

Northwestern Journal of International Law & Business

Volume 40
Issue 3 *Spring*

Article 2

Spring 2020

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Kevin J. Fandl

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Recommended Citation

Kevin J. Fandl, *Can Smart Contracts Enhance Firm Efficiency in Emerging Markets?*, 40 NW. J. INT'L L. & Bus. 333 (2020).

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Can Smart Contracts Enhance Firm Efficiency in Emerging Markets?

*Kevin J. Fandl, J.D., Ph.D.**

Abstract:

Blockchain technology has the potential to eliminate one of the most significant barriers to economic growth through private business transactions in developing countries—lack of trust. In a typical developed country, individuals and firms conduct transactions within an institutional environment that offers security through the enforcement of agreements. Transparent and effective courts, while imperfect to be sure, enable parties to feel secure in their transactions even if their level of trust in the other party is low. This security, in turn, facilitates transactions far afield from high-trust relationships (e.g., immediate relatives), generating transactions based upon economic value rather than party trust alone.

Developing countries often lack effective or transparent institutions and are frequently plagued with corruption that weakens substantially their level of security in economic transactions. Accordingly, individuals and firms in developing countries seek contracting parties whom they trust, knowing that it is trust that will ensure enforcement more than courts or law enforcement. Transactions in this type of environment are thus limited to known entities, such as relatives or colleagues who have a trust-relationship with the individual. As a result, potentially valuable transactions are avoided due to lack of trust, which, on a macro-level, limits the economic growth potential of the entire economy.

*Blockchain technology and smart contracts offer a solution to the trust problem prevalent in developing country contractual transactions. First, because blockchain uses an open architecture, all transactions are publicly accessible, immutable, and verifiable by anyone. This helps to eliminate corruption and fraud from the transaction. Second, because all smart contract transactions are recorded along a blockchain and cannot be modified *ex post*, a permanent and publicly accessible ledger is available to shed any doubt about payments or other transactions throughout the process. And third, because blockchain systems are automated, security in the enforcement mechanism is all but guaranteed. For instance, failure to deliver goods by a set time will automatically trigger a default clause that transmits payment of liquidated damages to the injured party without the intervention of a judge or arbitrator.*

* Kevin J. Fandl, Ph.D. (George Mason University), J.D./ M.A. (American University), B.A. (Lock Haven University), is an Associate Professor of Legal Studies and Strategic Global Management at Temple University. He is the former Senior Counsel to the Assistant Director for U.S. Immigration and Customs Enforcement.

Numerous problems with this approach exist. For instance, access to information about technology such as blockchain, especially among firms that would most directly benefit from it (e.g., informal firms), is highly limited for the moment. Second, smart contracts are in their infancy and work primarily with clearly stipulated terms that allow for no interpretation, which are not always common in contracts between firms. In this case, eliminating a neutral arbiter from the transaction also eliminates the possibility of reviewing the circumstances of a breach or other contract mishap. And third, though lack of trust in parties may be reduced through this technology, lack of trust in online financial transactions may be exacerbated. The use of electronic finance options in developing countries is far less common than in developed countries, making implementation of a completely online transmission system particularly challenging.

Despite the evident weaknesses in applying smart contracts and blockchain technology to developing country firm transactions, there is great potential for at least small-scale application in certain markets where party trust levels are particularly low. In this paper, I will review literature on the development of smart contract technology and its application in relevant contexts. I will consider the potential impact that this technology could have if properly implemented in emerging markets. And I will offer a set of suggestions for policymakers to consider in educating firms and incentivizing their use of this technology. What follows is an introduction to the area of smart contracts as a substitute or at least a complement to legal institutions. I fully expect a robust literature to develop around this topic in the near future.

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I. INTRODUCTION

Contracts are one of the key tools in existence to enable the conduct of business.¹ Long before the present-day concept of a legal contract was codified by statute or, in the case of common law, precedent, merchants relied on the premise of offer and acceptance to transact business.² Enforcement of contracts historically rested with merchant communities and, in larger or more serious cases, with the ruling family.³ Today, enforcement power has shifted to courts and similar legal institutions. Without that power of enforcement, a contract was nothing more than a promise.⁴

Just as a contract is at the heart of a business transaction, effective contract enforcement is at the heart of economic growth and development.⁵ Long-distance trade, especially between unfamiliar parties, depends on trust in the institutions in existence to enforce the terms of the contract. This trust replaces what historically only existed between family members and what, therefore, largely limited the scope of trade.⁶

The importance of trust in trade cannot be overstated.⁷ Merchants of the past engaged in transactions with those parties whom they knew or whom their associates vouched for.⁸ Merchant guilds, tribes, and families built reputations that enabled them to transact business on the basis of those

¹ See generally Larry DiMatteo, *Law as a Source of Strategic Advantage: Strategic Contracting: Contract Law as a Source of Competitive Advantage*, 47 AM. BUS. L.J. 727, 732 (2010) (discussing the importance of the contract as a mechanism for conducting business).

² Leon E. Trakman, *The Twenty-First-Century Law Merchant*, 48 AM. BUS. L.J. 775, 784-785 (2011) (explaining the similarities between historical merchant transactions and modern-day institutions).

³ See WILLIAM BLACKSTONE, COMMENTARIES ON THE LAWS OF ENGLAND, 273 (1778) (discussing the jurisdictional limitations in the application of the *lex mercatoria*).

⁴ See, e.g., Philip M. Nichols, *Legal Theory of Emerging Economies*, 39 VA. J. INT'L L. 229, 275-277 (1999) (discussing the distinctions between relational and formal contract settings, in which institutions play a leading role).

⁵ See generally Michael Trebilcock & Jing Leng, *Contemporary Political Theory and Private Law: The Role of Formal Contract Law and Enforcement in Economic Development*, 92 VA. L. REV. 1517 (2006) (providing a comprehensive examination of formal and informal contract law enforcement and proposing that both could serve as effective substitutes for formal legal institutions).

⁶ For an overview of “relational contracts,” see Ian Macneil, *Relational Contract Theory: Challenges and Queries*, 94 NW. U. L. REV. 877, 892-895 (2000).

⁷ For a comprehensive overview of the importance of trust in business transactions, see FRANCIS FUKUYAMA, TRUST: THE SOCIAL VIRTUES AND THE CREATION OF PROSPERITY (1996).

⁸ Paul R. Milgrom, Douglass C. North & Barry R. Weingast, *The Role of Institutions in the Revival of Trade: The Law Merchant, Private Judges, and the Champagne Fairs*, 2 ECON. & POL. 1, 2 (1990) (assessing the importance of trust and reputation in conducting business transactions in the absence of legal institutions); see also Anjanette H. Raymond, *Confidentiality in a Forum of Last Resort: Is the Use of Confidential Arbitration a Good Idea for Business and Society?*, 16 AM. REV. INT'L ARB. 479, 506 (2005) (“Lex mercatoria utilizes reputation as a vital indicator of an individual’s standing within the commercial community. The impact on the reputation of a party is sometimes considered a more effective deterrent than the judicial process.”).

reputations. However, outsiders were rarely given the opportunity to engage in anything more than petty trade with these communities since they had no reputation to which the communities could look to for security.⁹

Merchant laws and enforcement techniques evolved into modern-day business laws, courts and arbitral bodies.¹⁰ In developed countries today, courts serve the role of guarantor to enable transactions to occur between parties when the level of trust is insufficient alone. Failure by one party to abide by the promises made to another leads to court intervention rather than physical violence or excommunication from a given community as may have happened in the past.

The trust that results from institutions operates on the premise that the institutions are themselves effective. A corrupt system of courts in which bribery more than justice drives decisions renders institutions ineffective and eliminates the guarantor of trust.¹¹ A court system that has no enforcement mechanism due to under-resourced law enforcement authorities makes legal decisions paper tigers.¹² And slow, bureaucratic and complex legal systems limit access to justice to those few able to navigate and expedite its resolutions.

Many emerging markets today suffer from one or more of these dilemmas. Corruption, ineffective enforcement, and bureaucracy can deprive parties of the institutional guarantees that underlie transactions in developed countries. Without effective institutions, parties are left to rely upon the traditional notion of trust in the other party. Since there is no guarantee of enforcement or the means to protect the nature of the transaction, lack of trust will serve as a deterrent to entry into certain types of contracts.

Contracts are built on trust. Institutions provide that trust in the absence of party familiarity and reputation. The strength of the institutions may indeed drive economic development through the creation of a trust environment that enables parties to take more risks in their business deals.¹³

⁹ See, e.g., Roberta Dessi & Salvatore Piccolo, *Merchant Guilds, Taxation and Social Capital* 11 (Toulouse Sch. of Econ., Working Paper No. TSE-581, 2015) (describing the limited access for outsiders to local merchant communities and highlighting the evolution of foreign merchant guilds).

¹⁰ See, e.g., Leon E. Trakman, *The Twenty-First-Century Law Merchant*, 48 AM. BUS. L.J. 775, 792-93 (2011) (describing the evolution of merchant law into modern law).

¹¹ See, e.g., Bernard S. Black & Anna S. Tarassova, *Institutional Reform in Transition: A Case Study of Russia*, 10 S. CT. ECON. REV. 211, 232-33 (2002) (showing a bi-directional relationship between corruption and weak institutions); Toke S. Aidt, *Corruption, Institutions, and Economic Development*, 25 OXFORD REV. ECON. POL'Y 271, 271-72 (2009) (discussing the negative perception of business managers about corrupt institutional environments).

