts: A New Era of Contract Use', 11.
[49] G.Jaccard, 'Smart Contracts and the Role of Law' (2017) *Jusletter IT*, 22; J.J. Szczerbowski, 'Place of Smart Contracts in Civil Law. A Few Comments on Form and Interpretation', 9 November 2017. Proceedings of the 12th Annual Scientific Conference NEW TRENDS 2017, published by *Private College of Economic Studies Znojmo*, ssrn.com/sol3/papers.cfm?abstract_id=3095933, 336.
[50] *Carlill v Carbolic Smoke Ball Co Ltd,* 262 (Lindley LJ).

offer and acceptance will not pose fundamental problems for the formation of smart contracts as the procedure of the formation of such agreements accommodates the elements of offer and acceptance.[51]

The adaptability of the contract law rules in smart contracts can again be illustrated by the vending machine example. Inserting the money creates a contract. This is not because of the technical functionality of the vending machine but a 'wrapper contract' is created. This is due to the law interprets the insertion of the money as a valid acceptance of an offer, which was made by the owner of the machine. Similarly, when the digital asset is uploaded to a smart contract, a contract is concluded between the two parties since that act is an acceptance of the offer made by another user irrespective to the actual transfer of the assets will be done by the smart contract.

Although the performance of the smart contract is automated, it still requires the contracting parties' will to become effective. Such intention is manifested at the moment when a party decides to enter into an agreement on the terms specified by the offeror in advance.[52] The point of this section is to illustrate that the requirements of offer and acceptance demanded for a valid contract by contract law are satisfied in common practice of formation of smart contracts.

One more note about English contract law on formation in relation to smart contract needs to be made. The will theory once proposed by theorists such as *Pothier* or *von Savigny* is supposedly the underlying theoretical basis for contracts. Accordingly, a consensus ad idem – 'a meeting of the minds' is required for the contract to be formed.[53] If this is true, why should such a consensus suddenly be unenforceable when expressed in a computer code rather than in a natural language? If both parties read and understand the terms written in computer code, which is also verifiable by any third party adjudicator (courts or arbitral tribunals could have expert evidence to distill the meaning of the computer code), then there is nothing preventing that meeting of the minds from being enforced.[54] Freedom of contract as one of the pillars of contract law dictates that parties should be free to write

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[51] This might as outlined already before be different for the other mentioned category of smart contract where the algorithyms act as an 'artifical agent'.

[52] Savelyev, 'Contract Law 2.0: «Smart» Contracts As the Beginning of the End of Classic Contract Law', 11.

[53] See e.g. *Scriven Bros & Co v Hindley* [1919] 3 KB 564.

[54] However, problems arise if at least one of the contracting parties does not understand the computer code but nevertheless conclude the smart contract. In this scenario the party who did not understand the computer code could try to advocate in hindsight for the existence of a 'mistake' and to rewind the smart contract. In German legal scholarship this case has been discussed but has always been rejected so far as an 'Inhaltsirrtum' according to § 119(1) BGB. It is said that in principle it is the risk of the parties to conclude a contract not knowing the underlying computer code. See Jünemann & Kast, 'Rechtsfragen beim Einsatz der Blockchain', 533; Kaulartz & Heckmann, 'Smart Contracts – Anwendung der Blockchain-Technologie', 622.

down their bargains in whatever form and language they want.[55] The chosen language can even be a dead language in Latin or a computer code[56] as long as it is not a business to consumer relationship (which will be discussed separately later). Moreover, given the adaptability of English contract law to (previously) new modes of communications: letters[57] or telex and instantaneous communications including e-mails,[58] one can speculate that the same will extend to smart contracts when (or if) their use becomes widespread.[59]

Lastly, one point should be made about contract law's approach towards 'automatic contracts'. It is clear from cases such as *Thornton v Shoe Lane Parking* (similarly to *Szabo*'s vending machine analogy) that a contract is formed when the coins are inserted into the machine. The fact that the subsequent process occurs without human intervention does not preclude the formation of a contract.[60] In *R (Software Solutions Partners Ltd) v HM Customs & Excise,* it was held that an 'automatic medium for contract formation' can result in valid contracts.[61] Once the broker in that case put the criteria into a software, the software would seek and conclude contracts on the broker's behalf with no further requirement of human action. The court found that a contract was completed. Hence, it is in fact highly likely that the formation of smart contracts on platforms including Ethereum will be held and recognized in law as valid formation of a legally enforceable contract.

II. Consideration

Under the English contract law, the existence of valid consideration represents a mandatory condition for any contract to be legally enforced. For a valid consideration, it is only required to be sufficient, and not adequate.[62] In other words, from the perspective of contract law formation, the value and equality of mutual exchange is legally irrelevant. Therefore, one may argue that the consideration requirement will be easily satisfied in case of smart contracts because smart contracts entail an exchange of digital assets as provided in above example of 10 Ether for a car.

