AKILLI SÖZLEŞMELERDEN DOĞAN ANLAŞMAZLIKLARDA KULLANILAN UYUŞMAZLIK ÇÖZÜM YÖNTEMLERİ ÜZERİNE BİR ELEŞTİRİ

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ÖZ

Blockchain teknolojilerinin kendine özgü merkezi olmayan doğası, yatırımcıları uluslararası tahkime yönlendirmektedir. Ancak bu durum akıllı sözleşmeden doğan anlaşmazlık üzerine tahkimin nasıl yürütüleceğine dair daha fazla analiz yapılmasını gerektirmektedir. İşbu makale, geleneksel tahkim kurallarının, akıllı sözleşmelere dayalı ticari işlemlerden doğan uyuşmazlıkları çözmek için uygun hale getirilmesini önermektedir. Bu amaçla, mevcut akıllı sözleşmelere dayalı ticari işlemlerden doğan uyuşmazlık çözüm yöntemleri, ya akıllı sözleşmelere tahkim kurallarının ekleyerek ya da akıllı sözleşme uyuşmazlıklarının tahkimi konusunda uzmanlaşmış bir tahkim kurumu oluşturularak geliştirilmelidir. Alternatif olarak, blockchain platformlarında akıllı sözleşmelerle ticari islem yapan piyasalar için yine aynı şekilde merkezi olmayan bir tahkim sistemi düşünülmelidir.

Anahtar Kelimeler: *Akıllı sözleşmeler, Blockchain, Bitcoin, Kripto para, Uyuşmazlık çözümü, Uluslararası tahkim.*

Jel Kodları: K11, K12, K33

A CRITIQUE ON CURRENT DISPUTE RESOLUTION METHODS OF SMART CONTRACT DISPUTES

ABSTRACT

The unique decentralized nature of blockchain technologies leads investors to international arbitration. However, lingering issues necessitates further analysis regarding how arbitration should be conducted on a smart contract-based dispute. To this end, this study proposes that traditional arbitration rules should adjust to be suitable to resolve disputes arising from smart contract transactions. Current smart contract dispute resolution methods should also evolve by either implementation of arbitration rules in the smart contracts on the blockchain, or development of a blockchain based arbitration institution specialized in

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arbitration of smart contract disputes. In the alternative, a completely decentralized arbitration system should be considered for the resolution of decentralized markets dealing with smart contracts on blockchain platforms.

Keywords: *Smart contracts, Blockchain, Bitcoin, Crypto currency, Dispute resolution, International arbitration.*

JEL Codes: K11, K12, K33

1. INTRODUCTION

Ashley from United States and Ben from Uganda enter into a Smart Contract[1] whereby the parties agree to exchange goods for crypto currency on a blockchain platform. A dispute arises because either the conditions of the smart contract are not met, or there is no payment. In such case, courts may not be able to do a reasonable human interpretation of the smart contract at issue since the agreement is written in coding language.

Originally, when computer scientists first proposed the idea of blockchain, they assumed that there would be no need for dispute resolution mechanisms because blockchain and smart contracts would eliminate the disputes altogether (Szabo, 1996).[2] An intangible marketplace free of conflicts was thought possible based on (1) the idea that that the parties to a smart contract would treat each other nicely as pairwise individuals, and (2) the terms of the agreement, resulting from a bargaining process, are automatically implemented in a decentralized manner, as defined below, once the conditions agreed upon are fulfilled. Smart contracts disputes, however, are commonplace (Werbach, 2017: 313).[3]

As technology evolves, blockchain technology is becoming widespread and popular, touching many industries, economic sectors, and professional fields, including law. It is, therefore, crucial to develop legal platforms where the parties identify, at the outset of the smart contract, the available and applicable dispute resolution mechanisms.

The unique decentralized nature of blockchain technologies leads investors to international arbitration (Rogers, 2018), thus, several third-party companies and blockchain platforms are developing arbitration protocols that parties to a smart contract can include as part of the code of such smart contracts. However, lingering issues necessitate further analysis regarding how arbitration should be conducted, whether the parties consent to arbitrate is required, designation of seat, arbitrator's qualifications, etc.

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[1] A smart contract is merely a piece of software code.
[2] When Nick Szabo invented the original smart contract in 1996, he failed to include dispute resolution mechanisms.
[3] Disputes result from formation errors, lack of meeting of the minds, consideration, capacity, legality.

This paper presents a basic critique and points out the deficiencies of the current smart contract dispute resolution methods. The purposes of this study are threefold. The first is to provide a brief historical background of blockchain development and to explain types of blockchain platforms. The second purpose is to give a brief explanation on crypto currency, smart contracts, current smart contract dispute resolution methods, and to outline the advantages of arbitration for smart contract transactions. The last purpose is to present a critique on current smart contract dispute resolution methods and to propose feasible solutions to said deficiencies to better facilitate smart contract transactions.