¹² Joel P. Trachtman, *The Theory of the Firm and the Theory of the International Economic Organization: Toward Comparative Institutional Analysis*, 17 NW J. INT'L L. & BUS. 470, 526 (1996) (explaining that "no institution is an island" and that institutions exist within a broader context, affected by governance and public policy).

¹³ Daniel Berkowitz, Johannes Moenius & Katharina Pistor, *Legal Institutions and International Trade Flows*, 26 MICH. J. INT'L L. 163, 172 (2004) (finding that the strength of

But when there is neither trust nor adequate institutions, the ability to enter those deals, and thus the ability to contribute to economic development in a trust-environment is substantially weakened.

In this short paper, I will take a first step in trying to understand how low-trust environments limit opportunities for economic growth and development in emerging markets, and I will examine how the advent of blockchain technology—specifically smart contracts—might strengthen that trust environment in the absence of effective institutions. The paper is broken down into three sections. First, I will describe the problem of doing business in low-trust environments and the role that institutions play in circumventing the trust problem. Second, I will provide a foundational overview of blockchain technology and smart contracts in the context of generating trust. And finally, I will apply these ideas to the economic development context to generate discussion and further research about useful applications in the future.

II. TRUST: THE FOUNDATION FOR DOING BUSINESS

A. The Basis for Contracts

To address the issue of how contracts underlie business, and how trust necessarily informs the effectiveness of those contracts, we must begin at the beginning with an examination of the contract itself. It is important at the outset to bear in mind that different jurisdictions across the world view contracts distinctly, yet all spring from a similar origin.¹⁴ In the majority of the world, which follow civil law precepts, contracts are identified by compliance with certain statutory requirements known to the parties. In the common law world, though statutes such as the Uniform Commercial Code provide some guidance to parties, most contractual arrangements arise based upon party interactions and intent. Given these different interpretations of contracts, our first question must necessarily be, *what is a contract?*

A simple definition for a contract might be *a legally enforceable promise*. But that is a far cry from the intricacies of contracts in both civil and common law systems. The common law's Restatement of Contracts defines a contract as, "A contract is a promise or a set of promises for the breach of which the law gives a remedy, or the performance of which the law in some way recognizes as a duty."¹⁵ Civil law differs in that it lays out certain elements of proper contract formation, including free and informed consent, capacity to contract, and lawful object and purpose.¹⁶

legal institutions determine key economic indicators, such as levels of international trade).

¹⁴ See Kevin J. Fandl, *Cross-Border Commercial Contracts and Consideration*, 34 BERKELEY J. INT'L L. 1 (2016).

¹⁵ RESTATEMENT (SECOND) OF CONTRACTS § 1 (Am. Law Inst. 1981).

¹⁶ CODE CIVIL [C. CIV.] [[CIVIL CODE] art. 1108 (Fr.); *but see id.* at art. 1128 (revising the French civil code to eliminate the requirement for lawful cause); Solene Rowan, *The New*

In both instances, the goal is to distinguish mere promises from those promises for which parties can look to the law to provide remedies in the event of breach. The Latin term *nudum pactum* refers to a set of promises that are not enforceable by law. An unenforceable promise, for instance, might include the promise to gift an object to another party.¹⁷ Lack of consideration would make such a promise unenforceable in common law jurisdictions, though civil law jurisdictions would permit it if it was accompanied by a notarial document.¹⁸ Similarly, a set of promises for which no evidence can be provided to prove their existence would be considered by both jurisdictions as unenforceable.¹⁹

While the civil law adhered to the concept of *pacta sunt servanda*, meaning that a person must perform their legal obligations, the common law maintained a more formless system for creating contracts, leaving much in the hands of the judges to interpret party interactions.²⁰ This has led to some differing determinations about which promises to enforce and which to leave in the hands of the parties making the promises.²¹ Yet the foundation in both systems of contract law is the making of the promise and the intent to be bound by that promise.

Making a promise to perform some obligation necessarily involves risk.²² Whether the promise is to deliver a container of luxury goods to a given destination by a set date or to pay for your meal at a fast food restaurant, the obligation being made by both parties involves an element of risk—namely, risk that the counterparty will fail to fully or properly perform their obligation under the agreement. This risk is mitigated principally by one concept—trust.²³

“By making a promise, a person invites another to trust, and to break a promise is to abuse that trust.”²⁴

The need for certain promises to be trustworthy is a reason why the law should enforce them. Contract law fortifies trust insofar as it provides grounds for confidence that another will perform a promise.

French Law of Contract, 66 INT’L & COMP. L.Q. 805, 814 (2017).

¹⁷ See generally Melvin Aron Eisenberg, *The World of Contract and the World of Gift*, 85 CALIF. L. REV. 821 (1997).

¹⁸ CODE CIVIL [C. CIV.] [CIVIL CODE] arts. 931-32 (Fr.).

¹⁹ See, e.g., Statute of Frauds 1677, 29 Car. 2 (Eng.).

²⁰ See, e.g., Arthur von Mehren, *The French Civil Code and Contract: A Comparative Analysis of Formation and Form*, 15 LA. L. REV. 687, 698-710 (1955) (providing a historical analysis of the development of common and civil law contract systems).

²¹ See, e.g., Fandl, *supra* note 14 at 111-12 (discussing the distinctions between common and civil law contracts during the early formation of contract law).

²² Alex Y. Seita, *Uncertainty and Contract Law*, 46 U. PITT. L. REV. 75, 120-21 (1984) (describing the transaction costs associated with contract formation).

²³ Ethan J. Leib, *Contracts and Friendships*, 59 EMORY L.J. 649, 656-57 (2010) (describing the relational trust aspects of effective contract formation).

²⁴ Anthony J. Bellia, *Promises, Trust, and Contract Law*, 47 AM. J. JURIS. 25, 25 (2002).

If the law renders a certain promise enforceable, a person may trust (have good grounds for confidence) that it will be performed. A degree of trust in certain promises is necessary, contract theorists say, for the realization of the goods that each asserts justifies a law of contract.²⁵

Certain types of promises undoubtedly require more trust.²⁶ For instance, a promise to provide a cup of coffee in exchange for five dollars would require minimal trust between the consumer and the coffee vendor; however, a promise to ship a container of luxury goods from Los Angeles to Shanghai between two unrelated first-time business partners would require substantial trust. The risk in the latter transaction is exceedingly high due to the variety of unknowns, including the reputation of the party, the financial position of the party, and the financial commitment.

Many of the risks that we face in contracting appear to be mitigated by the creation of binding documents, such as letters of credit, commitment letters, and the contract itself. However, without an effective and reliable institution to enforce those documents, they are nothing more than paper. For this reason, it is essential to examine the institutional environment and its own inherent risks in generating a sense of trust.

B. Institutions and Trust

Nobel Laureate Douglass North told us in 1991 that “[i]nstitutions are the humanly devised constraints that structure political, economic and social interaction. They consist of both informal constraints (sanctions, taboos, customs, traditions, and codes of conduct), and formal rules (constitutions, laws, property rights).”²⁷ According to North, institutions serve to reduce the transaction costs associated with human interactions. In particular, he explains that the importance of institutions arose along with the expansion of trade. As early traders began to engage in more long-distance ventures, reliable institutions (both informal and formal) were necessary to provide security in the transaction.²⁸

The institutions that North spoke about track the historical nature of societal structure—commonly agreed upon rules are established; a body is organized to interpret and apply those rules; another body is created to enforce punishments for violating those rules. In a modern society, we might see these as laws, courts and arbitrators, and law enforcement. But, at least according to North, these institutions are essential to economic development: “the inability of societies to develop effective, low-cost enforcement of contracts is the most important source of both historical stagnation and

²⁵ *Id.* at 27.

²⁶ *See generally* Frank B. Cross, *Law and Trust*, 93 GEO. L. J. 1457 (2005) (providing a comprehensive overview of the legal concept of trust and its impact on institutions).

²⁷ Douglass C. North, *Institutions*, 6 J. ECON. PERSP. 97, 97 (1991).

²⁸ *Id.* at 99-100.

contemporary underdevelopment in the Third World.”²⁹

The definition of an “institution” for purposes of this discussion includes both informal and formal legal constraints meant to restrict an individual’s actions and protect their interests.³⁰ Laws are a prime example of institutions as they delineate the actions that a party can or cannot take and prescribe punishments for actions taken outside those constraints. The equivalent informal constraint would be best practices, morals, and community value systems that serve the same purpose as laws.³¹

There are a host of problems with this approach. First, jurisdiction poses a substantial problem as laws generally have only domestic application and law enforcement lacks extraterritorial power.³² Thus, while parties to a contractual transaction in Philadelphia and New York may find comfort in the legal institutions that govern their engagement, a transaction between parties in Philadelphia and Bogotá³³ will be far less assuring. A number of mechanisms have arisen to try to build the necessary institutional environment around cross-jurisdictional transactions, including arbitration, international treaties, and diplomacy.³⁴ However, for a party operating in an efficient institutional environment, none of these mechanisms effectively substitutes the comfort that a party has in their domestic legal system.