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[55] Szczerbowski, 'Place of Smart Contracts in Civil Law. A Few Comments on Form and Interpretation', 335.
[56] See Jünemann & Kast, 'Rechtsfragen beim Einsatz der Blockchain', 533; Kaulartz & Heckmann, 'Smart Contracts – Anwendung der Blockchain-Technologie', 622; Kaulartz, 'Herausforderungen bei der Gestaltung von Smart Contracts', 204.
[57] *Adams v Lindsell* (1818) 1 B & Ald 681.
[58] *Entores v Miles Far East Corp* [1955] 2 QB 327; *Brinkibon Ltd v Stahag Stahl und Stahlwarenhandelsgesellschaft mbH* [1983] 2 AC 34.
[59] Norton Rose Fulbright, 'Can smart contracts be legally binding contracts', http://www.nortonrosefulbright.com/files/r3-and-norton-rose-fulbright-white-paper-full-report-144581.pdf , p. 22.
[60] *Thornton v Shoe Lane Parking* [1978] 2 QB 163 (Lord Denning MR).
[61] *R (Software Solutions Partners Ltd) v HM Customs & Excise* [2007] EWHC 971, para. 67.
[62] Illustration case: *Chappel & Co Ltd v Nestlé Co Ltd* [1959] AC 87.

Yet *Werbach* and *Cornell* raise an interesting argument as they point out that smart contracts do not contain an *exchange of promises* as it is usually the case in normal contracts and a requirement for a valid consideration. They illustrate their argument with an analogy, which is best cited in full:

'If someone balances a pail of water on top of a door, he does not promise to drop water on whoever next opens the door. Rather, he has merely set up the mechanical process by which that will happen. In a similar way, a contract to transfer one bitcoin upon such-and-such event occurring is not really a promise at all. It does not say 'I will pay you one bitcoin if such-and-such happens', but rather something like 'You will be paid one bitcoin if such-and-such happens'…the so-called '[smart] *contract*' is not an exchange of promises or commitments. Creation of a smart contract – while setting certain events in motion – does not commit any party do no anything. There's nothing being prospectively promised'.[63]

That certainly is a departure from the realm of traditional 'dumb' contracts. However, that issue does not prevent the authors from reaching the conclusion that smart contracts are nevertheless legally valid contracts. *Savelyev* asks himself whether a smart contract is not a contract because it does not contain any obligations. However, he holds that such a conclusion would be too simplistic for several reasons. First, the parties still express their will when they enter into a contract and they are bound by the result of their action. Secondly, contract law acknowledges certain types of agreements which are performed instantaneously at the moment of conclusion (executed contracts). *Savelyev* concludes that it is probably more correct to state that the main consequence of the conclusion of a smart contract is not an appearance of 'obligations' but the result of self-limitation in certain rights by technical means.[64]

Werbach and *Cornell* themselves argue that though such commitments might not constitute promises per se, smart contracts are agreements that purport to alter the parties' rights and obligations and that an agreement may still count as a contract even if it leaves nothing open to be done or performed. [65] For them, smart contracts constitute present agreements without further promises to perform. Hence, anyone, who argues smart contracts do not involve a 'promise', but more of a guarantee, precludes it from being recognized a contract, has an unrealistically 'idealistic' view of contract law. Some considerations, such as: benefit, right or detriment, loss or responsibility etc.,[66]

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[63] Werbach & Cornell, 'Contracts Ex Machina', 340.
[64] Savelyev, 'Contract Law 2.0: '«Smart» Contracts As the Beginning of the End of Classic Contract Law', 18.
[65] Werbach & Cornell, 'Contracts Ex Machina', 341.
[66] *Currie v Misa* (1876) LR 1 App Cas 554.

will be conveyed under smart contracts inducing a reciprocal promise,[67] and pragmatically, there will almost always be sufficient consideration.

Lastly, another interesting point raised in relation to on-chain smart contracts is that they are unilateral contracts in nature. For instance, 'if X occurs then I will pay you'. Therefore, the consideration for such contracts is the act of performance itself.[68] Unilateral contracts have been enforced by English courts for a long time before. As such, they should be now. That does not prevent someone from committing a gift promise to the blockchain. Such a gift promise would be executed irrevocably in the same manner as other smart contracts.[69] Does this mean that smart contracts render gifts legally enforceable? It is submitted, though lack of authority on this issue should be noted, that the answer is no. Not every smart contract is a contract, and the fact that a gift executed through smart contract is irrevocable does not mean it is legally valid. A donor who changed his mind could potentially seek restitution under unjust enrichment, though the fact that the gift would be by then a *fait accompli* would make it substantially harder to recover. All in all, however, it is argued that both conceptually and pragmatically sufficient consideration will normally be present in smart contracts in order to render them legally enforceable.

III. Intention to create legal relations

In commercial relationships, the intention to create legal relations is presumed in common law. This presumption is to be disproved by the party claiming that there is no such intention.[70] Hence, it could be argued that for every smart contract entered into in commercial settings, the intention to create legal relations will be presumed regardless whether it is a business to business or a business to consumer transaction.