2. OVERVIEW

2.1. Historical Background

In 1929, the world witnessed widespread economic distress resulting from industrial stagnation which lasted approximately 10 years. The market crashed and the need for legal certainty emerged. Consequently, new protectionist regulations were enacted subjecting companies to comprehensive disclosures.[4]

In 1980s through liberalization and with the innovation of computers, manual information processing virtually disappeared. Automation enabled bankers and analysts to process and transmit data inexpensively and fast. Legislators acknowledged that legal certainty does not require imposing unnecessary regulatory burdens on investors (Brummer, 2019: 235 -258).

In 1991,[5] the U.S. real estate market collapsed lasting approximately 6 years to recover (Wheaton, 2008). The Finnish and Swedish economic crises followed (Miyagawa, 2009). In 2008, the real estate market collapsed again due to an overly aggressive, unregulated market (Brummer, 2019: 235 -258). Disillusioned by the cyclical inefficiency of traditional markets, Satoshi Nakamoto, developed Bitcoin blockchain and its white paper. Nakamoto propounded a decentralized system which would not use state sponsored currencies. Nakamoto proposed to break free from the traditional banking systems to avoid cyclical debacles and allow users to trade without relying on centralized laws and authorities, while replicating the use of today's deeds and public records office.

2.2. Blockchain

In the traditional database systems, the stored information may be hacked and copied. For example, in our sample fact pattern, Ashley stores a digital representation of a 10-dollar bill in a computer[6] to prove that the 10-dollar bill belongs to her. The potential issue here is that the digital representation of a 10-dollar bill in a computer can be copied easily. Ashley can make a copy of the digital representation of the 10-dollar

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[4] An example of the protectionist regulations would be Securities Act of 1933 and Securities Exchange Act of 1934.
[5] In 1991, Stuart Haber and Scott Stornetta described the first cryptographically secured chain of blocks that included time stamps.
[6] Traditionally, this could be done using a "database" software that allows easy querying and retrieval of digitally stored information.

bill stored in the traditional database, transfer the 10-dollar bill to Ben, and transact the same 10-dollar bill with other buyers. This double transacting defeats the asset value and undermines intangible asset transactions while bolstering the idea that physical transactions are safer due to anti-forgery regulations.[7]

Nakamoto's breakthrough addressed how to prevent digital money forgery and database copy prevention.[8] First, Nakamoto proposed a public ledger where investors have constructive notice that, for instance, in our fact pattern, Ashley gave the 10-dollar bill to Ben. Consequently, if Ashley or a third-party attempt to copy the 10-dollar bill and transfer to a third party bona fide purchaser, Cedric, investors with access to the ledger can notice the fraud and invalidate the latter transaction (Krishnamachari Interview, 08.04.2019). The proposed public ledger is a time-stamped recording system that gives constructive notice to the public of recorded interests on recorded assets. Through the public ledger, all blockchain investors can determine whether Ashley owns the 10-dollar bill or has transferred ownership (Krishnamachari Interview, 08.04.2019).

Second, Nakamoto proposed a cryptography system ("Crypto System"). Pursuant to the Crypto System, users are provided with a key pair: a private key and a public key. Through the Crypto System, in our example, Ashley can store and encrypt an asset using her private key. The encrypted information can only be decrypted using her public key. While the private key stores and encrypts the information, the public key detects that only Ashley could store and encrypt the asset at issue. In this system, Ashley cannot deny that she stored and encrypted the information because there is only one private key associated to her and to her public key (Krishnamachari Interview, 08.04.2019).

The Crypto System works as an authentication system because only a public key linked to a specific private key can decrypt information initially encrypted by the associated private key. Basically, Ashley can assert ownership of the stored and encrypted asset because only she has access to her private key. Other investors have notice of Ashley's ownership because they have access to Ashley's public key, which is associated to her private key (Krishnamachari Interview, 08.04.2019).

While the private key's secrecy is critical for security purposes, the public key's publicity is crucial to facilitate deals. Ashley is encouraged to make copies of her public key and give it to other blockchain

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[7] Digital assets are anything that does not exist in the physical world but described by set of bits. For example, a physical asset like a car and the ownership document of the car can be digitized. Record of ownership rights can be held by a government agency. Blockchain users can give notice of ownership to all other blockchain users by creating a record indicating a unique identification number, like a car's VIN, and the owner's address. A smart contract allows users to compile and upload terms of agreements into blockchain. A smart contract uploaded onto blockchain no longer runs in the creator's computer. It runs on every computer user registered on blockchain. Simultaneous execution is possible and no user, including the creator, can manipulate the terms of the agreement. Given the extensive amount of information on record, dealing with blockchain requires powerful software at a premium. Mining is the process by which blockchain grants new users an initial balance upon registration. Mining purports to incentivize more users to join the platform.

[8] This is called "double spend problem."

investors. The more people have her public key, the safer her transaction will be (Krishnamachari Interview, 08.04.2019). In other words, blockchain investors strive to keep the private key as secured as possible and to share the public key as much as possible with any potential blockchain investor. All blockchain platforms[9] use this approach.[10]

Parties may reveal their identities on blockchain if they wish to do so. This function stems from the differences between permissioned blockchain v. permissionless blockchain platforms (Krishnamachari Interview, 08.04.2019).

