INSTITUTE FOR INTERNATIONAL LAW AND JUSTICE
NEW YORK UNIVERSITY SCHOOL OF LAW

IILJ Emerging Scholars Paper 28 (2017)

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EMERGING SCHOLARS PAPERS

ISSN: 1552-6275

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New York, NY 10012
U.S.A.

Version of 27 September 2017

Cite as:
IILJ Emerging Scholars Paper 28 (2017)

BLOCKCHAIN AS AN EMERGING CROSS-BORDER PAYMENTS INFRASTRUCTURE: AN EXAMINATION OF ITS DEVELOPMENT AND STANDARDS NEEDS

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Abstract

With its offer of security, increased efficiency, and lower costs, blockchain has the potential to revolutionize the cross-border payments system. However, before these advantages can be fully realized, there are a number of standards that will need to be developed. These include technological standards, governance and liability standards, and compliance with existing regulatory standards. The current landscape of blockchain development is highly fragmented, and numerous stakeholders possessing varying degrees of public and private regulatory power have taken on the task of establishing standards. This paper examines blockchain's potential role in the cross-border payment infrastructure, predicts its needs for standards, and considers the standard-setting candidates within the framework of the global administrative law (GAL) typology. It asks the question—what type of regulatory body is most likely to emerge as the dominant blockchain standard-setter? Through an exploration of these organizations and comparison with analogous situations, this paper concludes that private governance will likely play a dominant role in blockchain standard-setting. Whether there will be any space for public regulators will depend in large part on (1) the scope and magnitude of distributional consequences accompanying any given standards regime, and (2) whether and to what extent private regulators preemptively address the regulatory issues that are of most concern to public regulators.

1. Introduction

The cryptocurrency bitcoin's emergence in 2008 was heralded by many as the start of a technological revolution capable of disrupting the entire global financial industry. However, as bitcoin's weaknesses as a currency became more apparent, interest shifted to blockchain, the underlying distributed ledger technology. Today, there are estimated to be more than two hundred blockchain startups,[1] and in 2014 and 2015, "more than $1 billion of venture capital flooded into the emerging blockchain ecosystem," with "the rate of investment . . . doubling annually."[2] One of the most promising applications for blockchain technology is in the cross-border payment realm. The current cross-border payment apparatus is highly fragmented, inefficient, and expensive. The use of blockchain technology by global banks has the potential to reduce the time and cost involved in making transnational payments.

* J.D., 2017, New York University School of Law. I am grateful for assistance and support from the participants of the Law and Global Governance seminar and the Institute of International Law and Justice.

[1] COGNIZANT, BLOCKCHAIN IN BANKING: A MEASURED APPROACH 4 (Apr. 2016), https://www.cognizant.com/whitepapers/Blockchain-in-Banking-A-Measured-Approach-codex1809.pdf.

[2] DON TAPSCOTT & ALEX TAPSCOTT, BLOCKCHAIN REVOLUTION 9 (2016).

Realizing these objectives, however, requires the establishment of global standards for its use and operation, and it remains to be seen how, and by whom, these standards will be developed. Currently, there are a number of bodies stepping up as standard-setters, including several private industry groups, the International Standards Organization (ISO), and the Bank for International Settlements (BIS). These organizations represent different types of global administrative bodies—with varying mixes of private and public influence—and present distinct advantages and disadvantages. This paper considers these candidates and asks the question: which is most likely to emerge as the dominant standard-setter? Through an exploration of these organizations and comparison with analogous situations, this paper concludes that private governance will likely play a dominant role in blockchain standard-setting. Whether there will be any space for public regulators will depend in large part on (1) the scope and magnitude of distributional consequences accompanying any given standards regime, and (2) whether and to what extent private regulators preemptively address the regulatory issues that are of most concern to public regulators.

Section II briefly explains the current cross-border payment infrastructure and its weaknesses, emphasizing how much of the system is an attempt to solve the problem of trust between parties to a transaction. Section III describes blockchain, its possible applications, and the research and development initiatives currently pursued. This section explores the advantages of blockchain—disintermediation, speed, efficiency, and security, to name a few—and the ways it could be used to overhaul the existing cross-border payments infrastructure. Section IV then considers some of the standards that blockchain will likely require to gain widespread and effective adoption. Section V proposes several organizations that could take the lead in setting blockchain standards. These organizations are examined in light of the global administrative law (GAL) typology of administrative bodies. Section VI follows with an analysis of these bodies and their chances of emerging as the dominant blockchain standard-setter.

2. The Current Cross-Border Payment System

One of the primary hurdles to accomplishing an electronic payment is the need for trust between the parties. Two parties directly transacting often lack a means of verifying each other's identities or of ensuring

that the transaction is carried out as agreed upon.[3] For instance, if Party A is buying a bike from Party B, how does A know that B actually owns the bike? And how does B know that A possesses sufficient funds? Unless A and B transact face to face, neither can be certain that the other party will fulfill their side of the exchange.[4] When the parties lack a direct relationship of trust, this uncertainty can serve as an insurmountable roadblock. Consequently, the various mechanisms for executing payments, both domestic and international, all revolve around providing a trusted intermediary to mitigate this uncertainty.

Banks most traditionally serve as the trusted intermediary.[5] The most straightforward example is when the two parties to a transaction hold accounts with the same bank. The two parties can rely on the bank to verify identities and ensure that the transaction is carried out as agreed on. The situation is complicated, however, when the parties hold accounts with different banks, because then there needs to be a trusted relationship between the two banks. In many domestic payments systems, there exist regional and national clearinghouses that serve as the trusted intermediaries in these interbank transfers. The clearinghouse may be a private institution or a public institution, such as a central bank.

The issue with cross-border payments is that there exists no international clearinghouse to serve as the trusted intermediary between banks in different states. Instead, the wildly inefficient and costly correspondent banking system is used. As the Committee on Payments and Market Infrastructure (CPMI) explains, "[a]t the most basic level, correspondent banking requires the opening of accounts by respondent banks in the correspondent banks' books and the exchange of messages to settle transactions by crediting and debiting those accounts."[6] These accounts that banks open with each other are called *nostro* accounts.[7] However, most banks only have *nostro* accounts with two or three correspondents per currency.[8]

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[3] TAPSCOTT, *supra* note 2, at 3.

[4] THE MISSING LINKS IN THE CHAINS?, LONG FINANCE 13 (2016) [hereinafter THE MISSING LINKS]. Third parties can be conceived of as serving three roles: (1) validation, (2) safeguarding, and (3) preserving. Validation is about confirming the identities of the participants, and the existence of the subject(s) of the transaction. Safeguarding is to guard against double spending, or selling the same thing twice. Lastly, preserving involves recording transactions for oversight and dispute resolution. *See id.*

[5] There are a number of ways of making payments, both domestically and internationally. For example, there are electronic payment and transfer services such as PayPal and Venmo, just to name a few, and there are more traditional money transmitters such as Western Union and MoneyGram. However, this section will focus on how payments are accomplished through the domestic and international banking system.

[6] COMMITTEE ON PAYMENTS AND MARKET INFRASTRUCTURES, CORRESPONDENT BANKING 6 (2015), http://www.bis.org/cpmi/publ/d136.pdf.

[7] DOMINIQUE RAMBURE & ALEC NACAMULI, PAYMENT SYSTEMS 43–44 (2008).

[8] *Id.* at 44.

