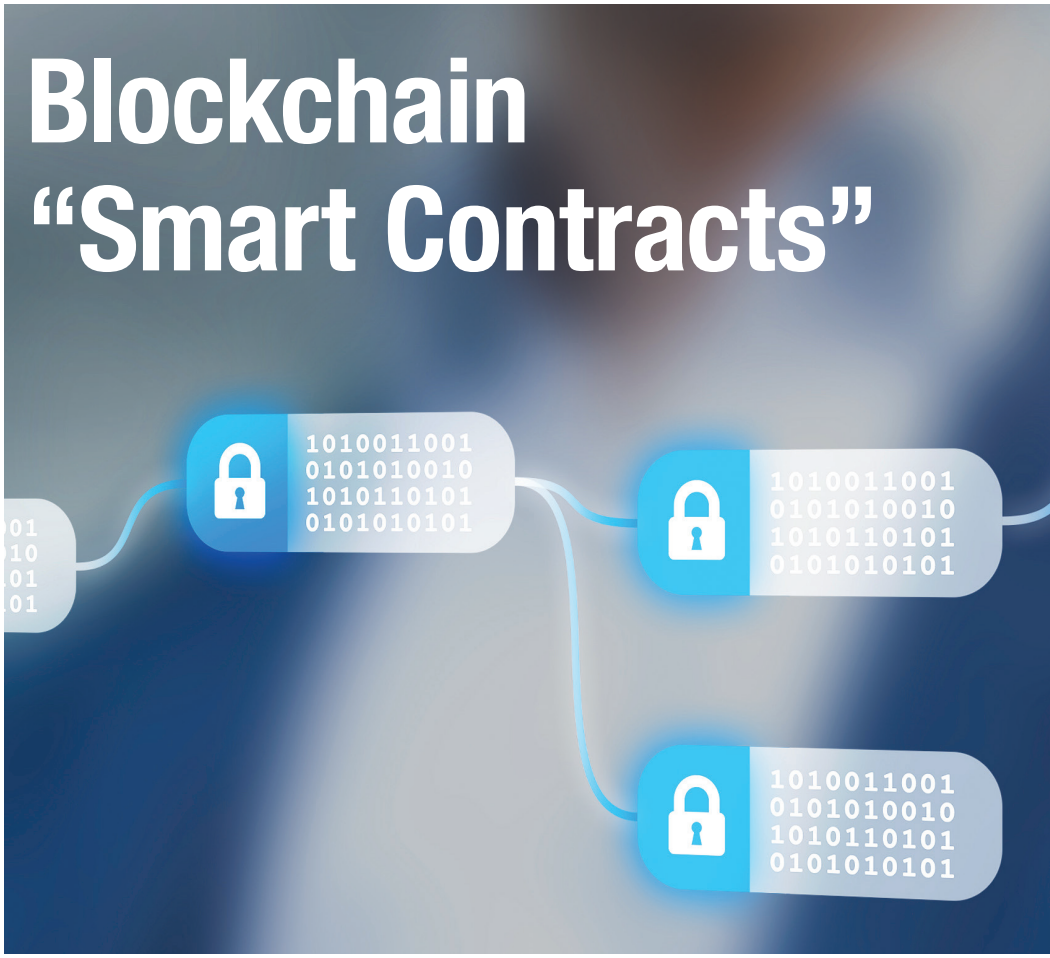
Unanswered Legal Issues

Blockchain "Smart Contracts"

By Kevin T. McCarthy

The economic benefits that blockchain technology provides are clear. However, disputes will inevitably arise between parties to blockchain smart contracts.



Blockchain technology has experienced a recent explosion in mainstream industries. Many businesses, especially financial institutions, manufacturers, and insurers and reinsurers, have recognized the potential benefits that blockchain offers and have begun incorporating the technology into their businesses. Blockchain is a decentralized computer ledger that permanently stores transactions made by the blockchain's users in sequential blocks of computer code. A number of articles already discuss the functionality and benefits of blockchain, and this article will not discuss those topics in detail. Instead, this article focuses on some major legal issues that will inevitably arise with blockchains.