Again, a more nuanced view can be offered. *Savelyev* comes to a conclusion that by concluding a smart contract, the contracting parties have the intention to use an alternative regulatory system and not traditional contract law. Therefore, there might not be a true intent to create legal relations.[71] However, he also admits that if the result is factually the same in substance to the one regulated by 'usual contracts', it can (and must according to us) be argued that the nature of the

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[67] Werbach & Cornell, 'Contracts Ex Machina', 370.
[68] *Carlill v Carbolic Smoke Ball Co Ltd* [1892] 1 QB 296, 265 (Lindley LJ).
[69] Werbach & Cornell, 'Contracts Ex Machina', 370.
[70] See e.g. *Esso Petroleum Limited v Commisioners of Customs and Excise* [1975] UKHL 4 .
[71] Savelyev, 'Contract Law 2.0: «Smart» Contracts As the Beginning of the End of Classic Contract Law', 11.

relations is the same.[72] The initial part of the argument is interesting – after all the fact of eliminating lawyers and courts from the equation is an advantage[73] of smart contracts, so there is no intention of *legal* relations – but rightly rebutted.

The parties do *not* wish to enforce their contracts in court because they believe that such enforcement will be unnecessary since a smart contract is guaranteed to be performed. That is not the same, however, as wishing that if the smart contracts end up in court, they will not be upheld by the court. In the conclusion of a smart contract, if the offer has been accepted, it has also commenced as being performed. On this basis, it is very unlikely that a reasonable party would not see this as a binding and enforceable agreement'.[74] Hence, it is almost certain that the intention to create legal relations will be found in most smart contracts, especially in commercial settings. In any event, a precautious party who wants to ensure there is an intention to create legal relations can do so by 'wrapping' the code up in a contract. This can be done by writing a paper contract acknowledging that the smart contract is a valid legal agreement.

IV. Capacity

For a contract to be enforceable, parties need to have the capacity to enter such a contract. However, Ethereum, and in fact most of the other existing blockchain platforms, does not check for full legal capacity. Instead anyone in principle can open an account without having sufficient capacity to do so. As smart contracts have no means to test for capacity, they can be entered into by minors, drunks or any other incapacitated person. Therefore, people, who are in the real world lacking the capacity to sign a contract, could potentially do so on the blockchain platform. However, if there was no capacity, then a party could invalidate the transfer of any asset ex post legally through an action in unjust enrichment and technically through a reverse transaction.[75] That is a poor alternative due to the realm of pseudonymous users with cryptographic strings of random letters and numbers. As such, it may be hard to identify who to sue. In addition, a reverse transaction can only factually rewind the contract but not legally void the transaction as it may remain on the blockchain since the blocks are

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[72] Savelyev, 'Contract Law 2.0: «Smart» Contracts As the Beginning of the End of Classic Contract Law', 11.
[73] Werbach, 'Trust, But Verify: Why the Blockchain Needs the Law', 36.
[74] Catchlove, 'Smart Contracts: A New Era of Contract Use', 11.
[75] See also Jünemann & Kast, 'Rechtsfragen beim Einsatz der Blockchain', 532; Schrey & Thalhofer, 'Rechtliche Aspekte der Blockchain', 1436.

immutable.[76] Despite to what has been said, the bottom line remains that if someone possesses legal capacity, he will be free to enter into legally binding smart contracts.

Lastly, another small but interesting observation is that the contracting parties to a smart contract are, at a technical level, not even people but only cryptographic private keys which represent individual persons.[77] Could there even be a discussion of capacity since the parties are technically not human? This is not really the case since for autonomous smart contracts, the private keys do not act by themselves, but are instructed by humans.

In summary, the aim of the above section was to show that smart contracts are capable, by virtue of the flexibility and adaptability of the English contract law and the very process of their formation, of being formed as legally valid contracts. However, the mainstream law firms are still advising their clients that for the sake of certainty, a legal 'wrapper' ought to be created. [78] It has been urged that with smart contracts, reliably creating that wrapper and ensuring that valid offer and acceptance has taken place will likely require an explicit process that incorporates the legal requirements for electronic execution of traditional, non-automated contracts rather than relying on speculative smart contract-friendly interpretations of common law rules.'[79] A suggestion would be parties must click the 'I agree' button before launching.

Such 'code-and-contract' hybrids that entail both a smart contract and a paper contract acknowledging the smart one is perhaps the best intermediary solution at the moment. The drafting of the 'wrapping' may require more than just 'I accept that I am bound by the outcome of the smart contract'. Such a clause could be unenforceable for incompleteness or uncertainty under common law. In the long run, given the efficiency driven business world, the legal system should create legal certainties so that costly 'code-and-contract' hybrids can be avoided.