Consequently, if two banks do not hold accounts with each other, an intermediary will be needed to accomplish a transfer. All the banks involved in this process issue statements for the accounts they hold, including the *nostro* accounts.[9] These statements must then be reconciled to ensure that the correct transfers were made.[10]

Take an example: Payer wants to make a payment to payee. However, payer is in the United States, and banks with Bank A, while payee is in Denmark and is with Bank C. Bank A and Bank C do not have a relationship with each other, and so have no channel through which they can directly transfer money. Consequently, they will use an intermediary with which they both have a relationship, Bank B. First, Bank A will debit Payer's account, and will then credit the account that Bank B holds with Bank A. Bank A will then send a payment message to Bank B, which will instruct Bank B to debit Bank A's account with Bank B and credit Bank C's account. Bank B will then send Bank C a payment message, prompting Bank C to debit Bank B's account with Bank C and then credit the payee's account.[11]

An essential element of the cross-border payment system is the Society for Worldwide Interbank Financial Telecommunication (SWIFT). In the above example, the three banks would communicate with each other using SWIFT. SWIFT was established in 1973 as part of an effort to develop a standardized electronic communication system for payments.[12] Prior to its development, countries had communication standards for domestic payments, but lacked common standards for cross-border payments.[13] SWIFT was established by a group of banks to solve this problem, and now includes nearly 8,300 financial institutions in 208 countries.[14] SWIFT establishes messaging standards and bank identifier codes, and validates conformity with these standards, thereby enabling full automation in communication and reconciliation.[15] Today, SWIFT is the leading provider of messaging and processing services, facilitating cross-border payments.[16]

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[9] *Id.* at 44.
[10] *Id.*
[11] This is based on the example in CORRESPONDENT BANKING, *supra* note 6, at 7.
[12] RAMBURE & NACAMULI, *supra* note 7, at 46.
[13] *Id.*
[14] *Id.* at 47.
[15] *Id.*
[16] *Id.* at 48. *See generally* Pauline Brosch, The Society for Worldwide Interbank Financial Telecommunications (SWIFT), in Benedict Kingsbury & Richard B. Stewart (eds.), Private-Public Ordering of Transnational Markets (OUP 2018, forthcoming).

The current cross-border payments system is widely criticized for its inefficiency, slow speed, and high cost.[17] It can take two to three days to clear and settle a domestic payment and five days to complete a cross-border payment.[18] These payments can also accumulate large amounts in fees, as each middleman requires a cut. Consequently, there is serious demand for a better cross-border payment system, one that is faster, cheaper, and secure. Blockchain may offer this better system.

3. What is Blockchain?

The term "blockchain" originally referred to the distributed ledger technology underlying the digital currency bitcoin.[19] Blockchain consists of a ledger shared across every computer in a given network.[20] When one party seeks to transfer bitcoin to another party, the payer enters a security code and initiates the transaction. Then, the computers in the network use sophisticated algorithms to verify and clear the transaction.[21] A record of the transaction is then "stored in a block which is linked to the preceding block," thereby updating the blockchain.[22] Blockchain is distributed, meaning that rather than relying on a central database—which would be vulnerable to hacking and fraud—a copy is stored on every computer in the network.[23] Relatedly, because every computer in the network has a copy, the blockchain is public in the sense that every network participant can view the recorded transaction history.[24] Lastly, it is encrypted to maintain security.[25]

The key innovation of blockchain is that it solves the issue of trust. Rather than relying on financial institutions and clearinghouses as intermediaries, blockchain employs sophisticated algorithms that verify the parties and the transaction by harnessing the collective computing power of the computers in the

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[17] Angela Walch, *The Bitcoin Blockchain As Financial Market Infrastructure: A Consideration of Operational Risk*, 18 N.Y.U. J. LEGIS. & PUB. POL'Y 837, 850 (2015) ("Existing systems are faulted for their ancient and creaky technology, the slow speed at which payments are processed across borders or transactions are settled, and the high fees charged to move money around the world.").
[18] Laura Shin, *Bitcoin's Shared Ledger Technology: Money's New Operating System*, FORBES (Sept. 9, 2015 10:00 AM) http://www.forbes.com/sites/laurashin/2015/09/09/bitcoins-shared-ledger-technology-moneys-new-operating-system/#3764b729c4fc.
[19] TAPSCOTT, *supra* note 2, at 6.
[20] *Id.* at 6–7.
[21] Walch, *supra* note 17, at 845.
[22] *Id.* at 7.
[23] *Id.* at 6.
[24] *Id.*
[25] *Id.* at 6–7.

network.[26] Because there is an indelible ledger of all previous transactions within the network, it is possible to track and validate transactions.[27] Cutting out the middleman—or middle*men* as is often the case—vastly simplifies the transaction, while also reducing the cost and time involved.

Another benefit of a distributed ledger is that it eliminates the need for duplicate data entry where each participant keeps a separate ledger, and eliminates the need to reconcile between these separate records.[28] This process of recording and reconciliation inserts inefficiencies into the payments system, and so the use of a shared ledger presents a considerable advantage.

While it currently can take five days to fully effectuate a cross-border payment, a blockchain network can accomplish such a payment in ten minutes.[29] Furthermore, blockchain removes the need for intermediaries, thereby reducing the amount charged in fees. According to Stanford professor Susan Athey, "[t]he days of [banks] holding on to people's money a little bit longer and benefiting from that, or charging people fees and high margins on exchange rates," would end with the use of blockchain.[30] Blockchain also offers superior security and increased transparency, reducing opportunities for fraud.[31]

While blockchain technology was developed in relation to bitcoin, many are exploring the technology's applications independent of the digital currency.[32] As blockchain is still in its infancy, and given its wide-ranging applications[33], there are innumerable directions in which this technology could develop. This paper specifically focuses on blockchain's applications in payment systems. However, even within the payment sphere, there are numerous different ways in which blockchain could be applied. One possibility is a direct

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[26] *Id.* at 5.
[27] THE MISSING LINKS, *supra* note 4, at 12–13.
[28] THE MISSING LINKS, *supra* note 4, at 12.
[29] The bitcoin blockchain updates, processing any given transaction in the network, roughly every ten minutes. Some of the blockchains in development could accomplish transactions in mere seconds. Shin, *supra* note 18.
[30] *Id.*
[31] *Id.* ("In addition to speed and a smaller middleman's cut, a shared ledger system offers superior security and transparency. A Bitcoin payment is a "push" transaction, meaning that money leaves a Bitcoin wallet only if the owner sends it. … The shortened settlement time also reduces the risk of fraud. Shared ledger technology could even curb the current epidemic of identity theft.")
[32] The term 'blockchain' technically refers to the distributed ledger associated with Bitcoin, however, the term is now used more broadly to refer to the type of technology. This paper will use the term, 'blockchain', to refer to distributed ledger technology generally.
[33] Tapscott emphasizes Blockchain's vast applications, including beyond the financial industry, stating that, "[t]his new digital ledger of economic transactions can be programmed to record virtually everything of value and importance to humankind: birth and death certificates, marriage licenses, deeds and titles of ownership, educational degrees, financial accounts, medical procedures, insurance claims, votes, provenance of food, and anything else that can be expressed in code." TAPSCOTT, *supra* note 2, at 7.

peer-to-peer payment system, in the vein of bitcoin. This could entirely cut out the need for financial institutions, or any other intermediary, to make payments. Another possibility entails financial institutions adopting blockchain to replace their current payments infrastructures. This would preserve a role for banks and other financial institutions in payments, however, it would cut out the need for intermediaries such as clearinghouses and correspondent banks.[34]

Furthermore, distributed ledger technology can vary with respect to certain characteristics, and it so it remains to be seen exactly what a payment system blockchain would look like. Bitcoin is built on a public blockchain; anyone can join the network, download the blockchain, make transactions, and even build upon it.[35] In contrast, other blockchains are private, or permissioned. This means that there are various permissions which prescribe who may access data and write new data into the ledger.[36] Financial institutions have so far favored permissioned blockchains because they are easier to manage and control; privacy can be better protected, problematic users can be blacklisted, the blockchain can be optimized for specific purposes, and updating the program is far easier.[37] It also remains to be seen whether blockchains will be adopted to work with traditional currencies or digital currencies (like bitcoin).

Tech startups developing blockchain technology are rapidly proliferating. It is estimated that there are more than 200 blockchain startups, and venture capital funding for these companies reached $1 billion in 2015 and was expected to reach $2.5 billion in 2016.[38] These start-ups are developing blockchains for various uses in wide-ranging industries.

Notably, central banks are also expressing interest in blockchain. The Bank of England and the People's Bank of China "have discussed issuing their national currencies onto some sort of distributed ledger."[39] U.S.