Specifically, this article focuses on the legal questions that must be answered regarding blockchain smart contracts. The first issue is whether courts will hold blockchain smart contracts to be legally binding and enforceable contracts between parties. If not, the issue becomes whether smart contracts constitute admissible evidence, and if so, what weight they will be given at trial. Finally, when disputes do arise, courts will need to determine where the proper forum for suit lies. Smart contracts' decentralized nature creates an inherent difficulty in choosing the proper forum for litigation.

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A Brief Introduction to Blockchain Smart Contracts

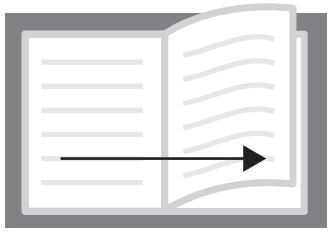
Blockchain is essentially a single, computerized ledger of transactions. The ledger is shared and authenticated by the network's users. To visualize it simply, it is helpful to think of blockchain as a book—one of the oldest systems for storing data. Anthony Lewis, *A Gentle Introduction to Blockchain Technology*, Bits on Blocks Blog (Sept. 9, 2015), https://bitsonblocks.net.

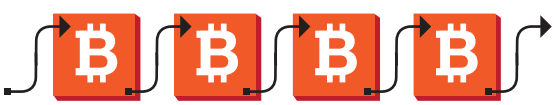
A book is a chain of interrelated pages containing data, whereas a blockchain is a chain of interrelated blocks of code containing data. Each page in a book has two components: (1) the text; and (2) information about the page itself, which is the title of the book or chapter at the top of the page, and generally, the page number on the bottom of the page. Similarly, each block in a blockchain has (1) the contents of the block, which is the particular data being stored; and (2) a header containing information about block, is the particular block's "hash" (its page number) and the hash of the previous block in the chain.

To understand blockchain's structure better, it is useful to visualize a real-life example. Bitcoin's blockchain provides an easy and practical example. Bitcoin is a type of cryptocurrency. It can be spent electronically to purchase goods and services, although the United States government treats it as a form of property rather than as legal tender.

Figure 1 helps illustrate how Bitcoin transactions are stored on the Bitcoin blockchain. *Id.* As mentioned, each block contains (1) the contents of the block; and (2) a header, which contains information about the block. The orange blocks seen above, which represent blocks of data on Bitcoin's blockchain, contain information about various Bitcoin transactions that occur within a specific time frame (*i.e.*, "A pays B three Bitcoins"). The header of the block contains the specific block's hash (page number), and a reference to the previous block's hash, thus forming a coherent, internal structure of blocks similar to numbered pages in a book. Every time that a new block is entered

Figure 1





into the chain, it is timestamped because of its reference to the previous block's hash. Taking the example "A pays B three Bitcoins," A's transaction with B is now a permanent block in the chain that is the ever-growing Bitcoin blockchain.

Blockchain limits the need for third-party clearinghouses, such as banks and other financial institutions, through its use of public, key cryptography. Every user of a blockchain has a public key and a private key. These keys are random sets of numbers that are mathematically linked (*i.e.*, "100111"). A user's public key is provided to other users of the blockchain, whereas the user's private key remains secret. Before A sends B the three Bitcoins, A will send her public key to B. Then A will sign the Bitcoin transaction with her private key and send it to B. Next, B must accept the transaction with A's previously provided public key. As mentioned, the two keys are mathematically linked. Therefore, if B has the wrong public key, or if the transaction is not signed with A's personal and secure private key, blockchain will reject the transaction as fraudulent, thereby preventing fraudsters from impersonating A in the transaction with B. This internal verification system lessens transactional uncertainties and limits the need for third-party clearinghouses in transactions.

Insurers and reinsurers have recently recognized the economic benefits that blockchain smart contracts offer to their businesses.

Aside from cryptocurrencies such as Bitcoin, blockchain technology also allows users to enter certain contractual terms into blockchain blocks known as "smart contracts." A "smart contract" is not a contract in the traditional sense. Instead, it is a prewritten software program that automates performance of each party's obligations in an "if-then" format. Many contractual terms (*i.e.*, quantity to be delivered, delineation of property rights, liens) can be embedded into a coded format. In 1996, Nick Szabo defined smart contracts using a simple and well-known example: the vending machine. Nick Szabo, *Smart Contracts: Building Blocks for Digital Markets* (1996),Thinklab, https://thinklab.com/content/736837. Purchasing a candy bar from a vending machine is really a contractual relationship. You put the required amount of money in the machine and type the letters and numbers associated with the snack that you desire. The underlying code in the machine will then ensure that the letters and numbers entered are valid and check that the money inserted is sufficient to cover the required balance. If the machine's requirements are met, it will deliver your snack without the need for an intermediary to verify and complete the transaction. This forms a basic contractual relationship between you and the machine's owner.