Second, in order for institutions to be effective, they must be transparent, just, and accessible.³⁵ In much of the world, institutions lack

²⁹ DOUGLASS C. NORTH, INSTITUTIONS, INSTITUTIONAL CHANGE, AND ECONOMIC PERFORMANCE 54 (1990).

³⁰ Julio Faundez, *Douglass North’s Theory of Institutions: Lessons for Law and Development*, 8 HAGUE J. RULE L. 373, 385 (2016).

³¹ See Kevin J. Fandl, *The Role of Informal Legal Institutions in Economic Development*, 32 FORDHAM INT’L L.J. 1, 10-12 (2008) (describing the nature of informal legal systems and constraints); Francis Fukuyama, Address at the IMF Conference on Second Generation Reforms: Social Capital and Civil Society (Oct. 1, 1999), <https://www.imf.org/external/pubs/ft/seminar/1999/reforms/fukuyama.htm> (highlighting the importance of informal legal norms in modern economies).

³² See generally Phillip Wm. Lear & Blake D. Miller, *Exhaustion of Tribal Court Remedies: Rejecting Bright-Line Rules and Affirmative Action*, 71 N.D. L. REV. 277, 308-309 (1995) (stipulating that extraterritorial enforcement of contract law is a matter generally left to treaty law).

³³ Legal institutions in Colombia and much of Latin America are generally considered untrustworthy by business professionals. See, e.g., INTER-AMERICAN DEVELOPMENT BANK, BETTER SPENDING FOR BETTER LIVES: HOW LATIN AMERICA AND THE CARIBBEAN CAN DO MORE WITH LESS, (Alejandro Izquierdo, et al. eds, 2018) (discussing the effects of declining trust in communities and institutions in Latin America), <https://flagships.iadb.org/en/DIA2018/Better-Spending-for-Better-Lives>.

³⁴ See generally Larry A. DiMatteo, Lucien Dhooge, Stephanie Greene, Virginia Maurer, & Marisa Pagnattaro, *The Interpretive Turn in International Sales Law: An Analysis of Fifteen Years of CISG Jurisprudence*, 24 NW. J. INT’L L. & BUS. 299 (2004) (examining a number of remedies utilized in international sales contracts).

³⁵ See Clifton Johnson, General Counsel of Int’l Develop. L. Org., Address at International Scientific Conference: “The development of the Court Administration: directions and model”: Enhancing Judicial Transparency and Promoting Public Trust (June

these qualities, either due to corruption or bureaucratic inefficiency. Arbitration functions as a suitable substitute for effective courts; however, enforcement mechanisms continue to fall within the sphere of the state, meaning that even if an effective judgment can be attained, enforcing that judgment often poses the same problems inherent in the court system itself. In these jurisdictions, informal mechanisms such as reputational trust, often combined with the threat of violence, can serve as a more effective avenue to create constraints on the parties.³⁶

Third, access to institutions—even the most effective ones—comes at a financial cost. Though court access is usually a minimal financial burden, effective legal counsel can add significant expense to a transaction. Similarly, the use of arbitral mechanisms, which are often private, can generate substantial costs. These costs may limit the options of parties to lower-value transactions that could potentially lose more by seeking resolution than they lost as a result of the bad behavior of their counterparty.

Though many other limitations exist, we can take these three as indicative of the larger problem of institutions, whether formal or informal. Reliance on institutions as a source of trust in a transaction adds risk, cost, and unpredictability. In effect, though institutions offer security to many transactions and generate a sense of trust amongst parties that may in itself promote good behavior, an institution is a third-party that is joining the transaction, and that third-party can weaken, just as easily as it can strengthen, the trust between parties.

III. BLOCKCHAIN AND THE MANUFACTURING OF TRUST

A. Trust Environments

In a low-trust environment, reputation is everything. Without a positive reputation, and the necessary contacts to go along with that reputation, there is little chance of broad economic growth through expansive business transactions. Commercial activity will be limited to small circles of trust that largely exclude outside, unknown relationships that may be beneficial to both parties.³⁷ These low-trust environments create a clan-based mentality that restricts opportunity.

If a covenant be made, wherein neither of the parties perform presently, but trust one another; in the condition of mere nature (which

28, 2018), <https://www.idlo.int/news/speeches-and-advocacy/enhancing-judicial-transparency-and-promoting-public-trust>.

³⁶ Douglass C. North, *Economic Performance Through Time*, 84 AM. ECON. REV. 359, 360 (1994) (“Institutions are the humanly devised constraints that structure human interaction.”).

³⁷ John Helliwell, *Economic Growth and Social Capital in Asia* 15-16 (Nat’l Bureau of Econ. Research, Working Paper No. 5470, 1996) (finding that higher levels of societal trust yield stronger economic performance).

is a condition of war of every man against every man,) upon any reasonable suspicion, it is void: but if there be a common power set over them both, with right and force sufficient to compel performance, it is not void. For he that performeth first, has no assurance the other will perform after, because the bonds of words are too weak to bridle men's ambition, avarice, anger, and other passions, without the fear of some coercive power

But in a civil estate, where there a power set up to constrain those that would otherwise violate their faith . . . he which by the covenant is to perform first, is obliged so to do.³⁸

As discussed above, the advent of institutions has helped tremendously to overcome the limitations of this clan-based mentality. Institutions provide the foundation for providing security in low-trust environments, promising the same type of protections that would be afforded in a high-trust environment. They substitute rules and consequences for reputation, leveraging the resources of a government or similar body to provide the parties with confidence that their relationship can proceed even in the absence of trust.

[T]rust represents the “key building block of society” and thus also plays an essential role for the formation of interactions and relationships in the context of peer-to-peer marketplaces and services. For example, renting out an apartment on Airbnb does not only require hosts to trust potential guests to behave in a considerate and respectful manner (toward both the host and the apartment) but also to trust in Airbnb's ability, integrity, and benevolence with regard to booking and payment processes. Also guests heavily rely on their (prospective) host and the offered apartment to be adequate and fulfill their needs. In all this, the platform provides not only the technical infrastructure, user interfaces, and process guidance but also services such as insurance and reputation systems, thus taking a pivotal role in establishing and maintaining trust among users.³⁹

Nobel Laureate Douglass North has argued in the past that institutions help to reduce the transaction costs associated with entering into business relationships.⁴⁰ The more efficient an institutional environment, including the courts, legal system and law enforcement, the less burden on the parties to see their transaction through to its intended conclusion. However, even the

³⁸ THOMAS HOBBS, *LEVIATHAN* 91 (Oxford Univ. Press 1996) (1651).

³⁹ See Florian Hawlitschek, Benedikt Notheisen, & Timm Teubner, *The limits of trust-free systems: A literature review on blockchain technology and trust in the sharing economy*, 29 *ELECTRONIC COM. RES. & APPLICATIONS* 50, 50-51 (2018) (quoting Sundararajan Mazzella, A., D'Espous, V. & Möhlmann, M., *How digital trust powers the sharing economy*, IESE INSIGHT 24, 27 (2016)); see also Florian Hawlitschek, et al., *Trust in the Sharing Economy: An Experimental Framework*, 70 *SWISS J. BUS. RES. & PRAC.* 26 (2016).

⁴⁰ Douglass C. North, *Institutions*, 5 *J. OF ECON. PERSP.* 97 (1991).

most efficient institutions do not eliminate transaction costs. Moreover, not all institutional environments are created the same. Many developing countries (and some developed countries) are bound to weak institutional environments that provide little or no reasonable protection for parties to a business transaction, leaving the parties to rely upon relational trust, reputation, and informal means of protection for their transaction. Informal contract enforcement and dispute resolution can be very effective; however, informal mechanisms impose significant limitations on the environment within which transactions occur.⁴¹

Parties enter into contracts when they can be ensured that their commitments will be legally enforced. This enforcement historically occurred through informal mechanisms, such as guilds and similar merchant organizations. The rise of institutions, such as courts and law enforcement, enabled trust-based transactions to take place beyond small communities.⁴² And today, powerful domestic institutions in many parts of the world, along with international institutions such as the World Trade Organization, enable global transactions between unrelated parties to occur in an environment of trust.⁴³ However, in an institutional environment in which trust in those institutions is low, parties may be significantly less likely to engage in transactions with unrelated parties due to the increased risk of non-enforcement. “An inherent constraint on traditional contracting is that the parties must trust the state, and a variety of private intermediaries that facilitate efficient operation of the system.”⁴⁴ In those environments in which the level of trust in the state is low, parties often resort to informal mechanisms, which, as noted above, constrain their opportunities to operate outside of their relational trust environment.

The constraints imposed by an informal institutional environment have been linked to slower overall economic growth.⁴⁵ Parties that cannot easily operate outside of their relational trust circle, due to concerns over the risk associated with doing so, may pass up otherwise lucrative growth opportunities. The risk mitigation provided by effective, formal institutions

⁴¹ See Michael Trebilcock & Jing Leng, *The Role of Formal Contract Law and Enforcement in Economic Development*, 92 VA. L. REV. 1517, 1519, 1522 (2006) (discussing the challenges in enforcing contracts outside the traditional legal system).

⁴² See generally Leon Trakman, *From the Medieval Law Merchant to E-Merchant Law*, 53 U. TORONTO L. J. 265 (2003).