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[34] Tapscott describes this possibility as "big banks [continuing to] reign supreme by deploying the blockchain without bitcoin, cherry-picking elements of distributed ledger technology and welding them to existing business models[.]" TAPSCOTT, *supra* note 2, at 70.

[35] *Asking Permission: What's the difference between a public and private blockchain?,* Smith + Crown, https://www.smithandcrown.com/permission-blockchains/.

[36] THE MISSING LINKS, *supra* note 4, at 12.

[37] *Asking Permission supra* note 35 ("[M]any see permissioned blockchains as the future that banks, regulators, and other established players will embrace. They provides more control and can be adapted to existing regulations and business processes. Their strongest argument is that permissionless blockchains simply present too much risk.")

[38] COGNIZANT, *supra* note 1, at 4.

[39] Nathaniel Popper, *Central Banks Consider Bitcoin's Technology, if Not Bitcoin*, https://www.nytimes.com/2016/10/12/business/dealbook/central-banks-consider-bitcoins-technology-if-not-bitcoin.html?_r=0.

Federal Reserve governor Lael Brainard stated: "We are paying close attention to distributed ledger technology, or blockchain, recognizing this may represent the most significant development in many years in payments, clearing and settlement."[40]

Most relevant for the purposes of this paper are start-up tech companies such as Ripple, which are developing blockchains to be used by financial institutions to augment or replace their existing domestic and international payments infrastructures. Ripple has built a blockchain and a digital currency, called XRP, specifically for the use of global financial institutions.[41] Ripple offers "direct bank to bank" and near instantaneous settlement at lower costs than traditional payment infrastructure, and its testing of the technology is yielding positive outcomes.[42] This paper considers most closely blockchains such as Ripple's and how they are being applied by global financial institutions to facilitate payments.

4. Blockchain's Standards Needs

While blockchain offers dramatic possibilities for a faster, cheaper, and more efficient cross-border payment system, for these objectives to be fully realized, a number of standards and regulatory needs must be addressed. These can be placed in several general categories: (1) technical standards, (2) governance and liability standards, and (3) standards relating to compliance. [43]

A. Technical standards

Technical standards needs are primarily related to the performance and compatibility of blockchain.[44] For blockchain's potential to increase efficiency and reduce costs to be fully realized, there need to be common "standards that enable interoperability."[45] One of the reasons why blockchain is so attractive is its potential for eliminating the need for intermediaries. But without common technical standards, independent

[40] *Id.*
[41] *Welcome to Ripple*, https://ripple.com/
[42] *See id.; U.S. start-up R3, banks test Ripple's cross-border payments technology*, Reuters (Oct. 20, 2016), http://www.reuters.com/article/us-banks-ripple-blockchain-idUSKCN12K20H.
[43] This section presents several of the standards needs that are currently the subject of focus. This is not to imply that there are not other standards and regulatory needs. This paper presents a sample.
[44] BLOCKCHAIN & ELECTRONIC DISTRIBUTED LEDGER TECHNOLOGIES, STANDARDS AUSTRALIA 4, http://www.standards.org.au/OurOrganisation/Events/Documents/Blockchain%20NFTA%20Information%20Sheet.pdf ("[T]echnical solutions that promote interoperability, and compatibility between existing systems. . . . will allow the technology to be more widely used and deployed.")
[45] COGNIZANT, *supra* note 1, at 2.

and incompatible blockchains will be adopted by different institutions that will be unable to directly transact with each other. Such a situation would once again require a resort to intermediaries analogous to correspondent banks, thereby detracting from the efficiency gains presented by blockchain.

Currently, the development of blockchain is highly fragmented, with many start-ups and financial institutions developing and testing different blockchains. While this fragmentation may be natural for technology in its infancy, there will need to be some consolidation, or at the very least, consensus on certain common technical standards to ensure that separately developed blockchains are interoperable. A 2017 report by the CPMI describes the current situation with respect to blockchain development and interoperability:

> Industry is experimenting with a number of potential [blockchain] arrangements, and multiple [blockchain] arrangements are likely to emerge providing different, similar and complementary functionality. As such, one technical challenge would be to enable arrangements to communicate or connect with one another and with legacy systems in order to facilitate the conduct of a variety of financial transactions. The development of technical interoperability standards can facilitate this by providing a base layer of connectivity that also helps lower implementation and integration costs. Successful development of standards may encourage broader adoption of [blockchain] in the financial system, which could potentially bring network scale efficiencies.[46]

Consequently, to promote compatibility, there will need to be standards on matters such as terminology, process, privacy, and cyber security, to name a few.[47] For example, in the way that SWIFT standardized communication between banks, there will need to be standardization of the language used to communicate with, and possibly between, blockchains.[48] Common XML data standards provide another example of a necessary technical standard, as these will be needed to ensure consistent data structures and interpretation processes.[49]

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[46] DISTRIBUTED LEDGER TECHNOLOGY IN PAYMENT, CLEARING AND SETTLEMENT, COMMITTEE ON PAYMENTS AND MARKET INFRASTRUCTURES 18 (2017), http://www.bis.org/cpmi/publ/d157.pdf.
[47] BLOCKCHAIN & ELECTRONIC DISTRIBUTED LEDGER TECHNOLOGIES, STANDARDS AUSTRALIA 4, http://www.standards.org.au/OurOrganisation/Events/Documents/Blockchain%20NFTA%20Information%20Sheet.pdf
[48] A related issue is the need to standardize the terminology used to describe blockchains. This is a matter of defining precisely what constitutes a 'blockchain,' as well as the various possible characteristics, such as 'permissioned' or 'unpermissioned,' and 'proof of work' or 'proof of concept'. Creating precise and standardized terminology and definitions will be crucial so that fintech firms, financial industry participants, and regulators can communicate effectively. *See* THE MISSING LINKS, *supra* note 4, at 16.
[49] *Id.*

Despite a debate about the optimal way and time to introduce technical standards,[50] ultimately, common technical standards will be essential to the success of blockchain technology. As the managing director of the blockchain consortium R3 stated: "How good would a fax machine be if you had no one to communicate with? The power of this technology is in the network effect…."[51] Standards will facilitate the reaching of a critical mass necessary to attain said network effect.

B. Governance and liability standards

The next category of standards relate to issues of governance and liability. While bitcoin has virtually no governance structure,[52] blockchains designed for financial institutions will require clear governance structures that provide for who may access, input and correct data, among other things.[53] This is essential for the effective management of the blockchain. For example, "[d]ue to the persistence of data in [distributed ledgers], correcting transaction or data errors may be difficult unless a single entity is authorized to promote changes across all nodes," and so there needs to be a governance structure designating which entity may correct these errors.[54]

A clear governance structure is important not only for the effective functioning of blockchains, but also because of the civil liberty and privacy issues implicated when large amounts of data are collected and stored.[55] With widespread use of distributed ledger technology, there comes "the potential to compile detailed records on individuals by organizations such as financial services companies or governments…."[56] Consequently, it is prudent to develop clear and common standards specifying "how records on individuals

[50] There are two general ways in which blockchain standards can be developed: (1) a critical mass of stakeholders *agree* on common standards, and (2) certain practices are adhered to by a sufficient number of important actors to effectively *become* standards. There are many who are arguing for proactive agreement on common standards, and these actors are the primary focus of this paper. However, there are also voices arguing for the first route; asserting that the blockchain community should allow the technology to further develop and certain standards will develop naturally though that process. *See infra* 131–135 and accompanying text.
[51] Ben McLannahan, *Goldman Sachs quits R3 blockchain consortium*, FINANCIAL TIMES (Nov. 21, 2016) https://www.ft.com/content/598934e0-b010-11e6-9c37-5787335499a0.
[52] This lack of any governance structure, while a key part of the bitcoin philosophy, has led to issues for the cyrptocurrency, for instance, making it problematic to upgrade the system. *See* THE MISSING LINKS, *supra* note 4 at 17.
[53] *Id.*
[54] *Id.*
[55] *Id.*
[56] *Id.*

are kept on distributed ledgers, who owns this data, under what circumstances, if any, it may be aggregated into a single [distributed ledger], and the procedures for correcting errors and removing data."[57]

Relatedly, there are questions of liability and indemnity for mistakes and a need for dispute resolution processes.[58] Clearly assigning responsibility and liability, as well as providing for a dispute resolution mechanisms, would help to reduce uncertainty and manage risk.