Blockchain technology allows the same type of automation to be applied to data-based portions of contracts. For example, say that Company A agrees to purchase 500 widgets from Company B. The parties then translate this agreement into blockchain coding. The block of coding states, "if Company B delivers 500 widgets to Company A by December 1, 2017, at 5:00 PM ESD, then Company A delivers $10,000 USD to Company B."

The blockchain can then be linked to sources known as "oracles." An oracle is an outside source that provides information to the blockchain smart contract, such as stock prices from the New York Stock Exchange. In our hypothetical smart contract between Company A and Company B, the oracles would be Company A's computerized delivery database and the two companies' bank accounts. Once Company B's delivery of 500 widgets is confirmed in Company A's system, the blockchain will automatically trigger Company A's bank account to transfer $10,000 to Company B's bank account without any required action by the parties or any verification by a third-party clearinghouse. This clearly lowers transactional costs, but legal issues will inevitably arise, as will be discussed later.

The Benefits of Smart Contracts

As discussed above, smart contracts lower transactional uncertainty and costs across a number of industries. Walmart was the first company truly to embrace blockchain technology as part of its business structure, which was prompted by a serious supply-chain issue regarding a Salmonella outbreak in papaya shipments. Robert Hackett, *Walmart and 9 Food Giants Team Up on IBM Blockchain Plans*, Fortune (Aug. 22, 2017), http://fortune.com. Walmart subsequently cooperated with IBM to begin recording all of its food purchases in blockchain contracts.

Now every stage of Walmart's food supply chain is coded into Walmart's private blockchain. If a food-quality issue arises, Walmart can cheaply and efficiently search the permanently stored code in the blockchain ledger to determine the food's source and the cause of the quality issues. Frank Yiannas, Walmart's vice president of food safety, stated that "blockchain technology enables a new era of end-to-end transparency in the global food system." Becky Peterson, *IBM Wants to Use the Technology that Underlies Bitcoin to Help Prevent Major Foodborne Outbreaks Like Salmonella*, Business Insider (Aug. 22, 2017), http://www.businessinsider.com. Walmart is anticipating that entering its food purchases into smart contracts will save it billions of dollars in supply-chain management and audit costs, as well as contract-enforcement costs, within the next few years.

Blockchain's benefits are not limited to the manufacturing sector, however. Insurers and reinsurers have recently recognized the economic benefits that blockchain smart contracts offer to their businesses. In 2016, a group of reinsurance companies launched the Blockchain Insurance Industry Initiative (B3i), with the purpose of determining how blockchain technology could increase transparency and lower costs in the reinsurance industry. The blockchain ledger can be viewed as "a shared" bordereau, where the entries are made, saved, and verified by the blockchain's users (the parties to the reinsurance agreement). Larry Schiffer, *Blockchain Technology and Reinsurance*, IRMI (Mar. 2017), https://www.irmi.com. Each individual entry is timestamped, permanently stored on the blockchain ledger, and the entry cannot be altered. The ledger is shared by all the parties to

the reinsurance agreement, allowing them to see and verify the complete transaction. This allows the parties to avoid redundancy and inconsistency. It also increases security because of blockchain's built-in cryptographic system of verification.

The insurance industry has also recognized the economic efficiencies and benefits that blockchain offers. Most recently, AIG teamed up with IBM to begin implementing its multinational insurance programs into blockchain smart contracts. Annap Derebail, *Helping AIG Innovate on Its Multinational Insurance Programs with Blockchain*, IBM Insurance Industry Blog (July 13, 2017), https://www.ibm.com. Multinational insurance programs are replete with administrative inefficiencies and costs. The existence of master and country-specific contracts creates a continuous flow of information between customers and the insurers. A blockchain contract allows the parties to store permanently and timestamp each piece of information exchanged, forming a verified and sequential ledger.