F. Conflict areas between smart contracts and traditional contract law

What has been demonstrated until this point is that the smart contracts can, in principle, fulfil the requirements for the formation of contracts and that existing problems are not unbridgeable. This,

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[76] Schrey & Thalhofer, 'Rechtliche Aspekte der Blockchain',1436.

[77] Werbach & Cornell, 'Contracts Ex Machina', 371.

[78] Clifford Chance, 'Are Smart Contracts Contracts? Talking Tech Looks at the Concepts and Realities of Smart Contracts' December 2017, available at: https://talkingtech.cliffordchance.com/en/tech/are-smart-contracts-contracts.html

[79] Clifford Chance, 'Are Smart Contracts Contracts? Talking Tech Looks at the Concepts and Realities of Smart Contracts'.

however, does not mean that there are no conflict areas between smart contracts and traditional contract law, whatsoever outside the realm of contract conclusion. Some of the most important issues will be outlined in the following to complete the whole picture and broader our general vision on smart contracting.

I. Flexible enforceable legal contracts vs. firm self-enforcing smart contracts

'A smart contract asks its parties to tie themselves to the mast like Ulysses and ex ante commit to abiding by the terms of the agreement'.[80] The main point about performance in smart contracts is that those contracts are fully automated and performed by computers with no external intervention. Unlike the performances of traditional contracts, the performance of a smart contract cannot be stopped, neither voluntarily by the parties (they cannot breach or amend it) nor by a central entity, court or any other supervisor.[81]

As a result, traditional contract law is flexible while smart contracts are in principle firm and fixed. Once the smart contract terms have been programmed into the code and executed onto blockchain, there is no longer a need for reliance on the willingness of the various parties to perform. Smart contracts are performance-based and ensure a greater likelihood of performance unlike conventional contracts.[82] This 'self-enforceability' nature of the smart contracts is what primarily distinguishes this new technology from traditional 'dumb' contracts. *Savelyev* describes it as being 'technically binding for all the parties…[s]ubsequent change of circumstances or intent of the party to it is irrelevant. '[83] Therefore, he argues that smart contracts leave no room for opportunistic behavior or any efficient breach of contract. As a result, this creates tensions with classic contract law. [84] That is true to an extent. Contract law is neither adapted nor prepared to accommodate self-enforcing contracts. Because of this nature, an action in court finding the terms of a smart contract unenforceable may have no practical effect as the contract will be performed regardlessly.[85] Furthermore, due to the nature of blockchain technology, once a contract goes onto the blockchain, it cannot be revoked or amended. In other words, any rescission, rectification or variation is in principle impossible. One could imagine a

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[80] Raskin, 'The Law and Legality of Smart Contracts', 309.
[81] Paech, 'The Governance of Blockchain Financial Networks', 1082.
[82] Catchlove, 'Smart Contracts: A New Era of Contract Use', 9.
[83] Savelyev, 'Contract Law 2.0: «Smart» Contracts As the Beginning of the End of Classic Contract Law', 15.
[84] Savelyev, 'Contract Law 2.0: «Smart» Contracts As the Beginning of the End of Classic Contract Law', 15.
[85] Werbach & Cornell, 'Contracts Ex Machina', 373.

blockchain is where certain authorities have access to change the existing 'blocks'. However, that would of course undermine the very essence of blockchain.[86]

Not only traditional enforcers like courts are powerless in affecting the performance of smart contracts, but also the agreements are final as no amendments can be made.[87] Smart contracts are not flexible and therefore unable to accustom to changing circumstances or parties' references.[88] This DNA of smart contracts puts them on a collision course with traditional contract law doctrines including variation and frustration. An event that 'significantly chang[es] the nature…of the outstanding contractual rights and/or obligations from what the parties could reasonably have contemplated at the time of its execution that it would be unjust to hold them to the literal sense of its stipulation'[89] would render the parties discharged under the doctrine of frustration. Regrettably, under a smart contract, the parties will have to perform, or to be more exact, performance will follow regardless their choice or rights.

It seems to be true that the term smart contract is a misnomer since they are in fact not smart at all, at least not in the way of traditional contract law. They are not smart enough to adjust as events unfold. Even beyond mistakes, parties may not anticipate the exact scenario that arises at the time of performance. Most contracts are incomplete, in the sense that they do not specify an outcome for every event possible. Courts can also fill in the blanks when the contractual expression of the parties' intents are ambiguous.[90] The self-enforceability and inability of courts to stop the performance of a smart contract could in principle also result in illegal contracts being performed, exacerbating the already anxious reservations about cryptocurrency and blockchain being used for illicit means. It means that the computer code does not consider a possible nullity of a legal contract (unless taught to do so) and that discrepancies can occur between the legal and the informatics systems, which then may result in unfair or even unlawful smart contracts being enforced.[91] The described outcome is of course detrimental to the social welfare to the degree that computer codes are used to regulate and steer social behavior outside legal solutions.[92]

The only possible way to influence or to stop the execution of a smart contract is by programming it in a way that it seeks external input from oracles on further execution at the