This need for governance and liability standards largely stems from the different incentive structure that

C. Compliance standards

In the final category are standards relating to compliance with existing laws and regulation. Blockchain developers will need to find ways of complying with existing international financial regulations, such as know your customer, anti-money laundering, countering the financing of terrorism, ultimate beneficial ownership, and sanctions screening regulations. [59] Institutions implementing blockchains will need to either integrate blockchains within their existing systems of regulatory compliance or will need to build new systems. It is thought that blockchain technology could be used to increase the efficiency of know your customer checks, however, a fundamental change would entail significant upfront costs.[60]

Additionally, there will likely need to be compliance with regulations concerning the ways in which data included in blockchains is stored, protected, and used.[61] While the international financial regulations discussed above are designed to cross territorial borders and jurisdictions, other types of regulations vary between jurisdictions, and so complying with these may raise tricky issues. As one report states, "[d]ifferences in financial and company laws across jurisdictions mean that supervising a [distributed ledger] 'network' might be considerably more complex than supervising central market infrastructures… [d]ifferent

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[57] *Id.*
[58] *Id.*
[59] BLOCKCHAIN & ELECTRONIC DISTRIBUTED LEDGER TECHNOLOGIES, STANDARDS AUSTRALIA 3, http://www.standards.org.au/OurOrganisation/Events/Documents/Blockchain%20NFTA%20Information%20Sheet.pdf
[60] BLOCKCHAIN APPLICATIONS IN BANKING, DELOITTE (2016), https://www2.deloitte.com/content/dam/Deloitte/ch/Documents/innovation/ch-en-innovation-deloitte-blockchain-app-in-banking.pdf.
[61] The question of data governance is an important issue in blockchain development and arises in both the second and third categories. The second subsection discusses data governance standards designed to reduce uncertainty and risk for blockchain users, while the third subsection deals with standards enabling compliance with existing data governance and protection regulations.

nodes may be established in different jurisdictions and subject to different privacy, completion, insolvency and other requirements."[62]

Furthermore, blockchain users will likely face certain consumer protection regulations. There is a need for institutions using blockchain to "ensure that users' rights are honored… that users' potential losses are minimized, for example, due to insufficient security and access controls, criminal abuse of funds, bad management, manipulation of exchange rates, discrimination of user groups, etc."[63]

5. Candidates for Standard-Setters

Just as the landscape of blockchain technical development is varied and fragmented, the initiatives to develop blockchain standards are similarly splintered. A number of organizations have emerged as potential standard-setters. These organizations vary along numerous dimensions, including, and most critically for the purposes of this paper, the role of public and private power and influence.

The global administrative law project presents a typology of global administrative bodies that is helpful in conceptualizing the various standard-setting candidates. It proposes five types of global administration, the most relevant for this paper's purposes being: "transnational networks of cooperative arrangements between national regulatory officials" (transnational network governance), "administration by hybrid intergovernmental-private arrangements" (hybrid public-private governance), and "administration by private institutions with regulatory functions" (private governance).[64] There are examples of each of these three types of global administration active in developing blockchain standards, and they will be examined in turn.

A. Interstate network governance – Bank of International Settlement Committee on Payments and Market Infrastructure

Interstate networks bring together national officials or regulators to facilitate cooperation on issues that cross domestic jurisdictions.[65] They tend to be dominated by informal modes of cooperation, and while

[62] THE MISSING LINKS, *supra* note 4, at 17.
[63] Harry Leinonen, *Decentralised Blockchained and Centralised Real-Time Payment Ledgers: Development Trends and Basic Requirements*, *in* TRANSFORMING PAYMENT SYSTEMS IN EUROPE 236, 256 (Jakub Górka ed., 2016).
[64] Benedict Kingsbury, Nico Krisch, & Richard B. Stewart, *The Emergence of Global Administrative Law*, 68 L. & CONTEMP. PROBS. 15, 20 (2005).
[65] *Id.* at 21.

their decisions often are not legally binding, they may still be highly effective.[66] The Bank for International Settlements (BIS) is one such interstate network, serving as a forum for central banks. The BIS seeks to "serve central banks in their pursuit of monetary and financial stability, to foster international cooperation in those areas and to act as a bank for central banks."[67] The BIS hosts and supports six committees and three associations that engage in standard-setting, one of which is the Committee on Payments and Market Infrastructures (CPMI).[68] The CPMI's mandate is to promote "the safety and efficiency of payment, clearing, settlement and related arrangements."[69] To this end, the CPMI sets "global standards and recommendations for the regulation, oversight and practices" of these types of arrangements.[70] Its membership consists of 25 central banks, with senior officials of the member central banks acting as the CPMI representatives.[71] The CPMI standards do not possess a binding legal authority, but are implemented through the members. The primary set of standards promulgated by the CPMI is the Principles for Financial Market Infrastructure (the PFMI), which establishes standards for payment, clearing, and settlement systems.[72]

The CPMI appears to be closely monitoring the development and adoption of blockchain technology, and carefully considering its implications for the global financial system, as well as the CPMI's own role. In a 2015 report, the CPMI noted that the "use of distributed ledgers … could foster disintermediation of traditional service providers," and result in wide-ranging disruptions to the existing financial market infrastructure.[73] The report notes that the technology could especially "challenge the intermediation role …

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[66] *Id.*
[67] *About the BIS – overview*, BANK FOR INTERNATIONAL SETTLEMENTS, https://www.bis.org/about/index.htm?m=1%7C1 (last visited Oct. 14, 2016).
[68] *The BIS*, BANK FOR INTERNATIONAL SETTLEMENTS, https://www.bis.org/about/profile_en.pdf (last visited Oct. 14, 2016).
[69] Committee on Payments and Market Infrastructures (CPMI) – overview, BANK FOR INTERNATIONAL SETTLEMENTS, https://www.bis.org/cpmi/index.htm (last visited Oct. 14, 2016)
[70] *Id.*
[71] *Membership*, BANK FOR INTERNATIONAL SETTLEMENTS, https://www.bis.org/cpmi/membership.htm (last visited Nov. 18, 2016).
[72] *Monitoring the implementation of standards*, BANK FOR INTERNATIONAL SETTLEMENTS, https://www.bis.org/cpmi/info_mios.htm?m=3%7C16%7C599 (last visited Nov. 18, 2016).
[73] DIGITAL CURRENCIES, COMMITTEE ON PAYMENTS AND MARKET INFRASTRUCTURES 15 (Nov. 2015). The CPMI elaborated on blockchain's implications for the global financial markets infrastructure in a 2017 report: "A DLT arrangement may have possible effects on the overall financial market architecture. In some implementations, the arrangement can be seen as more of an incremental upgrade over current arrangements, and one that does not change significantly current business practices. In other implementations, such as an unrestricted arrangement, DLT may lead to disintermediation of certain functions or certain entities. Such a change in business practices may affect

[of] banks," explaining why many banks are aggressively working to co-opt blockchain and preserve their roles.