⁴³ See, e.g., World Trade Organization, *ICC-WTO Small Business Champions*, https://www.wto.org/english/forums_e/business_e/sbc_e.htm (last visited Feb. 22, 2020) (highlighting one of the WTO initiatives targeting increasing participation by small businesses in international trade).

⁴⁴ Kevin Werbach & Nicholas Cornell, *Contracts Ex Machina*, 67 DUKE L.J. 313, 330 (Nov. 2017).

⁴⁵ Douglass C. North, *Institutions and Growth*, in JEFFRY A. FRIEDEN & DAVID A. LAKE, *INTERNATIONAL POLITICAL ECONOMY: PERSPECTIVES ON GLOBAL POWER AND WEALTH* 47-59 (2000) (describing from a historical perspective the central role played by institutions in fostering economic growth).

opens the door to non-relational business transactions, essentially inserting a trust element into a transaction with significant trust-related risks.

Until now, parties in low-trust environments caused by ineffective institutions have had little choice but to depend on informal institutions as a means to facilitate their business transactions. Reform of those institutions has been an intense effort by a number of multilateral and nonprofit organizations for the past few decades.⁴⁶ Yet, little progress has been made in this effort. Technology may offer a solution in the form of blockchain. Rather than replicating the traditional structure of institutions in a more advanced manner, blockchain appears to be modernizing the historical trust environment in which a community of disinterested yet trusted parties could be counted upon to provide the foundations of trust for a given transaction. The next section will explain the fundamentals of blockchain and how it may fit into the broader trust environment of business transactions.

B. Blockchain

A blockchain is an electronic distributed ledger that utilizes multiple computers to verify and record transactions without the possibility for modification. Or, in a simpler sense, it is a means to permanently and unalterably record a transaction. These transactions might be purchases of goods using Bitcoin, whereby the use of the Bitcoin is permanently and unalterably recorded so that the spent Bitcoin cannot be reused; or they may be completion of a performance element of a contract, whereby the beneficiary of that performance cannot withhold their resulting obligations as the record of performance has been made.

The concept of blockchain originated with a white paper written by Satoshi Nakamoto in 2008, which largely focused on Bitcoin.⁴⁷ Mr. Nakamoto's paper suggested that technology had the ability to substitute for institutions the trust elements of certain types of transactions.⁴⁸ This new technology was first debuted in 2009 with the advent of Bitcoin, the first electronic currency not tied to any institution but linked only to blockchain technology.

Bitcoin (and blockchain generally) operates with a number of nodes, which are computers connected to a network.⁴⁹ These nodes operate together to verify the users on the network and the validity of the transactions. This is accomplished by first verifying the users attempting to engage in a

⁴⁶ See, e.g., *Justice and Development*, WORLD BANK, <https://www.worldbank.org/en/topic/governance/brief/justice-rights-and-public-safety> (highlighting several law and justice initiatives of the World Bank).

⁴⁷ Satoshi Nakamoto, *Bitcoin: A Peer-to-Peer Electronic Cash System* (2008), <https://bitcoin.org/bitcoin.pdf>.

⁴⁸ *Id.*

⁴⁹ Tara Mandjee, *Bitcoin, its Legal Classification and its Regulatory Framework*, 15 J. BUS. & SEC. L. 157, 161–62 (2015) (defining Bitcoin and its role as a new currency).

transaction, for instance, buying and selling Bitcoins. A public and private user key is utilized to create a digital signature certifying that the users are who they say they are.⁵⁰ Then, the nodes review the ledger associated with the users and the Bitcoins in their transaction to confirm that they are legitimate and available for transactions. Assuming the users and the transaction are properly verified, the transaction proceeds and the changes are immediately recorded in the ledger—the blockchain—to ensure that further transactions occur on the basis of what has been recorded in that ledger.

The opportunity for fraud and cheating in a system like this seems rampant. However, the system was cleverly designed to integrate protections that largely eliminate the risk of fraud. In order for a node to validate (or invalidate) a transaction within the network, that computer must solve a complex mathematical problem that requires immense guessing; however, the mathematical problem is so complex that it would take a single computer years to solve.⁵¹ Thus, to change or validate the transaction, each node must work with other nodes in the network to answer the problem collectively.⁵² Once the problem is solved by one of the nodes, that computer must share its “proof of work” with other computers on the network to verify its problem-solving. This means that a potential hacker or fraudster would have to compromise seemingly innumerable computers in order to potentially pass off fraudulent data.⁵³

Blockchain is seen to possess five key elements that make it a good substitute for institutions in business transactions: 1) consensus, 2) validity, 3) uniqueness, 4) immutability, and 5) authenticity.⁵⁴ Note that these key elements are labeled differently, but function the same way, throughout the blockchain literature.⁵⁵

Consensus refers to the community of users in the blockchain network that verify the validity of transactions. *Miners* are users that actively attempt to solve the complex mathematical problems described above in order to earn

⁵⁰ *Id.* at 162.

⁵¹ Jesse Marks, *Distributed Ledger Technologies and Corruption the Killer App?*, 20 COLUM. SCI. & TECH. L. REV. 48–49 (2018).

⁵² Note that the incentive for a particular node to engage in the mathematical problem-solving is to earn Bitcoins as a reward. This is a practice known as mining Bitcoins. *See, e.g.*, Mike Orcutt, *How Secure is Blockchain Really?*, MIT TECHNOLOGY REVIEW (Apr. 25, 2018), <https://www.technologyreview.com/s/610836/how-secure-is-blockchain-really/>.

⁵³ Marks *supra* note 51, at 47–48.

⁵⁴ Richard Gendal Brown, *Introducing R3 Corda™: A Distributed Ledger Designed for Financial Services* (Apr. 5, 2016), <https://gendal.me/2016/04/05/introducing-r3-corda-a-distributed-ledger-designed-for-financial-services/>.

⁵⁵ *See, e.g.*, Scott A. McKinney, Rachel Landy & Rachel Wilka, *Smart Contracts, Blockchain, and the Next Frontier of Transactional Law*, 13 WASH. J.L. TECH. & ARTS 313, 319 (2018) (describing these elements as consensus, provenance, immutability, finality, and decentralization).

Bitcoins as a reward for their efforts.⁵⁶ Once they solve a problem, they must share their proof of work with the other users on the network, who in turn validate their entries. If validated, a new block is created within the ledger for the validated transaction and that block is copied to every other computer on the network, giving all users copies of the updated ledger.⁵⁷

Validity is one of the key elements that I will discuss in the context of smart contracts. In essence, validity refers to the immediate clearance of a transaction due to the presumed immutability of the blockchain along which it occurred and the validation of the users and their accounts.⁵⁸ Validity occurs through the automation of certain transactional elements, such as the automatic distribution of funds once a certain performance is completed, or the release of goods once payment has been verified.

Uniqueness refers to the built-in protocol that prevents someone from making the same transaction using the same funds or data element twice. In other words, the system design prevents a user from repeating the same transaction, such as by spending the same Bitcoin twice. In order to clear a transaction, at least half of the nodes in the network must validate the transaction. An attempt by a user to re-spend a Bitcoin would be rejected by those nodes because those nodes would see that the previously completed transaction in the blockchain has already been copied to their ledgers.⁵⁹

Immutability refers to the inability of a user to change a past transaction without substantial effort and verification. This feature is achieved through a combination of two parts of the blockchain process: hashes and the consensus protocol.⁶⁰ The hash is a unique fingerprint assigned to the miner that successfully solves the mathematical problem required to create a block for the verified transaction. That hash is unique to the user and transaction. Altering the block would require the generation of a new hash that requires completion, once again, of a new mathematical challenge. If that were achieved, the user would then have to create a new hash for all subsequent transactions (blocks) along the same ledger (chain). Any conflicting information would lead to immediate rejection of the change by the computers along the node, each of which maintains a copy of the previously verified blocks and their unique hashes.

The final element in blockchain technology is authenticity. Every user in a blockchain transaction possesses both a public key and a private key—codes that only the user has access to and that are linked together. The private key is used to create the encryption sequence embedded in the public key, and thus only the holder of the private key can decrypt a transaction

⁵⁶ See Orcutt, *supra* note 52.

⁵⁷ See Marks, *supra* note 51, at 50–51.

⁵⁸ *Id.* at 51–52.

⁵⁹ *Id.* at 52.

⁶⁰ See Orcutt, *supra* note 52.

containing that particular public key.⁶¹ This is accomplished through the creation of a digital signature, which every user must use to conduct transactions in the network. Of course, this is potentially problematic as users that lose their private key would no longer have access to the transactions along the blockchain and may lose ownership of the Bitcoins associated with the transaction.⁶²

These elements offer the promise of trust in the absence of institutions. The minimal risk of corruption or fraud, the substantial level of transparency, and the certainty of recordation make blockchain a viable alternative to a weak institutional environment for business transactions. Blockchain has the potential to remove the institutional element from the business environment without removing the efficiency and confidence those institutions are meant to provide. By doing so, transaction costs are largely reduced to zero since, in a smart contract transaction for instance, there are few, if any, costs associated with enforcement of the promises—all of which would be automated.

With respect to business transactions, “[t]he law provides a source of confidence, not a guarantee, that a promise will be performed. If a promisor breaches a contract, the promisee does not magically receive the promised performance or even its monetary equivalent.”⁶³ Blockchain appears to be a potential substitute for those institutions that might be used when the institutions fail.