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[86] Savelyev, 'Contract Law 2.0: «Smart» Contracts As the Beginning of the End of Classic Contract Law', 19.
[87] O'Shields, 'Smart Contracts: Legal Agreements for the Blockchain', 178.
[88] Hsiao, 'Smart Contract on the Blockchain-Paradigm Shift for Contract Law', 691.
[89] *National Carriers Ltd v Panalpina (Northern) Ltd* [1981] AC 675 ,700 (Lord Simon of Glaisdale).
[90] Werbach & N. Cornell, 'Contracts Ex Machina', 369.
[91] Jaccard, 'Smart Contracts and the Role of Law', 8.
[92] Jaccard, 'Smart Contracts and the Role of Law', 8.

occurrence of certain predefined events.[93] The external input can result in either from a human controlled IT process into which the smart contract is embedded, or from authorities or courts. Such a solution, where a smart contract has a clause stating that court decisions can be incorporated into a contract via an oracle could sort out the problem with the execution of, for example, illegal smart contracts.

However, there is an important flaw in such an argument. It would require every party in every contract to agree to insert such a clause since in computer code, there can be no 'implied term' ex post, and assuming that in the near future there will be millions of such smart contracts executed every day, it would be impossible to police if every contract has such a clause. Alternatively, "multisig" technology could be implemented. In simplification, it is a system whereby to be carried out the contract requires two out of three keys: one key is in the possession of each party (i.e. two keys of the contract), and the third key is in possession of a mutually trusted third party (e.g. an arbitrator). If two parties agree on performance, they both sign using their keys and contract is executed. If there is disagreement, the trusted third party can choose to sign and thus activate the contract, or to withhold signature thus preventing the contract from being executed.[94]

Apart from the problems of illegality, there is also the problem of variation within a smart contract context. As being said once a smart contract is programmed and put onto the blockchain, it is supposed to run until its completion. A contract provision for modification of the smart contract in certain agreed circumstances would need to be programmed into the code from the outset, but this is yet seldomly done.[95] Therefore, it may be required to programme broad allowance into the code. However, one has to understand that this would of course lessen the additional certainty otherwise gained through the use of smart contracts.[96]

II. The different objectives of legal contracts and smart contracts

It has been shown that while the formation of smart contracts does not really challenge the traditional rules of contract law, their self-enforcing nature challenges contract law. This is because the traditional enforcers who are confronted with strong smart contracts might be helpless ex post.[97] That is the new situation which every legal definition of smart contracts needs to bear in mind as once

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[93] Paech, 'The Governance of Blockchain Financial Networks', 1083.
[94] Werbach & Cornell, 'Contracts Ex Machina', 345.
[95] Catchlove, 'Smart Contracts: A New Era of Contract Use', 13.
[96] Catchlove, 'Smart Contracts: A New Era of Contract Use', 13.
[97] Raskin, 'The Law and Legality of Smart Contracts', 311.

a strong smart contract has been initiated, it will in principle be enforced.[98] The problems arise from the underlying tension between the decentralised nature of the blockchains and the centralized traditional enforcement procedures.

Smart contracts are sometimes called the first real disruptive innovation in the legal profession and it is said that the technology will eliminate (or at least drastically reduce) the need for lawyers, any sort of paralegals, judges or arbitrators.[99] Others however seem to be convinced that lawyers are here to stay. To say it in the words of *Raskin*:

> 'The creators of smart contracts have invited society to a party they are throwing. They say that this party has better food, booze, and music than the party being thrown down the street. But the other party has all of the people, even if the amenities are not as good. Whether society shows up to this new party is an open question. This is because legacy systems exist for a reason. By definition, they work. Both switching costs and uncertainty stand as barriers to the adoption of any new technology. Yet if the value of the new technology is overwhelming, such a change is more likely to occur. One way of reducing uncertainty is by situating the new in the old.'[100]

The invitation to situate 'the new in the old' is ubiquitous across the literature. It shall be discussed further below. *Werbach* and *Cornell* conclude that smart contracts will not replace contract law. For them, even if smart contracts can meet the doctrinal requirements of traditional contract law, they serve a very different purpose.[101] Contract law is exclusively a remedial institution and it does not aim to ensure performance ex ante, but to adjudicate the ex post grievances that may arise. Smart contracts instead eliminate the act of remediation by admitting no possibility of a breach of contract. However, the reasons that gave rise to contract law as such do not disappear. If the contracting parties cannot (or do not) represent ex ante all possible outcomes of a smart contract arrangement, the results may diverge from their mutual intent.[102] The smart contract might also lead to legally sanctioned results including duress, unconscionability and illegality. Hence, promise-oriented disputes and grievances will not disappear from the legal world, but only shift their complexion.