Similarly, the widespread adoption of blockchain could dramatically reduce the role for central banks—a matter of vital concern to the BIS.[74] As the CPMI notes, "[t]he emergence of distributed ledger technology could present a hypothetical challenge to central banks, not through replacing a central bank with some other kind of central body but mainly because it reduces the functions of a central body and, in an extreme case, may obviate the need for a central body entirely for certain functions."[75] The manner in which blockchains are ultimately adopted will affect the degree to which the roles of central banks are diminished. For instance, if blockchains are adopted in conjunction with digital currencies, the "widespread substitution of banknotes with digital currencies could lead to a decline in central bank non-interest paying liabilities," which could result in "a reduction in central bank earnings."[76] Relatedly, the greater the use of digital currencies, the more "monetary policy may lose efficacy."[77] Though, if blockchains continue to use traditional currencies, central banks will be able to hold onto some of these customary roles. However, regardless of whether blockchains are developed to use digital or traditional currencies, the settling and clearing functions of many central banks will no longer be relevant.[78]

Faced with a threat to their role and influence, central banks have a powerful incentive to carve out a role for themselves in a payments system based on blockchain. This may entail central banks adopting blockchain technology themselves, possibly with a central bank-issued digital currency, an option that a number of central banks are researching.[79] What this would look like is far from clear, and beyond the scope

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the competitive balance in financial markets and have implications for financial market architecture. It may also introduce new, nonbank players that are not currently covered by or contemplated in existing regulatory regimes." DISTRIBUTED LEDGER TECHNOLOGY IN PAYMENT, CLEARING AND SETTLEMENT, COMMITTEE ON PAYMENTS AND MARKET INFRASTRUCTURES 19 (2017), http://www.bis.org/cpmi/publ/d157.pdf.

[74] *Id.* at 16.

[75] *Id.* at 17.

[76] *Id.* at 16.

[77] *Id.*

[78] DIGITAL CURRENCIES, COMMITTEE ON PAYMENTS AND MARKET INFRASTRUCTURES 17 (Nov. 2015) ("[S]ettlement might no longer require a central ledger held by a central body if banks (or other entities) could agree on changes to a common ledger in a way that does not require a central record-keeper and allows each bank to hold a copy of the (distributed) common ledger.")

[79] *See id.* (Nov. 2015); Victoria Cleland, Bank of England, Fintech: Opportunities for all? (Sept. 8, 2016) (Describing how the Bank of England is "undertaking more fundamental long-term research on the wide range of questions posed by the potential of a central bank-issued digital currency (CBDC)").

of this paper, however it is an interesting possibility to contemplate. Alternatively, central banks, perhaps acting through the BIS CPMI, could preserve some influence over the global payments systems by setting standards or regulations for blockchain technology as it relates to payments infrastructure. As previously noted, the widespread adoption of blockchains would have dramatic implications for the global financial system, including the introduction of new risks. As the BIS is concerned with the stability of the global financial system, working to identify, manage, and mitigate the risks posed by blockchain technology is properly within the BIS's scope.

There are significant advantages to network governance that can make it an effective means of addressing global regulatory challenges, and may indicate that the BIS is an effective institution for setting blockchain standards. Networks can offer a means of harnessing public power without some of the encumbrances seen in formal interstate treaty governance, and even domestic governance. These networks provide a continuing forum for negotiating and problem solving, often utilizing informal processes, enabling flexibility and fast responses in addressing regulatory challenges.[80] This flexibility is crucially important when approaching the regulation of a nascent technology such as blockchain, whose standards needs will inevitably change.

Furthermore, the participants of the network, typically national regulators or ministers, work together repeatedly, developing relationships and reputations, which some scholars argue promotes cooperation.[81] Given blockchain's ability to reach across jurisdictions, enabling the cross-border flow of money, goods, and data, its regulation will require cooperative approaches on the part of domestic regulators and officials, something which networks are thought to facilitate.

However, there are also disadvantages to interstate network governance structures. Critics point to the risk of interest group capture and the bargaining power imbalances, where powerful states and economic markets can in effect dictate rules to the rest of the participants. Others point out that establishing separate networks according to issue precludes issue linkages that could facilitate bargaining.[82] Furthermore, while

[80] Stavros Gadinis, *Three Pathways to Global Standards: Private, Regulator, and Ministry Networks*, 109 AM. J. INT'L L. 1–2, 7 (2015).
[81] *Id.*
[82] *Id.* at 7–8.

informality presents advantages, it can present due process deficiencies, and consequently, some networks have adopted formal notice-and-comment type processes to address some of these concerns.[83] These concerns, to the extent they are present in any given network, can serve to undermine the legitimacy of standards and regulations created by the network. If blockchain industry participants do not consider standards created by a network such as the BIS CPMI legitimate, this could undermine voluntary compliance. However, a network such as the BIS CPMI, due to its governmental nature and access to public power, can use various sanctions and coercive measures to compel compliance.

B. Hybrid public-private governance – International Standards Organization

Hybrid public-private governance bodies "combine private and governmental actors."[84] Hybrid bodies vary considerably along a number of dimensions, including the relationship and balance of power between the public and private elements. The ISO—which has created a technical committee on blockchain and distributed ledger technology—is arguably an example of a hybrid public-private institution. It is a non-governmental international organization consisting of a network of 163 national standards bodies (NSBs).[85] It was established in 1947 and charged with the development and harmonization of standards with the goal of "facilitating international exchange of goods and services and [] developing cooperation in the spheres of intellectual, scientific, technological and economic activity."[86] There is only one member per country, and each national standards body represents the ISO in its country.[87] There are three different member categories: full members, correspondent members, and subscriber members, with each category possessing a different level of influence within the organization.[88] The national standards bodies vary; some are private bodies, while others have a more public or governmental nature.[89] Standards Australia, Australia's NSB, is

[83] *Id.*
[84] Benedict Kingsbury, Nico Krisch, & Richard B. Stewart, *The Emergence of Global Administrative Law*, 68 L. & CONTEMP. PROBS. 15, 22 (2005).
[85] *About ISO*, ISO, http://www.iso.org/iso/home/about.htm.
[86] Eran Shamir-Borer, Legitimacy without Authority in Global Standardization Governance: The Case of the International Organization for Standardization (ISO) in Global Administrative Law: The Casebook.
[87] *ISO members*, ISO, http://www.iso.org/iso/home/about/iso_members.htm.
[88] *Id.*
[89] Shamir-Borer, *supra* note 86 ("Many of [the] NSBs, particular those from developed countries, are private entities… [f]or instance, the US representative within ISO, the American National Standards Institute (ANSI), is a private, non=profit organization, consisting of members from both the private sector … and federal governmental agencies. … [But] the vast majority of NSBs that constitute the ISO membership (over 70%), particularly those from

an example of the former, as it is organized as a non-governmental organization and includes members of industry as well as government.[90] Due to this mix of private and governmental influence, ISO can be considered a hybrid body.[91]

ISO standards are issued as recommendations to members, however many have been very effective, being widely adopted by governments, industry, NGOs, and other influential actors.[92] So while ISO standards are not formally mandatory, many have taken on a de facto mandatory character.

The ISO's technical committee on blockchain was established in 2016.[93] The committee's scope is the "[s]tandardization of blockchains and distributed ledger technologies to support interoperability and data interchange among users, applications and systems."[94] The effort is to be led by Standards Australia, and will include 35 other ISO members, including major players such as the U.S., the U.K., Germany, and Japan.[95] The inaugural ISO blockchain standards meeting was held in Sydney in April of 2017.[96] This move to establish a technical committee can be understood as ISO's attempt to insert itself into the process of blockchain development.

In its proposal, Standards Australia stated: "ISO has the opportunity to take the global lead in this emerging area of standards development similar to the approach previously taken in standardising banking messages."[97] This statement emphasizes the important role that ISO standards play in the global financial system, particularly ISO 20022, which serves as "common 'language' for all financial communications,

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developing countries, are governmental in nature (either governmental departments or autonomous governmental bodies).")

[90] *About Us*, Standards Australia, http://www.standards.org.au/OurOrganisation/AboutUs/Pages/default.aspx.

[91] Shamir-Borer, *supra* note 86 ("Given [the] duality in ISO's organizational character, it is not surprising that, while some scholars have classified ISO as a private body, others have included it in the constantly expanding category of "hybrid" bodies; that is, both intergovernmental and non-governmental.")

[92] *Id.*

[93] ISO/TC 307 Blockchain and electronic distributed ledger technologies, ISO http://www.iso.org/iso/home/standards_development/list_of_iso_technical_committees/iso_technical_committee.htm?commid=6266604.