The ledger can be viewed and verified by each party to the insurance program, which increases transparency. Issuing and administering multinational policies on a blockchain ledger allows the parties to have consistent views of policy terms and conditions. The single, verified ledger provided by blockchain increases efficiency by removing the high costs associated with filtering through thousands of documents to determine the parties' agreed-upon terms. In addition, regulators receive controlled access to the blockchain and are able to verify compliance efficiently.

The economic benefits that blockchain technology provides are clear. However, disputes will inevitably arise between parties. There are a number of unanswered legal questions regarding blockchain smart contracts that will need to be answered when litigation ultimately results.

Will Courts Hold that "Smart Contracts" Are Legally Binding and Enforceable Contracts?

Contracts are only legally binding if the required legal processes are met. Namely, there must be an offer and acceptance, as well as adequate consideration from both parties. The first issue with smart contracts is that the entire agreement between the parties cannot be embedded into the blockchain coding. Some contractual terms, such as "reasonableness" or the idea of "perfect tender" under the Uniform Commercial Code, simply cannot be translated into a blockchain's coding. Therefore, a portion of the parties' agreement must remain in paper format. Parties will inevitably dispute, and the courts must decide, whether these blockchain smart contracts are legally enforceable parts of the agreed-upon terms in the corresponding paper contracts.

This issue first arose in the realm of online purchases. Web-based purchases exploded in the early 2000s, and a major issue for the courts was whether the terms and conditions of sale listed on companies' websites constituted legally enforceable portions of contracts of sale with consumers. Although this is not necessarily the same situation as with blockchain contracts, it raises a similar issue: can contractual terms stored in an online source be incorporated by reference into the parties' contract? The courts unanimously decided that merely posting terms and conditions on a company's website did not make those terms legally binding and enforceable. *E.J. Rogers, Inc. v. UPS*, 338 F. Supp. 2d 935 (S.D. Ind. 2004). Instead, the courts determined that there must be an explicit reference in the written contracts between a company and its customers evidencing the parties' intention to incorporate the online terms and conditions, as well as the parties' intention to be bound by those terms. *Affinity Internet, Inc. v. Consolidated Credit Counseling Serv., Inc.*, 920 So. 2d 1286 (Fla. Ct. App. 2006). Courts found support for this in §132 of the Restatement (Second) of Contracts, which states that a contract "may consist of several writings if one of the writings is signed and the writings in the circumstances clearly indicate that they relate to the same transaction." Restatement (Second) of Contracts §132 (1981).

The doctrine of incorporation by reference seemingly provides a path to ensure that the courts will hold smart contracts to be legally binding and enforceable. The parties must place clear language in their paper contract that evinces their intent to incorporate the smart contract and to be bound by the terms of the smart contract. However, another issue arises with incorporating smart contracts into the parties' paper contract because the blockchain continuously changes as more transactions are added to the ledger. This inherent characteristic of smart contracts raises contract modification as an issue.

This same issue arose in the context of web-based sales. Companies often change their terms and conditions governing sales, and courts had to determine whether these changes were validly incorporated by reference into sales contracts executed before the changes were made. The general consensus was that the changes were validly incorporated into past contracts as long as the company provided adequate notice to its customers. *Douglas v. United States Dist. Ct. for the Central Dist. of California*, 495 F.3d 1062 (9th Cir. 2007). Notice issues arguably do not apply to smart contracts because each party has full access to the blockchain and can independently view and verify new transactions.

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The statute of frauds also poses potential smart-contract enforcement issues. The Uniform Commercial Code states that contract modifications are enforceable if they are reasonable and comply with the statute of frauds. U.C.C. §2-209. Under the Uniform Commercial Code's statute of frauds, a contract for the sale of goods for $500 or more is not enforceable unless it is memorialized in a writing signed by the party against whom enforcement is sought. U.C.C. §2-201. Additionally, the common law statute of frauds requires a

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signed writing for contracts for the sale of real property and contracts that cannot be completed within a year. This poses a risk that new transactions added to a blockchain ledger may be held unenforceable because they do not comply with the statute of frauds. A potential counterargument is that each transaction is independently verified and accepted by the parties before it is added to the blockchain ledger. This, in effect, acts as acceptance of the new transaction and could function as a de facto electronic signature.

There are a number of uncertainties surrounding the legal status of blockchain smart contracts. Incorporation by reference seems to offer a path to enforceability, but the ever-changing character of blockchain ledgers raises additional issues for the incorporation by reference doctrine. These questions will need to be answered by the courts when litigation inevitably arises from smart contracts.