Whatever the future may hold, the discussion of smart contracts offers us an opportunity to re-evaluate the existing norms of contract law. *Werbach* and *Cornell* reject for example the argument that the function of contract law is to strengthen and affirm our moral obligations or to facilitate reliance

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[98] Raskin, 'The Law and Legality of Smart Contracts', 311.
[99] Tjong Tjin Tai, 'Smart contracts en het recht', 176.
[100] Raskin, 'The Law and Legality of Smart Contracts', 340.
[101] Werbach & N. Cornell, 'Contracts Ex Machina', 318.
[102] Werbach & Cornell, 'Contracts Ex Machina', 318.

through opting into predictable further consequences.[103] According to them, contract law exists to adjudicate the justice of a situation ex post and its basic function is to decide whether one party has failed to perform a contractual obligation. Therefore, contract law is only a remedial institution and it does not aim at creating new reasons. It aims at resolving disputes, taking the reasons as already given.[104] If that is the objective of contract law, then smart contracts do not even purport to do what contract law does as they have two very different objectives: Smart contracts want to ensure actions, while contract law functions to recognize and remedy grievances. Therefore, smart contracts cannot replace contract law. At best, smart contracting might be able to reduce the need for contract litigation and thus minimizing transaction costs.

III. Ex post authoritative judgments vs. ex ante automated assessments

Much was made about the ex ante and ex post distinction in the discussions. *Hsiao*, for example, argues that parties of a smart contracts are actually changing the paradigm of contract practice from ex post authoritative judgments (by judges or arbitrators) to ex ante automated assessments. [105] Parties conclude a smart contract because they believe that the *ex ante* automated results will only infrequently diverge from an authoritative decision maker such as a judge or arbitrator.

Werbach also deals with the ex ante and ex post distinction when he says that 'smart contracts are good at setting forth anticipated conditions and consequences ex ante, and then ensuring the consequences occur upon fulfillment of the conditions. Legal contracts are good at cleaning up the mess when, as inevitably occurs, things do not go according to plan. Difficulties arise when the smart and legal contracts disregard one another'.[106] However, contract law and smart contracts must be reconcilable since after all, contract law exists to regulate the way that parties' contract. Therefore, in whatever form the parties decide to contract, the law will apply. Those claiming that smart contracts are not contracts and will never be because they do not conform with the rules of contract law are mistaken. If parties decide to make a transaction using smart contracts, the law will have no choice but to accept that conduct and adapt.

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[103] Werbach & Cornell, 'Contracts Ex Machina', 354.
[104] Werbach & Cornell, 'Contracts Ex Machina', 361.
[105] Hsiao, 'Smart Contract on the Blockchain-Paradigm Shift for Contract Law', 690.
[106] Werbach, 'Trust, But Verify: Why the Blockchain Needs the Law', 52.

IV. Computer code vs. natural language

Another thread often present in discussions of smart contracts is the language they are written in: the code. The code, being binary in nature, is said to be less ambiguous and more clear[107] and thus more certain, making transactions considerably less expensive due to the certainty of execution and the low risk of litigation.[108] Granted, the limitation of programming language still leaves some room for ambiguity, but this is significantly less than in plain English.[109] Several authors correctly argue that while programming language may in fact remove linguistic ambiguity, it will remain helpless in relation to changes of circumstances, lacunae or questions of equity or good faith.[110]

Paech's proposal is to combine 'smart' and 'dumb' contracts – leaving parts of the agreement outside the blockchain record, as non-smart or modifiable, while other obligations would be inserted into the blockchain as self-executory and immutable.[111] As already mentioned others suggest that there should be a 'dumb' contract as a 'legal wrapper' which would set out the terms of the contract, incorporating the smart contract code by reference, as well as to insert a fail-safe in the smart contract that would allow the code to be terminated or amended in certain (agreed) scenarios.[112]

The more complicated and complex the smart contracts need to ensure safety for the parties, the lesser their appeal. However, not every smart contract needs in fact a bespoke human-negotiated contract alongside it. Standard contract forms will be widespread at least for business to consumer contracts and low-value agreements.[113] Still the reality today is such that the smart contract code and paper contracts coexist in individual transactions. This can be imagined on a spectrum which contracts fully in natural language on one end and fully computer coded contracts on the other.

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[107] Catchlove, 'Smart Contracts: A New Era of Contract Use', 10.
[108] Paech, 'The Governance of Blockchain Financial Networks',1082.
[109] Catchlove, 'Smart Contracts: A New Era of Contract Use', 15. For a more skeptical views, see: Tjong Tjin Tai, 'Smart contracts en het recht', 181. He is arguing that even computer experts have problems to understand the code.
[110] See e.g. Jacobs & Lange-Hausstein, 'Blockchain und Smart Contracts: zivil- und aufsichtsrechtliche Bedingungen', 13; Guggenheim, 'The Potentional of Blockchain for the Conclusion of Contracts', 96.
[111] Paech, 'The Governance of Blockchain Financial Networks', 1097.
[112] Lim, Saw & Sargeant, 'Smart Contracts: Bridging the Gap Between Expectation and Reality', Ryan, 'Smart Contract Relations in e-Commerce: Legal Implications of Exchanges Conducted on the Blockchain', 15.
[113] Werbach, 'Trust, But Verify: Why the Blockchain Needs the Law', 54. For possible legal implications see the following chapter on consumer law and smart contracting.