C. Smart Contracts

Smart contracts are one of the technological possibilities that came into existence because of blockchain technology. The cryptographer Nick Szabo coined the term *smart contract* in 1996, which he defined as “a set of promises, specified in digital form, including protocols within which the parties perform on these promises.”⁶⁴ For Szabo, the smart contract was made possible due to the Internet and increasing sophistication of computer processing abilities, which he believed, in time, would lead to a transition of contracts to a purely digitized environment.

At the time of Szabo’s prediction, some elements of contracts had already been moving into the digital environment. Certain financial transactions, such as the auto-execution of securities purchases, were becoming more common, adding both efficiency and security to what had

⁶¹ Jean Bacon et al., *Blockchain Demystified: A Technical and Legal Introduction to Distributed and Centralised Ledgers*, 25 RICH. J.L. & TECH. 1, 14 (2018).

⁶² See, e.g., Gregory Barber, *A Crypto Exchange CEO Dies – With the Only Key to \$137 Million*, WIRED (Feb. 5, 2019, 4:57 PM), <https://www.wired.com/story/crypto-exchange-ceo-dies-holding-only-key> (describing the death of Canadian Gerry Cotton, who died without leaving behind his key to access the millions of dollars in Bitcoins that are now, presumably, lost in the ether).

⁶³ Bellia, *supra* note 24, at 34.

⁶⁴ Nick Szabo, *Smart Contracts: Building Blocks for Digital Markets*, EXTROPY, 1996.

been human-controlled (and thus subject to error) actions.⁶⁵ Yet these pre-blockchain smart contracts still relied substantially on human input and review to ensure that the technology was functioning as intended.

When blockchain appeared on the scene, smart contracts were given a new persona as potentially independent transactions without the need for human input beyond the initiation of the transaction.⁶⁶ A smart contract is “a set of promises, specified in digital form, including protocols within which the parties perform on those promises.”⁶⁷ It is a contract that relies upon automation and code to make a traditional contractual transaction more efficient and secure.

At its core, a smart contract is still a contract. In order for it to have legal effect and be enforceable in court, if necessary, the contract still requires all of the basic elements of offer, acceptance, intent, and, in common law jurisdictions, consideration.⁶⁸ Yet the verification that the contract was properly formed and that performance was properly executed would not take place through negotiation, arbitration or judicial intervention; rather, it would take place automatically within the blockchain network.

What turns a traditional contract into a smart contract is automation, or in programmatic language, “if/then” conditions built into computer code. A simple smart contract might include a term that will release the lien on a piece of property automatically once payment has been processed. It might release funds held in escrow once goods have been received by a shipper. It may facilitate a judge-less execution of a will.⁶⁹ It may allow for two parties to negotiate the lease of a car using automated interactions based upon predefined conditions set by the parties, giving a whole new meaning to haggling.⁷⁰ Or it might terminate a contract once a key deadline has passed without expected performance logged. In each of these scenarios, computers are used to execute conditional clauses in a contract once the conditions have been satisfied (or once a performance deadline has passed)—a rather simplistic function given the complexity of computers today.⁷¹

Practically speaking, while traditional contracts are created on paper or something similar, smart contracts must be created via computer code. The

⁶⁵ See Werbach & Cornell, *supra* note 44, at 320–23 (describing Professor Harry Surden’s explanation of the evolution of digitized contracts).

⁶⁶ McKinney et al., *supra* note 55, at 321–22.

⁶⁷ Szabo *supra* note 64.

⁶⁸ McKinney et al., *supra* note 55, at 322–23.

⁶⁹ Etienne Dussault, *Introduction to Solidity Programming and Smart Contracts (For Complete Beginners)*, MEDIUM (Aug. 4, 2018), <https://medium.com/coinmonks/introduction-to-solidity-programming-and-smart-contracts-for-complete-beginners-eb46472058cf> (providing a crude example of the execution of a “smart will”).

⁷⁰ Jeremy M. Sklaroff, *Smart Contracts and the Cost of Inflexibility*, 166 U. PA. L. REV. 263, 273–74 (2017).

⁷¹ See McKinney et al., *supra* note 55, at 323–25 (explaining the limited usage of smart contracts in 2018).

debate about the distinction of the two forms is beyond the scope of this article.⁷² What is of importance to this fundamental examination of smart contracts is how they might provide an alternative to traditional legal institutions, thus offering a tool to facilitate business transactions with trust built into the code of the contract. The use of smart contracts to replace traditional contracts has the power to potentially eliminate the need for institutional support, from interpretation to enforcement of promises.⁷³

Most smart contracts drafted as of the date of this article are created using a programming language known as Solidity.⁷⁴ This is one of four major programming languages used in blockchain.⁷⁵ Solidity was created in 2014 by developers at Ethereum.⁷⁶ Ethereum is a blockchain platform created in 2014 by a Swiss nonprofit known as the Ethereum Foundation.⁷⁷ Its asserted function is to operate as “a decentralized platform that runs smart contracts: applications that run exactly as programmed without any possibility of downtime, censorship, fraud or third-party interference.”⁷⁸ Solidity is one of the key languages used to program smart contracts on the Ethereum platform.

Smart contracts offer a number of advantages over traditional contracts. First, they obviate the need for judicial intervention to determine whether a valid contract has been formed and what it consists of. There would be no more need for a parole evidence rule, or challenges to the mutual assent of the parties as the smart contract would not allow performance to begin unless, and until, all of the relevant formation factors had been accounted for and satisfied.⁷⁹ Disputes over whether parties actually agreed to given terms would be avoided. Of course, it would no longer be possible for verbal contracts to come into existence in the smart contract context either.

Second, much of the security provided during traditional contract negotiations through representations and warranties would be rendered

⁷² For more information about the formation of smart contracts, *see generally Smart Contracts & Legal Enforceability*, CARDOZO BLOCKCHAIN PROJECT REPORT #2 (Oct. 2018), https://cardozo.yu.edu/sites/default/files/2020-01/smart_contracts_report_2_0.pdf.

⁷³ *See, e.g.,* Alexander Savelyev, *Contract Law 2.0: “Smart” Contracts as the Beginning of the End of Classic Contract Law 21*, (Nat’l Research Univ. Higher Sch. of Econ., Working Paper No. BRP 71/LAW/2016, 2016), https://papers.ssrn.com/sol3/papers.cfm?abstract_id=2885241 (suggesting that smart contracts operate without the need for a legal system).

⁷⁴ *Introduction to Smart Contracts*, SOLIDITY, <https://solidity.readthedocs.io/en/v0.5.6/introduction-to-smart-contracts.html> (last visited Feb. 8, 2020).

⁷⁵ The other three programming languages used in blockchain are Serpent, Viper and Mutan.

⁷⁶ *See generally* Tiffany L. Minks, *Ethereum and the SEC: Why Most Distributed Autonomous Organizations are Subject to the Registration Requirements of the Securities Act of 1933 and a Proposal for New Regulation*, 5 TEX. A&M L. REV. 405, 408–10 (2018) (explaining the rise and impact of Ethereum).

⁷⁷ ETHEREUM, <https://www.ethereum.org> (last visited Feb. 20, 2020).

⁷⁸ *Id.*

⁷⁹ McKinney et al., *supra* note 55, at 326–27.

unnecessary with a smart contract.⁸⁰ Those traditional statements protect a party in the event that their counterparty lied or withheld information relevant to the agreement.⁸¹ For instance, if a party misstated their financial liquidity, a representation would protect the other party in the event of bankruptcy. A smart contract avoids the need for such protections as conditional performance language can be written into the code, triggering certain outcomes in the event of party misstatements, such as transferring funds automatically in the event of a default.

Third, and quite significant in terms of the forthcoming discussion about smart contracts in developing countries, the enforcement provisions built into smart contracts offer a superior remedy for parties to a dispute.⁸² The key here is automation. Rather than having to draft a choice of law and choice of forum clause in a contract, or relying on conventions such as the Uniform Commercial Code or the Convention on the International Sale of Goods, parties to a smart contract enjoy the benefits of strict compliance with the stated performance obligations in the agreement.⁸³ If the performance obligations are not met, a trigger is executed by which the non-breaching party is made whole.⁸⁴ For instance, if a party failed to deliver the requested goods on time, payment, which may have been held in escrow, is returned to the buyer and, if deposits were made for liquidated damages, the buyer may receive access to those funds as well, all without the need to involve arbitrators or the courts.

A key element that readers should understand about smart contracts is that they exist in a pre-determined environment with conditions established *ex-ante*, meaning that the work going into a contract to ensure that it is accurate and precise is likely more extensive than that of a traditional contract, which may count on negotiation and favorable interpretation post-execution.⁸⁵ Likewise, the risk of default is much greater in a smart contract given the automated enforcement provisions and lack of flexibility in interpreting party intent for their actions.

The inflexibility in a smart contract is the result of technological limitations. As of this writing, a smart contract cannot be designed to interpret common traditional contract terms such as “best efforts” or

⁸⁰ *Id.* at 328–29.

⁸¹ *See, e.g.*, Tina Stark, *Nonbinding Opinion*, 15 BUS. L. TODAY 3 (2006) (discussing the remedies available at common law for misrepresenting a statement of fact).