[94] *Id.*

[95] ISO Appoints Australia to Take Global Lead on Blockchain Standards, https://www.cryptocoinsnews.com/iso-appoints-australia-take-global-lead-blockchain-standards/

[96] Media Release, Standards Australia (March 2, 2017), http://www.standards.org.au/OurOrganisation/News/Documents/Media_Release_Blockchain_Report_2_March_2017.pdf.

[97] BLOCKCHAIN & ELECTRONIC DISTRIBUTED LEDGER TECHNOLOGIES, STANDARDS AUSTRALIA 4, http://www.standards.org.au/OurOrganisation/Events/Documents/Blockchain%20NFTA%20Information%20Sheet.pdf.

whatever the business domain, the communication network and the counterparty (other financial institutions, clients, suppliers and market infrastructures)".[98] Given this successful history of developing widely adopted standards, ISO possesses a high degree of credibility.

Hybrid public-private bodies have been effective in a number of different spheres, especially when there is a need for public-private cooperation in furtherance of some common goal.[99] The creation of these hybrid bodies is often "triggered by the need to increase the effectiveness, legitimacy, or accountability of the global regimes to which these bodies belong."[100] The bringing together of public and private power can enable the accumulation of greater resources and expertise, and can facilitate the involvement of various affected parties.[101] ISO, for example, presents a formalized process for the development of standards that seeks to involve a wide range of stakeholders so that resulting standards are perceived as legitimate, and thus widely accepted and adopted.[102] Within the context of blockchain, a hybrid body such as ISO has the capacity to facilitate a multi-stakeholder approach to setting standards—one that incorporates the expertise, experience and perspectives of actors from government, the tech industry, and financial institutions—in the hopes of producing effective standards. Hybrid bodies are also thought to "achieve a higher degree of efficiency, as [they] make possible a range of different institutional tools and mechanisms."[103] As stated in the previous subsection, a flexible and innovative approach to standard-setting is important for dealing with a complex and rapidly changing technology such as blockchain.

However, there are also drawbacks to hybrid organizations. There can be difficulty balancing the interests and power of the public and the private elements. Additionally, there may still exist due process concerns, such as the greater influence that NSBs from developed countries often enjoy in ISO's standardization process. While there are multiple reasons for this disparate influence, one is that

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[98] *ISO 20022 Universal financial industry message scheme*, ISO, https://www.iso20022.org/faq.page.
[99] Lorenzo Casini & Giulia Mannucci, *Hybrid Public-Private Bodies within Global Private Regimes: The World Anti-Doping Agency (WADA)*.
[100] Lorenzo Casini, *"Down the rabbit-hole": The projection of the public/private distinction beyond the state*, 12 INT'L J. CONSTITUTIONAL L. 402 (2014).
[101] *Id.*
[102] Shamir-Borer, *supra* note 86 ("[M]uch of the design of, and changes in, ISO's standardization procedures can be explained as part of its efforts to gain and maintain the legitimacy granted by various stakeholders on whose support ISO is dependent for its success.")
[103] Bruno Carotti & Lorenzo Casini, *A Hybrid Public-Private Regime: The Internet Corporation for Assigned Names and Numbers (ICANN) and the Governance of the Internet*.

membership in some ISO organs, including the Technical Management Board, which counts among its responsibilities setting procedures for the standardization process, is determined according to the "financial strength of NSBs' home countries".[104] These drawbacks, while certainly not fatal to a hybrid body such as ISO's ability to generate effective standards, are important to take into account.

C. Private governance – Industry organizations

Private governance exists when "regulatory functions are carried out by private bodies."[105] Several private blockchain bodies have emerged to claim governance power through standards development. A number of global banks, including Bank of America Merrill Lynch, Santander, and Royal Bank of Canada, among others, have established "the first interbank group for global payments based on distributed financial technology."[106] Called the Global Payments Steering Group (GPSG), the organization will "oversee the creation and maintenance of Ripple payment transaction rules, formalized standards for activity using Ripple, and other actions to support the implementation of Ripple payment capabilities."[107] The GPSG represents a private, industry-led effort to develop common rules and standards for the use of blockchain technology to make payments.

R3 represents another private group seeking to exert regulatory power over the use of blockchain in the financial services industry. R3 is a consortium of more than seventy financial institutions working to "design and deliver advanced distributed ledger technologies to the global financial markets."[108] Additionally, it seeks "to establish consistent standards and protocols… in order to facilitate broader adoption and gain a network effect."[109]

Private bodies can successfully tackle regulatory challenges by "accumulat[ing] highly specialized knowledge and experience," and "profitably metaboliz[ing] these skills in high professionalism and

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[104] Shamir-Borer, *supra* note 86.
[105] Benedict Kingsbury, Nico Krisch, & Richard B. Stewart, *The Emergence of Global Administrative Law*, 68 L. & CONTEMP. PROBS. 15, 22 (2005).
[106] *Major Banks Launch Global Payments Steering Group*, BUSINESS WIRE (Sept. 23, 2016 9:00 AM), http://www.businesswire.com/news/home/20160923005192/en/Major-Banks-Launch-Global-Payments-Steering-Group.
[107] *Id.*
[108] *About R3*, R3CEV, https://r3cev.com/about/ (last visited Oct. 16, 2016.
[109] R3 Press Release (Sept. 15, 2015), http://static1.squarespace.com/static/55f73743e4b051cfcc0b02cf/t/55f8119ce4b0550fcc16d156/1442320796627/PRESS+RELEASE+Global+banks+form+partnership+with+R3+-+FINAL.pdf.

resourcefulness in the context of concentrated industry efforts."[110] Industry participants, as those actually developing and implementing blockchain, are arguably most familiar with its standards needs and how best to meet these. However, there can be problems holding private regulatory regimes accountable.[111] The de facto regulatory activities of private bodies can produce "significant externalities for third parties," which may go unchecked without due process procedures.[112]

6. Which Type of Regime Will Dominate?

The previous section, which considers only a sample of organizations with the potential to set standards, demonstrates the fragmentation of the current blockchain landscape. If blockchain is to continue to develop and ultimately be implemented in the cross-border payments world, one, or more likely, several, of these candidates will need to emerge as the dominant standard-setter.

Due to the wide variety of standards that are required and the different issues they implicate, it is unlikely that just one organization will develop all blockchain standards. This is because, in part, different types of standards demand varying levels and types of expertise. Furthermore, different standards implicate a diverse interests and incentives. This will be further discussed in the following subsections.

A. Technical standards

In developing technical and performance standards, it is likely that modes of private governance will dominate—either through a purely private or a private-public hybrid body. This can be attributed to several factors: the concentrated expertise of private industry and the credibility it lends, a long history of private governance in the payments sphere, and the coordination game presented by blockchain development.

For standards to be effective, industry participants, developers, and other key stakeholders must consider them credible. A high degree of expertise and reputational capital is often key to the success of a standards regime.[113] This makes intuitive sense; those with technical expertise and experience will best be able to identify where standards are needed, evaluate the range of options, and make a technically logical

[110] Orfeas Chasapis-Tassinis, *ISDA's Private Governance Scheme in the Credit Derivatives Market* 1.
[111] A. Claire Cutler, *Private International Regimes and Interfirm Cooperation* 24 in The Emergence of Private Authority in Global Governance. ("[E]fforts to hold private institutions accountable in any democratic way are bound to flounder, for that which goes unrecognized is difficult to regulate.")
[112] Chasapis-Tassinis, *supra* note 110, at 1.
[113] See the example of ISDA, discussed in greater detail in the following subsection.

choice. When industry participants trust the expertise of the standard-setter, they are more likely to adopt and adhere to the standards. Industry groups such as GSPS, composed of blockchain developers as well as financial services professionals, can best claim this expertise. However, ISO may also be able to claim a high degree of credibility and expertise, given its successful history of developing effective standards for both the tech and financial services worlds.

There is a long history of private governance in major domestic and the cross-border payments systems. At the domestic payment level, the development of automated clearinghouse systems was largely an exercise in private governance.[114] In the United States, "[c]ollective self-governance through the National Automated Clearing House Association (NACHA) and its regional affiliates is a model of private law operated as a public-private partnership."[115] At the international level, SWIFT is the primary example of private governance.