The uncertainty over the current position of smart contracts, combined with desired ambiguity,[114] mean that for now high value smart contracts will be in the middle of the spectrum, or 'split' smart contracts, which is a natural language contract with encoded performance clauses for non-human aspects.[115] Commercial contracts contain usually numerous boilerplate clauses that protect the contracting parties from different edge-case liabilities. These are not always suitable for representation and execution through a code. Having said that, it becomes clear that smart legal contracts will require, at least for the near future, a blend between code and natural language.[116]

This blend of computer codes and natural language will continue to require solicitors for drafting purposes, which means that lawyers can, at least for now, sigh with relief. Moreover, another development also secures their future is that smart contracts will not eliminate commercial litigation. Smart contracts are self-executing, which could mean that challenging them through litigation is a fait accompli since a court order will have no practical effect on the performance.[117] This means smart contracts live to some extent outside the traditional contractual remedies and therefore, it can be forecasted that unjustified enrichment and reverse transactions will play a more important role in smart contracts disputes.[118] Judges when confronted with injustice or injury will not 'throw up their hands and defer to a distributed ledger'.[119] Litigation will persist, but it will be shifted from claims of breach of contract to claims of restitution.[120]

V. Consumer protection law and (egalitarian) smart contracts

Another potential conflict between smart contracts and traditional contract law which needs to be emphasized is in case of the protection of the weaker party. Protection of a weaker party is a principle that traditional contract law contains (at least to some extent) and that became of utmost importance with the rise of consumer protection law.[121] The business to consumer transactions are of

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[114] Freshfields Bruckhaus Deringer, 'A Smart New World: Blockchain and Smart Contracts', https://www.freshfields.com/en-gb/our-thinking/campaigns/digital/fintech/blockchain-and-smart-contracts/
[115] Norton Rose Fulbright, 'Can smart contracts be legally binding contracts', 14.
[116] Stark, 'Making Sense of Blockchain Smart Contracts'.
[117] Werbach & Cornell, 'Contracts Ex Machina', 373.
[118] Szczerbowski, 'Place of Smart Contracts in Civil Law. A Few Comments on Form and Interpretation', 335.
[119] Werbach, 'Trust, But Verify: Why the Blockchain Needs the Law', 36.
[120] Werbach & Cornell, 'Contracts Ex Machina', 376.
[121] About possible frictions between consumer law and artificial intelligence, see: Jabłonowska, Kuziemski, Nowak; Micklitz; Pałka & G. Sartor, 'Consumer law and artificial intelligence Challenges to the EU consumer law and policy stemming from the business' use of artificial intelligence', *EUI Working Paper*

particular interest for smart contracting because it is expected that this area is going to be the main sphere of applicability of smart contracts in the near future.[122] The related question is whether the general structure of smart contracts allows consumer protection at all, and if yes, to what extent.

Surprisingly, it has been argued that 'that the whole layer of legal provisions relating to consumer law (…) is non-applicable to smart contract' and therefore, there is no conflict between consumer law and smart contracting.[123] However, this opinion does not give any reason for the non-applicability of consumer law and should be rejected.[124] It almost goes without saying that consumer law is always applicable if the requirements for its applicability are fulfilled. As such, smart contracting is not and should not be a blind spot for consumer protection law. If one accepts that consumer protection law is in principle applicable to smart contracts, several legally relevant questions arise. To start with, fundamentally important right of the consumer to withdraw from the contract established by EU and UK Law seems to be in conflict with the immutability of the blockchain and the self-enforcing nature of the smart contract.

Another highly problematic area is the application of the Unfair Contract Terms Directive 93/13/EEC ('UCTD')[125] (respectively the national laws of EU Member States implementing it as in the case of the UK through the UK Consumer Rights Act 2015) on smart contracts. It is an area which is important for the determination of the content of a formatted contract. Some argue that the UCTD might not be applicable as it requires (see e.g. Art. 1(1) UCTD or section 63 of the UK Consumer Rights Act 2015) an unfair contract *term* in a *textual* form in which a requirement of an algorithm

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LAW 2018/11, http://cadmus.eui.eu/bitstream/handle/1814/57484/WP_2018_01.pdf?sequence=1&isAllowed=y

[122] For the reasons see Tjong Tjin Tai, 'Smart contracts en het recht', 182. For different views, see: Savelyev, 'Contract Law 2.0: '«Smart» Contracts As the Beginning of the End of Classic Contract Law', 20. He thinks the main field of applicability of smart contract are the business to business and consumer to consumer transactions. The exact impact of development of smart contracts on consumer law and policy is of course yet uncertain. It should also be pointed out that because to draft and enter smart contracts have high initial costs and require infrastructure and expert knowledge (coding) the access to it is not equal. Only those who can afford the powerful hardware and know how to computer-code or can afford to hire a programmer can (as of now) utilize the technology, though certain startups exist to allow 'laymen' to draft their own smart contracts.