Will Smart Contracts Be Admitted as Trial Evidence if They Are Not Enforceable Agreements?

The next issue with smart contracts is whether they will constitute admissible evidence in the event that the courts determine that they are not part of parties' enforceable contracts. The likely argument for admitting blockchain smart contracts as trial evidence is that they constitute business records. The state rules of evidence provide an exception to the rule against hearsay for documents constituting business records, as does the Federal Rules of Evidence:

> The following are not excluded by the hearsay rule, even though the declarant is available as a witness: Records of regularly conducted activity. A memorandum, report, record, or data compilation, in any form, of acts, events, conditions, opinions, or diagnoses, made at or near the time by, or from information transmitted by, a person with knowledge, if kept in the course of a regularly conducted business activity, and if it was the regular practice of that business activity to make the memorandum, report, record or data compilation, all as shown by the testimony of the custodian or other qualified witness, or by certification that complies with Rule 902(11), Rule 902(12), or a statute permitting certification, unless the source of information or the method or circumstances of preparation indicate lack of trustworthiness. The term "business" as used in this paragraph includes business, institution, association, profession, occupation, and calling of every kind, whether or not conducted for profit.

Fed. R. Evid. 803(6).

Blockchain smart contracts seem to fit clearly into the federal rule's definition of business records, above. A blockchain is a record of regularly conducted activity between the parties, which is recorded at the time the activity occurs. The timing of the recordation is easy to prove because each block of data is timestamped and permanently stored on the blockchain. It seems likely that courts would admit smart contracts into evidence as business records, but what evidentiary weight will courts give smart contracts?

Arguably, smart contracts are evidence of the contracting parties' course of performance or course of dealing. The Uniform Commercial Code states that course of performance and dealing are relevant for determining "the meaning of the parties' agreement, may give particular meaning to specific terms of the agreement, and may supplement or qualify the terms of the agreement." U.C.C. §1-303(d). However, while the Uniform Commercial Code states that the express terms of a contract must be read consistently with the parties' course of performance or dealing where viable, the express terms of the parties' contract prevail where they conflict with the course of performance or dealing. *Id.* If the courts do not find that smart contracts constitute part of an enforceable contract, they may likely attribute the same evidentiary weight to smart contracts as they do to other evidence of the parties' course of performance or course of dealing. If so, the express terms of the parties' paper contract will prevail over the smart contract.

If Smart Contracts Constitute Legally Enforceable Agreements, They Will Pose Serious Jurisdictional Issues

Proper jurisdiction for a contract dispute generally lies where the contract actually became final and binding. If smart contracts are held to be legally binding agreements, jurisdictional issues will arise because blockchain smart contracts are decentralized. The easiest approach would be that a suit may be brought in any jurisdiction where a party verified and validated the smart contract. Clearly, issues will arise with this approach, however, because many contracts involve multiple parties spread across national and international jurisdictions.

The best approach is for the contracting parties to code forum-selection clauses into their smart contracts. Courts have long held that forum-selection clauses are presumptively enforceable, except in the most egregious of circumstances. *Atlantic Marine Const. Co. v. United States Dist. Ct. for the Western Dist. of Texas*, 134 S. Ct. 568 (2013). Parties can code their dispute-resolution procedures into their blockchain smart contract, thereby avoiding any forum-selection issues. For instance, imagine in our earlier hypothetical that Company B delivered 500 yellow widgets instead of 500 red widgets. Company A then notes in its system that proper delivery was not received, which triggers the dispute-resolution block in the companies' blockchain smart contract. This block of coding returns a result that says, "File suit in the state of Michigan." Forum-selection clauses are an effective tool for avoiding the serious jurisdictional issues smart contracts pose.

Conclusion

Blockchain smart contracts offer a number of economic benefits to businesses. First, they significantly lower transactional uncertainties by providing internal transactional verification processes. Additionally, blockchain's permanent, timestamped ledger significantly lowers the costs associated with audits and transactional validation because it provides a sequential and unchangeable record of transactions. However, with smart contracts, there are a number of unanswered legal issues that must be determined when litigation inevitably arises. It is important for businesses and their legal counsel to anticipate these issues to best prepare themselves for potential future litigation. FD