Beyond the payments system, some point to a broader trend of increasing space for the emergence and domination of private governance regimes: "In many states, the privatization of government activities, the deregulation of industries and sectors, increased reliance on market mechanisms in general, and the delegation of regulatory authority to private business associations and agencies are expanding the opportunities for the emergence of private and self-regulatory regimes."[116] This trend may well be reflected in a future blockchain standards regime.

Perhaps most importantly, the need for technical and performance standards presents a coordination game, and thus provides a powerful incentive for cooperation within the industry. As previously discussed, if incompatible blockchains are developed, that is, if separate blockchains are unable to communicate and transact with each other, then there will once again be a need for trusted intermediaries. If Payer and Payee hold accounts with two different banks and those banks are part of two different, incompatible blockchain networks, Payer and Payee will not be able to directly transact. Rather, there will need to be a trusted intermediary, in the vein of correspondent banking, which would entail increased time and cost.

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[114] *Apple Pay, Bitcoin, and Consumers* at 1496.
[115] *Id.*
[116] A. Claire Cutler, *Private International Regimes and Interfirm Cooperation* 23 in The Emergence of Private Authority in Global Governance.

Consequently, the actors using blockchain for payments are involved in a "dilemma[] of common aversion," that is, they must "coordinate their policies by agreeing on some set of rules or conventions, to avoid mutually undesirable outcomes."[117] The undesirable outcome in the blockchain context would be multiple, incompatible procedures for making transfers over blockchain, which would rob the technology of some of its efficiency. Once a set of standards or rules is agreed upon, the actors will reach a state of Nash equilibrium, and will no longer have an incentive to defect.[118] Assuming a common set of standards and operating procedures are agreed upon, the actors using blockchain would have no incentive to deviate and use different procedures or standards, as doing so would only increase costs.

As one report puts it, "interoperability will be a commercial imperative…."[119] Given that the success of blockchain in the payment sphere is arguably contingent on interoperability, there will be strong incentives for industry participants to adhere to common technical standards once they are developed. Consequently, there will not be a great need for monitoring or enforcement mechanisms to ensure compliance. Industry groups tend to be effective standard-setters in situations presenting coordination games, because they bring technical expertise and industry credibility, and need not overly worry about defection.[120] This contrasts with games, such as the Prisoners' Dilemma, where there are significant incentives to defect, causing monitoring and enforcement mechanisms take on greater importance. [121] In such situations, the ability to marshal public power is more advantageous.[122]

The Internet Engineering Task Force (IETF) presents an example of an effective private standard-setter. The IETF is an informal, "international community" of actors "concerned with the evolution of the Internet architecture and the smooth operation of the Internet."[123] It is a "loosely self-organized group" and "the principal body engaged in the development of new Internet standard specifications."[124] The IETF identifies technical problems in the Internet, and develops protocols and specifications to solve these

[117] Stephen D. Krasner, *Global Communications and National Power: Life on the Pareto Frontier*, 43 World Politics 336, 338 (1991).
[118] *Id.* at 338.
[119] THE MISSING LINKS, *supra* note 4, at 19.
[120] See the discussion of ISDA in the following subsection.
[121] Duncan Snidal, *Coordination versus Prisoners' Dilemma: Implications for International Cooperation and Regimes*, 79 AMERICAN POLITICAL SCIENCE REVIEW 923, 926–927 (1985).
[122] *See id.*
[123] *About the IETF*, IEFT, https://www.ietf.org/about/ (last visited Sept. 25, 2017).
[124] P. Hoffman & S. Harris, *The Tao of IETF*, 4 (Sept. 2006).

problems, many of which become industry standards through widespread adoption.[125] The IETF is entirely private—it is composed of a small secretariat and volunteers, without any rules of membership or national representation.[126] The success of the IETF in promulgating protocols and specifications that go on to be adopted as industry standards demonstrates the feasibility of industry-driven private governance in certain situations. The IETF concentrates expertise and industry credibility to produce standards that solve technical problems in the Internet, and thus industry participants often have significant incentives to adopt these standards, and few to defect. Consequently, the absence of a central enforcement authority does not hinder the development of effective standards.

Complicating the analysis, however, is the likelihood that any given standards regime in the blockchain sphere will entail distributional consequences. Some actors will benefit more from one standards regime than another. In a coordination game where the actors are "indifferent about where they match," coordination involves little more than "communication and common sense."[127] Coordination becomes more difficult, however, when "actors have a strong desire to coordinate but some differences over exactly where to coordinate."[128] The blockchain standards ultimately agreed on will inevitably favor some actors more than others, and so blockchain stakeholders will disagree on the "cooperation point."[129] Depending on the perceived magnitude of these consequences, competition over which standards regime is chosen will be more or less intense. When distributional consequences are sufficiently significant, actors may block the adoption of cooperation points they perceive as less advantageous, or even "upset prevailing coordinated outcomes in an attempt to institute a movement to other conventions which are more favorable to them."[130] While coordination games are typically self-enforcing, the presence and scale of these distributional consequences may create more need for a centralized authority to aid in the formation of and adherence to blockchain standards. This remains something of an open question, as it is difficult to predict at this early

[125] *Id.*
[126] *Id.* at 11. Most volunteers work in the industry, especially in networking hardware and software vendors, and so have a keen interest in following and influencing the work of the IETF. Academics also make up a significant portion of the volunteers. *Id.* at 19. See Jeanette Hoffman, *Internet Governance: A Regulative Idea in Flux*, 4, available at https://duplox.wzb.eu/people/jeanette/pdf/hofmann_internet%20-governance_en2007.pdf.
[127] Snidal, supra note 121, at 931.
[128] *Id.* at 936 (in a long duration game such as the development of a system of standards, the actors will "be more concerned with the exact distributional consequences of particular coordination outcomes").
[129] *Id.* at 932.
[130] *Id.* at 936.

stage precisely what these distributional consequences will be, and how strongly they will influence blockchain stakeholders.

Also important to note, is the debate within the blockchain community concerning the best time to develop technical standards. Some clearly believe there is value in promptly commencing the standards development process, as evidenced by the creation of industry groups such as R3 and GSPS, and ISO's technical committee on blockchain.[131] Proponents of early standardization push back on the argument that early standardization will stifle innovation by pointing to the examples of the Internet: "If you compare blockchain development with that of the Internet, we are at the same moment when email standards were starting to be developed."[132] But there are also voices protesting this standardization effort, believing it is premature and will stifle innovation. A study consisting of interviews with developers, financial services professionals, and other stakeholders,[133] yielded a "consensus [] that technical standards dealing with performance, taxonomies and interoperability will emerge naturally," and if standards are formalized too soon, "innovation will be stifled and smaller developers will be driven out of the market."[134] As one developer put it: "Dinosaurs (large developers) love standards as they act as fences to keep the small mammals (innovative start-ups) out of their walled gardens."[135] This is an interesting dynamic, which may suggest some distributional consequences not necessarily related to the content of the standards, but rather to their timing.

Regardless of when technical standards ultimately emerge, it appears likely that either industry groups, ISO, or a combination of the two will take the lead. Given the necessity of expertise, the history of private governance in the payments system, and the coordination game presented by technical blockchain standards, a private industry group or a private public hybrid body such as ISO would be well positioned to set technical blockchain standards. However, to the extent that there are strong distributional consequences attached to

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[131] *See also* https://www.finextra.com/blogposting/13114/blockchain-and-standards-first-things-first ("There is growing belief that interoperability between different protocols is the key to unlocking the potential of blockchain. Interoperability and data interchange among users, applications and systems globally are needed to allow broader acceptation of blockchain in the financial industry. There is a growing consensus that common industry standards and protocols will be essential. Financial firms will need access to standardised data and platforms to realise the full benefits of this technology in terms of speed, efficiency and cost savings.")
[132] Katherine Heires, *Blockchain: Standards Wanted*, http://www.conatum.com/presscites/GARPBlkStds.pdf.
[133] THE MISSING LINKS, *supra* note 4, at 10–11.
[134] *Id.* at 42.
[135] *Id.*

any given standards regime, there may be more need for the centralized authority and enforcement capabilities of public governance.