[123] Savelyev, 'Contract Law 2.0: '«Smart» Contracts As the Beginning of the End of Classic Contract Law', 20.

[124] Numerous authors do not even discuss the problem of the applicability of consumer law for smart contracts and are assuming (naturally) its applicability in this context. See e.g. Buchleitner & Rabl, 'Blockchain und Smart Contracts', 12; Kaulartz, 'Herausforderungen bei der Gestaltung von Smart Contracts', 204; Kaulartz & Heckmann, 'Smart Contracts – Anwendung der Blockchain-Technologie', 618-621; Söbbing, 'Smart Contracts und Blockchain: Definitionen, Arbeitsweise, Rechtsfragen', 46; Tjong Tjin Tai, 'Smart contracts en het recht', 181.

[125] Council Directive 93/13/EEC of 5 April 1993 on unfair terms in consumer contracts.

could not fulfil.[126] This train of thoughts is however not very convincing as the UCTD does not per se require text form. In addition, it would be contra productive if the protection the UCTD grants could be circumvented that easily by converting unfair terms into a smart contract code.

The applicability of the UCTD to on smart contracts has been questioned because it does not necessarily need to be the case that all of the smart contract's terms are pre-formulated but some terms may be individually negotiated. [127] Art. 3(2) UCTD answers this question clearly when it says that the fact that certain aspects of a term or one specific term have been individually negotiated shall not exclude the application of the UCTD to the rest of a contract (if an overall assessment of the contract indicates that it is nevertheless a pre-formulated standard contract). Hence, it can be concluded that the UCTD is in principle applicable to smart contracts.

This applicability of the UCTD generates further legal discussion for smart contracting. Art. 5 UCTD seems to be of relevance. This article requires that the pre-formulated contract terms 'must always be drafted in plain, intelligible language' (as transposed in section 64(3) of the UK Consumer Rights Act 2015). The contractual parties are, in principle, free to choose any language for their contract which also includes 'computer language'. However, in a business to consumer context, the party autonomy is considerably limited due to the mentioned provision of the UCTD. Accordingly, in practice, it is likely that it will be difficult to defend the position that the computer code of a smart contract fulfills the requirement of being written in a plain, intelligible language from the perspective of an average consumer.[128] Does this issue lead to an a priori prohibition of smart contracting in case of business to consumer transactions? The answer to this question is negative: it does not. However, this mandatory consumer protection requirement obliges businesses to provide consumers with plain, intelligible translations of the computer code which are understandable to them. Only if this condition has been fulfilled, consumer can be bound by a smart contract, and accordingly secures legality of smart contracting in case of business to consumer transactions. [129]

G. Conclusion

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[126] Söbbing, 'Smart Contracts und Blockchain: Definitionen, Arbeitsweise, Rechtsfragen', 46.

[127] Kaulartz & Heckmann, 'Smart Contracts – Anwendung der Blockchain-Technologie', 622.

[128] Similar Kaulartz & Heckmann, 'Smart Contracts – Anwendung der Blockchain-Technologie', 618, 622; Kaulartz, 'Herausforderungen bei der Gestaltung von Smart Contracts', 204; Söbbing, 'Smart Contracts und Blockchain: Definitionen, Arbeitsweise, Rechtsfragen', 46.

[129] Kaulartz & Heckmann, 'Smart Contracts – Anwendung der Blockchain-Technologie', 622; Kaulartz, 'Herausforderungen bei der Gestaltung von Smart Contracts', 204.

In conclusion, this book chapter has demonstrated that the development of smart contracts does not represent a substantial challenge for the traditional contract law. In other words, this means that there is no need for the modification of the existing rules on contract formation, i.e. the rules on offer and acceptance, consideration, intention to create legal relations and capacity. This finding is certainly true when, as it is primarily the case in practice, the algorithms are exclusively employed as mere tools and not as real 'artificial agents'.

However, what has been identified is that there are other smart contracting features that challenge the traditional contract law approaches beyond the formation of contracts itself. The firm and self-enforcing nature of the smart contracts is in conflict with the concept of flexible, enforceable legal contracts. Likewise, the objectives of 'traditional' contracts and smart contracts differ considerably. Furthermore, it is challenging to bring the ex-ante automated assessment of smart contracts in line with the traditional contract law concept of ex post authoritative judgments. Another challenge is that smart contracts 'think' in computer codes while traditional, legal contracts are based on natural language. Eventually, an important point to raise is whether smart contracting represents challenges for the mandatory rules of consumer protection including consumer's right of withdrawal from the contract.

All in all, one should not be afraid of contract law challenges posed by smart contracts. These are neither the end of contract formation as we know it nor the end of contract law as such. Smart contracts may be seen as a litmus test for contract law and as a welcomed opportunity to think whether it is still fit for the challenges of the twenty-first century.