⁸² Werbach & Cornell, *supra* note 44, at 331–32 (explaining that smart contracts provide a more secure mechanism for enforcement in the form of automation); *but see* McKinney, *supra* note 55, at 330–40 (describing potential enforcement problems, such as a party closing their linked bank account in order to avoid automatic deductions).

⁸³ *But see* Sklaroff, *supra* note 70, at 277 (suggesting that parties tied to an inflexible smart contract may seek informal dispute resolution outside the confines of the agreement).

⁸⁴ McKinney et al., *supra* note 55, at 330.

⁸⁵ Sklaroff, *supra* note 70, at 280–81.

“commercially reasonable efforts.”⁸⁶ However, new advances in artificial intelligence may pave the way for more complex interpretive abilities in computers and, thus, a more expansive application of smart contracts in the future.⁸⁷

Of course, numerous problems exist with these purported benefits.⁸⁸ Smart contracts, as they exist today, can operate only in a very limited range of agreements, all of which involve “if/then” triggers as opposed to complex obligations. Smart contracts still require human input to develop the code that will be executed in the blockchain environment. And smart contracts remain quite inflexible, offering no room for interpretation, waiver, or modification once a contract has been executed.⁸⁹ Yet despite these (and other) problems, smart contracts have the potential to evolve into powerful tools that enable users to operate in a trust-oriented environment built without legal institutions.

IV. CAN BLOCKCHAIN ENHANCE GROWTH IN EMERGING MARKETS?

Economic growth in developing country markets typically trends behind that found in developed economies. Instability, corruption, and a variety of environmental and political factors play a role in holding some of these countries back. However, development economists have long found that one of the most effective targets for reform to promote growth in these countries is the strengthening of their institutional environments.⁹⁰ And while they have been cautious to credit legal reform in particular with sparking economic growth, they have agreed broadly that effective institutions enable an environment of trust that facilitates business.⁹¹

⁸⁶ *Id.* at 281 (providing an example of a contract to work with a sales agent in which the term “commercially reasonable efforts” is used as a condition of performance).

⁸⁷ See, e.g., Huu Nguyen and Scott Bailey, *Use of Artificial Intelligence for Smart Contracts and Blockchains*, SQUIRE PATTON BOGGS FINTECH LAW REPORT vol. 21 (March/April 2018).

⁸⁸ For an overview of several other problems faced by smart contracts within the current legal environment, see generally McKinney et al., *supra* note 55, at 330–40 (describing topics such as state law distinctions, the statute of frauds, and ethical considerations in smart contract enforcement).

⁸⁹ See Sklaroff, *supra* note 70, at 276 (explaining that “the transactional relationship created by a smart contract between two firms must be completely formed and precisely defined, eliminating forms of flexibility that are crucial to the contracting process.”).

⁹⁰ See generally Ronald J. Daniels & Michael Trebilcock, *The Political Economy of Rule of Law Reform in Developing Countries*, 26 MICH. J. INT’L. L. 99, 102 (2004); ROBERT J. BARRO, DETERMINANTS OF ECONOMIC GROWTH: A CROSS-COUNTRY EMPIRICAL STUDY (1997).

⁹¹ See Kevin E. Davis & Michael J. Trebilcock, *The Relationship between Law and Development: Optimists versus Skeptics*, 56 AM. J. COMP. L. 895 (2008) (surveying rule of law literature and finding that law legal reform has a positive effect on economic growth but is one of numerous key factors); see also Daron Acemoglu & James Robinson, *The Role of Institutions in Growth and Development* (Comm’n on Growth and Dev., Working Paper No.

Emerging markets in many instances function within weak institutional environments, either due to bureaucratic inefficiency or corruption.⁹² Consumers and businesses rely less on courts and law enforcement to protect their promises than they might in developed countries that enjoy a more efficient institutional environment. Reforming the institutions within developing countries has been a goal of economic development programs for many years, yet success has been elusive.⁹³

Institutional change is a slow-moving process that usually involves small adjustments rather than complete redevelopment.⁹⁴ “Rather than abruptly dismantling the rules, then, actors slowly subvert, build around, or redirect them.”⁹⁵ Aside from the occasional coup d’état that effectively revamps complete institutional environments, such as what we witnessed in Chile during the Pinochet years,⁹⁶ ineffective institutions remain ineffective in spite of efforts to change them.

Is blockchain the answer? As discussed above, blockchain has the potential to remove the need for formal institutions to facilitate trust and see promises through to their intended conclusions.⁹⁷ Could smart contracts then substitute for an efficient institutional structure in emerging markets, sparking the economic growth that has been held back within the weak institutional environment? Or will they always be an alternative to traditional contracts but never a replacement?⁹⁸

The centralized system of institutions that has driven economic

10, 2008), https://siteresources.worldbank.org/EXTPREMNET/Resources/489960-1338997241035/Growth_Commission_Working_Paper_10_Role_Institutions_Growth_Development.pdf.

⁹² Philip Keefer & Stephen Knack, *Why Don't Poor Countries Catch Up? A Cross-National Test of an Institutional Explanation*, 25 *ECON. INQUIRY* 590, 590 (1997).

⁹³ See generally *Investment Policy and Promotion*, WORLD BANK (Feb. 28, 2019), <https://www.worldbank.org/en/topic/investment-climate/brief/investment-policy-and-promotion>.

⁹⁴ See James Mahoney & Kathleen Thelen, *A Theory of Gradual Institutional Change*, in *EXPLAINING INSTITUTIONAL CHANGE: AMBIGUITY, AGENCY, AND POWER* 15 (James Mahoney & Kathleen Thelen eds., 2010); Wolfgang Streeck & Kathleen Thelen, *Introduction: Institutional Change in Advanced Political Economies*, in *BEYOND CONTINUITY: INSTITUTIONAL CHANGE IN ADVANCED POLITICAL ECONOMIES* 19-22 (Wolfgang Streeck & Kathleen Thelen, eds., 2005).

⁹⁵ Steven Levitsky & Maria Victoria Murillo, *Building Institutions on Weak Foundations: Lessons from Latin America*, in *REFLECTIONS ON UNEVEN DEMOCRACIES: THE LEGACY OF GUILLERMO O'DONNELL* 189, 192 (Daniel Brinks, Marcelo Leiras, & Scott Mainwaring eds., 2014).

⁹⁶ Robert A. Packenham & William Ratliff, *What Pinochet did for Chile*, *HOOVER INSTITUTION*, (Jan. 30, 2007), <https://www.hoover.org/research/what-pinochet-did-chile>.

⁹⁷ Werbach & Cornell, *supra* note 44, at 325 (describing the inherent trust built into Bitcoin transactions within the blockchain).

⁹⁸ *Id.* at 363 (arguing that smart contracts are inherently distinct from traditional contracts in that they rely not on contract law but on code crafted by the parties, and thus provide inherently distinct remedies).

development through widespread and long-distance contractual transactions has proven to be largely ineffective in many developing markets. Smart contracts executed within the blockchain environment provide a decentralized ledger system that builds trust into each element of each transaction without the need for a central authority to confirm its validity.⁹⁹ The distributed ledger system effectively engages a community of participants in the validation of each contract transaction by building its elements along the blockchain and simultaneously replicating those elements across the entire network to prevent alteration.¹⁰⁰

The potential applications of blockchain and smart contracts to create a trust environment in the absence of effective institutions is endless.¹⁰¹ At its most basic level of application, smart contracts could be used for financial instruments, such as loans, that require certain pre-conditions, rate negotiation, and performance by both parties with little room for interpretation about that performance.¹⁰² Similarly, smart contracts could help with public goods such as utilities or tolls, providing automated deductions from user accounts upon receipt of service, and clear and transparent conditions for when those deductions should occur and in what amount.¹⁰³ These solutions would be especially useful in a developing country where lack of trust in the credit system leads to low levels of automation. But beyond the hypothetical world of the value of smart contracts in the developing country context, we can highlight a recent practical example of their application to property titles in Honduras.

More than a decade ago, I wrote several articles describing the seemingly intractable problem of land titling in many developing countries where property titles are handed down through informal mechanisms, and formal registrations are infiltrated by corruption.¹⁰⁴ The inspiration for this

⁹⁹ *Id.* at 333 (“This radical decentralization is what potentially makes smart contracting a substitute for the state-based legal system, rather than an additional step before reaching that system.”).

¹⁰⁰ Marks, *supra* note 51, at 46-48 (providing a detailed explanation of the distributed ledger process).

¹⁰¹ Scott J. Shackelford & Steve Myers, *Block-by-Block: Leveraging the Power of Blockchain Technology to Build Trust and Promote Cyber Peace*, 19 *YALE J.L. & TECH.* 334, 336 (2017) (describing the potential of blockchain technology to “change everything” with respect to business applications).

¹⁰² Ryan Surujnath, *Off the Chain! A Guide to Blockchain Derivatives Markets and the Implications on Systemic Risk*, 22 *FORDHAM J. CORP. & FIN. L.* 257, 271 (2017).

¹⁰³ Alan Cohn, Travis West, & Chelsea Parker, *Smart After All: Blockchain, Smart Contracts, Parametric Insurance, and Smart Energy Grids*, 1 *GEO. L. TECH. REV.* 273, 297–303 (2017) (describing “smart grids” and “smart meters” as innovations in public utility contracts).