B. Governance and liability standards

Private governance will also likely play a large role in the development of governance and liability standards. Similarly to technical standards, these can also be conceived of as a coordination game. Failing to develop any standards relating to the governance of blockchain and liability will result in uncertainty, which could slow blockchain's adoption. If each blockchain possesses a different governance structure and liability rules, consumers may be uncertain of their rights, and hesitate to use the technology.

The emerging blockchain market and its governance and liability standards needs is in many ways similar to the over-the-counter (OTC) derivatives market. The various participants in the OTC derivatives market stood to gain from the standardization of contract terms, and so the International Swaps and Derivatives Association (ISDA) emerged to address this coordination game.[136] Until 1984, each derivative contract was individually negotiated, resulting in high transaction costs, legal uncertainty, and a "general feeling within the industry… that contract fragmentation was holding the market back."[137] In response, a group of leading financial institutions representing 80% of the swap market organized ISDA.[138] ISDA exhibited sufficiently strong network effects to attract the participation of more and more market players, ultimately to become the undisputed dominant institution.[139] Today, ISDA develops standardized documentation and contracts for various derivative instruments and addresses "industry-wide technical issues within the OTC derivatives market."[140]

Both cases present coordination games. In the case of ISDA, market participants realized that mutual gains to be realized through standardization were significant enough to induce cooperation. Similarly, those involved with blockchain technology realize the benefits to be gained from some degree of standardization, as evidenced by the creation of organizations like R3 and GSPS. ISDA's success can be attributed in part to

[136] Chasapis-Tassinis, supra note 110 at 1.
[137] *Id.* at 3.
[138] *Id.* at 3–4.
[139] *Id.* at 5.
[140] *Id.* at 16.

its "reputational capital with the industry" and "its virtually monopolistic market share."[141] The private groups developing blockchain technologies and standards have the potential of a similar reputational capital, as these groups tend to include leading financial institutions and tech developers, resulting in high concentrations of expertise. While no private blockchain group can yet claim market dominance, if one can gain sufficient market share, it could conceivably dominate the development of standards relating to governance and liability (and perhaps technical standards as well).

It is important to note that some of these standards may also have significant implications for issues within the traditional province of public governance actors, including the amount of risk borne by consumers versus blockchain managers relating to errors, and how data on the blockchain may be seen and used. While those adopting blockchain may be tempted to implement rules that are highly favorable to financial institutions at the expense of consumers, such a move could attract the interest of government regulators concerned with consumer protection. As such, if industry groups take the lead in developing governance and liability standards, it may be prudent to adopt standards that are reasonable towards both parties.[142]

C. Compliance standards

It is likely that public officials will be intensely interested in blockchain's compliance with existing global financial regulations. Given the global security interests that these regulations touch and the existence of entrenched network governance in these sphere, the development of these standards poses a significant possibility for public governance influence.

These global financial regulations, including know your customer, anti-money laundering, and countering the financing of terrorism are already an area where network governance dominates. The Financial Action Task Force (FATF) is a network of "officials from finance ministries, justice ministries, banking and securities regulators, police forces, and other government departments."[143] The FATF

[141] *Id.* at 7.
[142] This idea is further developed in the following section.
[143] Gadinis, supra note 80, at 29.

developed and updates the 40 Recommendations, which "lay out a set of measures national governments can take in order to detect and prevent money laundering" and terrorist financing more effectively.[144]

Unlike technical standards, these global regulations do not present a coordination game. Rather, the goals of the FATF and regulations such as know your customer are blocking the financing of terrorism and drug trafficking, which are global public goods. Given the cost of putting the necessary procedures in place, the potential gains from non-compliance, and the nonexcludability of the goods, there are considerable incentives to free ride and defect. Consequently, networks such as the FATF play an important role in ensuring compliance by raising the cost of defection through sanctions such as blacklists.[145]

There is arguably another global public good at stake as blockchain develops: the security and stability of the global payments system. While blockchain presents significant benefits for global payments, it is a new technology, and presents both known and unknown risks. Consequently, widespread adoption of blockchain without a careful consideration of how to prevent, manage, and mitigate systemic risks, would endanger the public good of stability in the payments system. The BIS CPMI is explicitly charged with promoting the "safety and efficiency of payment … thereby supporting financial stability and the wider economy," and so managing the risks associated with blockchain through standards is directly within the CPMI's wheelhouse.[146] Furthermore, because the role of central banks in cross-border payments will likely be diminished if blockchain is widely adopted,[147] the BIS may be motivated to carve out a role for themselves in a new blockchain-based payments infrastructure. Consequently, it is not unlikely that the BIS CPMI will insert itself into the blockchains sphere by developing standards relating to the management of systemic risk.

Private industry typically wants to minimize the role of public regulators; preferring the space to maneuver unencumbered by formal regulation. As such, blockchain industry groups may choose to self-regulate in an attempt to stave off public regulation. To this end, a private industry group could follow the

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[144] *Id.*

[145] Michael Findley, Daniel Nielson & J. C. Sharman, Orchestrating the fight against anonymous incorporation: a field experiment 286.

[146] *About the BIS – overview*, BANK FOR INTERNATIONAL SETTLEMENTS, https://www.bis.org/about/index.htm?m=1%7C1 (last visited Jan. 14, 2016).

[147] *See supra* notes 75–78 and accompanying text.

lead of ISDA, and aggressively focus on "preempting or influencing public regulation."[148] To protect its dominant role in the industry, ISDA has been responsive to the concerns of public regulators, at times preemptively adopting regulatory measures to prevent public interference. A prime example of this was ISDA's promulgation of the Big Bang Protocol in response to the Working Group on Financial Markets' recommendation that derivative documentation be amended to provide for cash settlement.[149] Private blockchain industry groups could conceivably adopt standards relating to systemic risk or pertaining to compliance with anti-money laundering measures so that networks of public officials such as the BIS or the FATF do not feel the need to intervene.

While self-regulation is a possibility, given the high stakes – the public goods of financial stability and blocking terrorism and drug-trafficking financing are highly valued – it seems likely that government regulators will ultimately develop standards (if not binding regulations) pertaining to blockchain. Given the effectiveness of networks in tackling other global financial challenges, it is probable that one of these networks, be it the FATF, the BIS CPMI, or some other body, will emerge as a blockchain standard-setter.

7. Conclusion

It is important to emphasize that blockchain technology remains in its infancy. And as such, while it seems undeniable that blockchain will have an enormous impact on society, the precise ways and manners in which it is ultimately applied remain unclear. This is especially true with respect to the payments system, where blockchain could be incorporated into the current system in various ways, or could even replace the existing infrastructure. This paper focuses on one possibility: financial institutions adopting blockchain technology to eliminate the intermediaries and other inefficiencies in the current infrastructure.

As a number of financial institutions are at advanced stages of development or even starting to put blockchains into practice, this possibility seems likely to come to fruition. As such, this paper argues that an essential part of continuing the development and application of blockchain is the developing of blockchain standards. These standards are broadly conceptualized as technical standards, governance and liability standards, and compliance standards. This paper examines several bodies that could serve as blockchain

[148] Chasapis-Tassinis, supra note 110, at 1.
[149] *Id.* at 29.

standard-setters, considering them in relation to the GAL typology of global administrative bodies. It concludes that private or private-public hybrid organizations are likely to dominate to setting of blockchain technical standards as well as governance and liability standards, in large part due to the coordination game these aspects of blockchain raise. However, depending on the magnitude of distributional consequences attached to proposed standards regimes, the ability of private actors to develop common standards autonomously may be compromised. Further, this paper finds that blockchain implicates certain public goods, and to this extent, regulatory networks may intervene.

As blockchain technology continues to develop and evolve, its standards needs may change and grow. The bodies best suited to address these standards needs may change as well. This paper seeks to provide a jumping off point for understanding the global administration of blockchain as it relates to the cross-border payments system.