¹⁰⁴ See Kevin J. Fandl, *The Role of Informal Legal Institutions in Economic Development*, 32 *FORDHAM INT’L L.J.* 1 (2008) (explaining the evolution of informal legal institutions in protecting rights outside of traditional legal mechanisms); see also Kevin J. Fandl, *Dead Capital and the Sea: Post-Tsunami Relief for the Southeast Asian Informal Economy*, 1 *YALE J. INT’L AFF.* 79 (2005) (discussing the challenges faced by informal landowners in India).

research was the work of Hernando de Soto, who wrote extensively about the importance of transitioning informal landowners and informal business owners into the formal economy—legalizing their titles—in order to promote broader economic growth.¹⁰⁵ And though his solution of government-led formalization drew criticism,¹⁰⁶ the underlying tenet of providing a formal and immutable record of property titles remains valid and important in economic development.

Of the 7.3 billion people in the world, only two billion have a title that is legal and effective and public regarding their control over an asset When something is not legally on record as being owned, it can therefore not be used . . . as collateral to get credit, as a credential that you can be able to transfer part of your property to invite investment in. Things are owned, but when they're not adequately paperized or recorded, they cannot fill the functions of creating capital and credit.¹⁰⁷

Property titles in Honduras, like in many countries, are maintained using paper records that are held by government offices (usually *notarios*). In 2017, roughly 80% of Honduran property was either untitled or improperly titled.¹⁰⁸ Coupled with a weak institutional environment, this left property holders in the delicate predicament of being challenged in their title to the land that they occupy, or threatened with occupation or violence in the absence of payment to what has been termed the “land mafia.”¹⁰⁹

Austin-based startup *Factom* proposed in 2015 to help Honduras by building a blockchain-based land registry to replace the existing paper-based system.¹¹⁰ According to the press release made when the company decided

following a devastating tsunami that led to property ownership debates).

¹⁰⁵ See, e.g., HERNANDO DE SOTO, *THE MYSTERY OF CAPITAL: WHY CAPITALISM TRIUMPHS IN THE WEST AND FAILS EVERYWHERE ELSE* (2000).

¹⁰⁶ See, e.g., Rafael La Porta & Andrei Shleifer, *Informality and Development*, 28 J. ECON. PERSPECTIVES 109 (2014) (calling de Soto’s theory the “romantic” view of informality); Juana Paola Bustamante I. and Kevin J. Fandl, *Incentivizing Gray Market Entrepreneurs in Emerging Markets*, 37 NW. J. INT’L L. & BUS. 415 (2017).

¹⁰⁷ Marks, *supra* note 51, at 66 (alteration omitted) (quoting Laura Shin, *Republic of Georgia to Pilot Land Titling on Blockchain with Economist Hernando De Soto, BitFury*, FORBES (Apr. 21, 2016), <https://www.forbes.com/sites/laurashin/2016/04/21/republic-of-georgia-to-pilot-land-titling-on-blockchain-with-economist-hernando-de-soto-bitfury/#5ba9f8444da3>) (quoting Hernando De Soto, Signing Ceremony at the Georgian Ministry of Justice (Apr. 15, 2016)).

¹⁰⁸ Rina Chandran, *Modernizing land records in Honduras can help stem violence, says analyst*, REUTERS, (Aug. 11, 2017), <https://www.reuters.com/article/us-honduras-landrights-tech/modernizing-land-records-in-honduras-can-help-stem-violence-says-analyst-idUSKBN1AR151>.

¹⁰⁹ *Id.*

¹¹⁰ *Honduras to Build Land Title Registry Using Bitcoin Technology*, FACTOM BLOG, (May 19, 2015), <https://www.factom.com/company/blog/honduras-to-build-land-title-registry-using-bitcoin-technology/>.

to engage in this effort, they said of Honduras that “[t]he country’s database was basically hacked. So bureaucrats could get in there and they could get themselves beachfront properties.”¹¹¹ Their goal was “putting all of the government’s land titles on the blockchain.”¹¹² It was an ambitious but noble project to say the least.

The basic idea was simple. All land titles would be relocated or created on a new peer-to-peer blockchain network whereby anyone who wanted access to the titles would have it.¹¹³ With a blockchain in place, registrations would have to be carefully entered to ensure accurate and complete records, knowing that changing a record (for legitimate or illegitimate reasons) would be nearly impossible. Transfers of land would be seamless, with titles open and obvious, and new registrants added to the blockchain without room for fraud.

The Honduran experiment was a brilliant first step toward utilizing blockchain technology to resolve some of the developing world’s most corruption-laden, institution-based problems. However, we will never know if it would have worked because it was never implemented in Honduras.¹¹⁴ The Honduran government never actually signed the agreement touted in the press, and it seems that they never intended to. Critics later suggested that Factom and similar blockchain supporters often miss the complexity of developing country politics: “[b]y assuming the problem is mainly about bureaucratic inefficiencies and paper-based processes, Bitcoin enthusiasts ignore the hardest part of the situation: long-standing conflicts over rights and power.”¹¹⁵

Subsequent to this failed experiment, other governments have begun looking for ways to implement blockchain technology and Bitcoins to help secure administrative processes, such as property titling.¹¹⁶ Some have successfully implemented blockchain titles, including the small town of South Burlington, Vermont,¹¹⁷ which, working with a startup company known as Propy, transitioned their property deeds to the Ethereum

¹¹¹ *Id.*

¹¹² *Id.*

¹¹³ Marks, *supra* note 51, at 67 (explaining the Factom CEO’s goal of leapfrogging archaic paper-based titling systems in other parts of the world).

¹¹⁴ *Id.* at 68.

¹¹⁵ Chelsea Barabas & Ethan Zuckerman, *Can Bitcoin Be Used For Good?*, THE ATLANTIC (Apr. 7, 2016), <https://www.theatlantic.com/technology/archive/2016/04/Bitcoin-hype/477141/>.

¹¹⁶ Laura Shin, *Republic of Georgia to Pilot Land Titling on Blockchain with Economist Hernando De Soto, BitFury*, FORBES (Apr. 21, 2016), <https://www.forbes.com/sites/laurashin/2016/04/21/republic-of-georgia-to-pilot-land-titling-on-blockchain-with-economist-hernando-de-soto-bitfury/#5ba9f8444da3> (explaining that Georgia, Sweden, Honduras and the City of Chicago have begun implementing this technology into government-related transactions).

¹¹⁷ *Here’s What a Blockchain Property Deed Looks Like*, GOVTECH BIZ, (Apr. 16, 2018), <https://www.govtech.com/biz/Heres-What-a-Blockchain-Property-Deed-Looks-Like.html>.

blockchain.¹¹⁸ Similarly, the United Nations Development Programme (UNDP) is applying blockchain and smart contracts to facilitate property titling in India as part of a pilot project meant to avoid many of the same problems faced in Honduras and other developing countries.¹¹⁹ Several other initiatives have been attempted in countries from Japan to Sweden.¹²⁰

These experiments in applying blockchain and smart contracts to difficult contractual scenarios in developing countries reflect two things: (1) a realization that institutional reform is either too slow or too cumbersome to resolve these issues; and, (2) an understanding that this technology is quickly evolving and shows substantial promise in more effectively resolving these issues than traditional means. This is not to say that there will not be significant difficulties in creating a world that operates to some degree along a blockchain rather than a traditional, human-controlled institution. I discuss a few of these potential problems below.

A. Adoption

The fact that blockchain exists as an option for buyers and sellers does not mean that they would utilize it in lieu of alternative methods. Change always comes at a cost. This is especially true in more traditional societies in which community practices are deeply embedded in the societal norms. This has been frequently seen in experiments involving the introduction of more productive mechanisms or approaches in a variety of contexts, a concept known as *bounded rationality*.

The term “bounded rationality,” coined by Herbert A. Simon in 1957, suggests that individuals make sub-optimal choices due to limited information as well as environmental factors that influence their decision-making (such as friends and family).¹²¹ This theory has been used to explain many seemingly irrational failures to adopt new techniques that would be more productive, from cacao farming techniques in Cote d’Ivoire¹²² to

¹¹⁸ The blockchain of these titles can be accessed here: <https://www.etherchain.org/account/a188e5a3da203f8ebc72ec7578532926dc1d3bec>.

¹¹⁹ Alexandru Oprunenco & Chami Akmeemana, *Using blockchain to make land registry more reliable in India*, UNDP BLOG, (May 1, 2018), <https://www.undp.org/content/undp/en/home/blog/2018/Using-blockchain-to-make-land-registry-more-reliable-in-India.html> (describing the potential for blockchain and smart contracts to alleviate corruption in property titling in India).

¹²⁰ *Blockchain in Government Tracker*, THE ILLINOIS BLOCKCHAIN INITIATIVE <https://airtable.com/universe/expsQEGKoZO2lExKK/blockchain-in-government-tracker> (last visited Feb. 22 2020) (tracking government efforts to transition to blockchain, mostly in the land registry sector).

¹²¹ HERBERT A. SIMON, *MODELS OF MAN* (1957).

¹²² ALAIN DE JANVRY, KAREN MACOURS & ELISABETH SADOULET, *LEARNING FOR ADOPTING: TECHNOLOGY ADOPTION IN DEVELOPING COUNTRY AGRICULTURE* 62 (2016) (using bounded rationality to explain why farmers in the Ivory Coast failed to adopt available technologies that would improve their yields).

spending decisions in India.¹²³

We have already seen in the failed Honduras experiment that governments may have cause to be hesitant in adopting blockchain and smart contract technology. Similar to an individual's hesitation to abandon past traditions, the bureaucrats' rationale for rejecting adoption of this technology is likely to be deeply rooted in corruption, which has historically provided them with undeserved benefits.¹²⁴ And though the current institutional architecture is inefficient and ripe with problems, abandoning that system for an untested and seemingly ethereal promise of efficiency and transparency is a big risk.

What may be needed to overcome this fear is an incentive. Cass Sunstein and Richard Thaler provide one possibility in their book, *Nudge*, which suggests that human behavior falls into certain routines that, once established, are exceedingly difficult to change.¹²⁵ Their argument is that people make choices based on the desire to have control over those choices, and when they are given a "choice architecture" that provides them with desirable options and makes them believe that they are in control of their decision-making, they tend to choose those options.

In the case of adopting blockchain and smart contract technology, useful incentives may come from a variety of sources, such as successful implementation in peer-countries; a desire to be the first-mover among a given community of countries; or broader international incentives, such as membership in elite organizations like the Organization for Economic Cooperation and Development (OECD).¹²⁶ Internally, parties may be more inclined to adopt this technology if they see it in operation amongst their peers, which may be the result of cross-border contracts in which their counterparts in other parts of the world utilize smart contract provisions.

B. Trust and Technology

The degree to which a user might utilize blockchain to facilitate a business transaction is largely related to their familiarity with technology in general and their willingness to trust that technology. This would suggest that more tech-savvy individuals could become early adopters of blockchain for

¹²³ Dean E. Spears, *Bounded Rationality as Deliberation Costs: Theory and Evidence from a Pricing Field Experiment in India*, (CEPS, Working Paper No. 195, 2009) (explaining an experiment in the sale of soap in rural India and finding that the negative effects of bounded rationality disproportionately fall upon the poor).

¹²⁴ Enrique Aldaz-Carrol & Eduardo Aldaz-Carrol, *Can cryptocurrencies and blockchain help fight corruption?*, BROOKINGS INSTITUTE (Feb. 1, 2018), <https://www.brookings.edu/blog/future-development/2018/02/01/can-cryptocurrencies-and-blockchain-help-fight-corruption/> (explaining the features of blockchain, such as transparency, that could work to eliminate corruption in public sector transactions).

¹²⁵ CASS SUNSTEIN & RICHARD M. THALER, *NUDGE* 40-52 (2008).

¹²⁶ The OECD requires members to adopt their anti-corruption convention among other things.

business, but their ability to rely on that technology is largely dependent upon the technical expertise and trust of the counterparty to the arrangement. Bitcoin is an example of blockchain technology, and its adoption by some merchants, though certainly not a majority, reflects the gradual growth of trust in the technology.¹²⁷

Accepting Bitcoin as a means to transact business is utilized as an alternative to existing currencies and other technologies, such as Apple Pay. When a merchant chooses to accept Bitcoin for payment, they are hedging their risk by maintaining a number of different payment options. Most of these companies see Bitcoin as a very small aspect of their currency portfolios. Because Bitcoin is not seeking to replace the existence of traditional currency, it is not seen as a threat to business or governance.¹²⁸

The use of smart contracts has a potentially larger effect on the institutional environment than Bitcoin. Smart contracts purportedly eliminate the need for courts, judges, arbitrators, and even lawyers in crafting, interpreting, and enforcing a contract. In the distant future, with artificial intelligence far more advanced than it is today, the possibility of the key business document—the contract—replacing the entire institutional apparatus built around it seems surprisingly possible.¹²⁹ This would forever shift the institutional environment, reducing the importance of the judge as the purveyor of contractual interpretation and replacing him or her with pre-determined code that would seemingly evolve to take into account mounds of data from precedent, best practices, industry standards, and so forth. The potential for an omnipotent interpreter in the form of a computer program could well be on the horizon.

Yet none of this theoretical world of the future will change the underlying mistrust that humans were embedded within their own genetic code: “the need for trust will not be obliterated but rather shifts from central authorities towards algorithms that govern users’ interactions.”¹³⁰ The advent

¹²⁷ Yoni Blumberg, *Here’s how you can—and can’t—spend Bitcoin*, CNBC (Dec. 7, 2017), <https://www.cnbc.com/2017/12/07/heres-how-you-can-and-cant-spend-Bitcoin.html> (explaining that over 100,000 merchants worldwide accept Bitcoin today).

¹²⁸ See Paul Vigna, *Bitcoin Turns 10: Still Not All Grown Up*, WALL ST. J. (Oct. 31, 2018), <https://www.wsj.com/articles/Bitcoin-turns-10-still-not-all-grown-up-1540987201> (explaining that consumers prefer the perks with traditional bank credit cards that do not come with Bitcoins).

¹²⁹ *But see* STAN. UNIV., ARTIFICIAL INTELLIGENCE AND LIFE IN 2030: ONE HUNDRED YEAR STUDY ON ARTIFICIAL INTELLIGENCE, 46-47 (2016) (*hereinafter* “Stanford Study”), https://ai100.stanford.edu/sites/g/files/sbiybj9861/f/ai100report10032016fnl_singles.pdf (“Contrary to the more fantastic predictions for AI in the popular press, the Study Panel found no cause for concern that AI is an imminent threat to humankind. No machines with self-sustaining long-term goals and intent have been developed, nor are they likely to be developed in the near future.”).

¹³⁰ Florian Hawlitschek et al., *The limits of trust-free systems: A literature review on blockchain technology and trust in the sharing economy*, 29 ELECTRONIC COM. RES. & APPLICATIONS 50, 57 (2018).

of machines to replace humans has caused uproar and revolution throughout history, yet these instances have largely related to physical substitution rather than mental. More recently, the application of technology to replace human thought processes has brought with it a more existential debate about whether we trust machines as decision-makers and interpreters of human actions.¹³¹ Scientists working in this area urge citizens to remain calm and not to fear a fundamental shift in control from humans to computers, and emphasize that regulation and other efforts to cease development in AI is likely to drive research underground into a much more dangerous environment.¹³²

V. CONCLUDING REMARKS AND FURTHER RESEARCH

Smart contracts will not replace traditional contracts or the need to encourage effective institutional environments.¹³³ A host of elements arise out of traditional contract processes, from assessing defenses to enforcement (e.g., unconscionability) to deciphering the validity of the contract formation in the first instance (e.g., duress).¹³⁴

The distributed ledger technology (DLT) that is at the heart of blockchain and smart contracts has tremendous potential to lend efficiency, fairness, transparency, and trust to our interactions with others. The openness and transparency alone provide an opportunity to overcome bureaucratic inefficiency and corruption by shining a bright light on the actions of government officials, corporations, and individuals, disincentivizing bad behavior.¹³⁵ Similarly, locking-in those transactions through a blockchain-approach ensures that people are true to their word (or actions) and cannot renege on their “smart” promises.¹³⁶

The technology apparent in smart contracts today may seem more of a novelty than a true revolution in contracting.¹³⁷ After all, parties are still drafting terms in the form of programming code; humans are still negotiating conditions so as to instruct the computers to execute actions on the basis of those conditions; and parties still need to provide the funds (i.e., Bitcoins) and assets called for by the contract. Are they truly smarter than traditional contracts? Some authors have argued that smart contracts are simply upgrades to the existing contract landscape and offer nothing more than

¹³¹ See generally Drew Simshaw, *Ethical Issues in Robo-Lawyering: The Need for Guidance on Developing and Using Artificial Intelligence in the Practice of Law*, 70 HASTINGS L.J. 174, 176 (2018) (highlighting the gaps in legal regulation over the use of artificial intelligence in the provision of legal services).

¹³² See Stanford Study, *supra* note 129.

¹³³ Werbach & Cornell, *supra* note 44, at 317-318 (2017) (arguing that smart contracts fail to fully satisfy the doctrinal requirements of contract law).

¹³⁴ *Id.* at 318.

¹³⁵ Marks, *supra* note 51, at 76-77 (describing the visibility that DLTs provide into the movement of money and assets along a blockchain).

¹³⁶ *Id.* at 77 (discussing the immutability of DLT records).

¹³⁷ Werbach & Cornell, *supra* note 44, at 344-350.

added efficiencies.¹³⁸

What I intended to do in this short article is to introduce the foundational question of whether blockchain technology offers a reasonable alternative to institutional reform for both simple and complex contractual transactions, especially in emerging markets. Technology has made our cities smarter with smart grids, meters, tolls, and so forth. It has made our health better with big data analysis, robotic surgery, and early detection systems. Will it make global business smarter by breaking down one of the key barriers to trade between unrelated parties—trust? If it does, will this stimulate economic growth in emerging markets, or will political intervention slow the train of progress? These are key questions that we need to be asking.

¹³⁸ See, e.g., ARVIND NARAYANAN ET AL., BITCOIN AND CRYPTOCURRENCY TECHNOLOGIES: A COMPREHENSIVE INTRODUCTION 2 (2016); *Not-So-Clever Contracts*, ECONOMIST (July 28, 2016), <https://www.economist.com/news/business/21702758-time-being-least-human-judgment-still-better-bet-cold-hearted>.