2.2.1. Permissioned blockchain (aka private/social blockchain)

On a permissioned blockchain platform, there is an identity management system where parties can access the blockchain network if they, at the outset, agree to reveal who they are. This means users of a permissioned blockchain platform are required to reveal their identities to join the blockchain. By doing so, every address created by private keys would be associated with an individual or organization (Krishnamachari Interview, 08.04.2019).

2.2.2. Permissionless blockchain (aka public/open blockchain)

On a permissionless blockchain platform, blockchain users are unaware of who the parties are. Users, however, can voluntarily choose to reveal their identities by building a smart contract that indicates the party identification.[11]

2.3. Crypto Currency[12]

Crypto currencies are digital cash that can be traded and stored. Today, the largest—and most widely known—crypto currency is Bitcoin,[13] invented in 2009.[14] Though over 900 different digital currencies teem the crypto currency market, Bitcoin represents a little less than a half the world's total crypto currency value (Maynard, 2017). Other popular crypto currencies are Ethereum,[15] Litecoin, Dogecoin, to name a few. Each crypto currency is unique and based on a different blockchain technology platform (Givari, 2018).

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[9] Bitcoin, Ethereum, Hyperledger Fabric, Litecoin, Dogecoin, OpenBazaar, etc. are popular blockchain platforms.

[10] The public key is used on the blockchain as the address of the party. When a user sends some bitcoin to another user, the transaction as stored in the ledger would show the public keys of the key pairs, for both the sender and the receiver.

[11] For instance, while Ethereum is typically permissionless blockchain, the smart contracts thereon can be created on a permissioned basis as well. Another example is Bitcoin which is permissionless blockchain only. There is another blockchain protocol called Hyperledger Fabric, which is only permissioned meaning the users could not use it in a permissionless manner.

[12] In this paper, cryptocurrency will be referred as Bitcoin representing other cryptocurrencies as well.

[13] Like securities' initial public offering, bitcoin currencies are also released to public through Initial Coin Offering ("ICO"). Like, securities' initial public offering including model arbitration clauses, ICOs can also include model cryptocurrency arbitration clauses.

[14] Bitcoin is a blockchain primarily for crypto currency transfers. Users can run very limited types of smart contracts on Bitcoin blockchain by using scripts. Scripts are used in Bitcoin coding languages.

[15] Ethereum is a platform for both crypto currency and smart contracts. In practice, when users of a blockchain want to write a smart contract, they typically use Ethereum blockchain.

Crypto currency uses Crypto System to link the user's identity to the digital system in a verifiable fashion associates the key pair, as explained above. Bitcoin blockchain creates a platform where the Bitcoin investors identify themselves with alphanumeric Bitcoin addresses, created using user's public key. Crypto currency systems recognize neither humans nor corporations. Therefore, transactions take place among addresses, not human names.[16]

Whenever a crypto currency transaction happens, said "transaction is verified, confirmed, and stored on a cryptographically secure public ledger—or "block"—that is linked to the preceding block, thus, creating the blockchain" (Arbitrationblog, 2017). Crypto currency transactions are not only faster, and simpler, but also far cheaper than compared to many traditional payment systems.[17] Therefore, trading between crypto currencies has grown to more than US$2 billion dollars per day. For instance, nowadays some international law firms agree to accept crypto currency payments in exchange for legal services (Velez interview, 27 March 2019).

2.4. Smart Contract

Smart contracts are computer science programming constructs proposed 14 years before Bitcoin by Nick Szabo (Andrew, 2018). The term smart contract popularized in the Blockchain community when Ethereum adopted the term (Krishnamachari Interview, 08.04.2019). However, Vitalik Buterin, who fostered the use of the term, now regrets its popularization as it is somewhat misleading (Scott, 2018). While smart contracts minimally relate to the law, they substantially relate to programming and computations allowing data storage and fund transfers.[18]

The core of a smart contract is the utilization of an algorithmic function or code that replaces traditional written contracts. For instance, the parties to an agreement can subject the execution of a

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[16] An address is tied to the corresponding user-owner of the private key, as explained previously. Addresses connect to an identity without revealing the identity. Identity secrecy was the initial rule of thumb in blockchain transactions; however, there is a tendency towards development of protocols allowing users to reveal their identity.

[17] Cryptocurrency transactions resemble deeds (grantor, grantee, legal description and signature) and replicate formal aspects of today's transactions such as signatures, chain of title or title assurance. This system provides title assurance and recordation of the transfer through bitcoin mining (like a county clerk officer receiving a recording an executed deed) and blockchain (like a public records office). Blockchain allows users to "rely on a continuously-growing record of economic transactions on a digital ledger without the need for a trusted third party to validate those transactions" (Arbitrationblog, 2017).

[18] This is the difference between bitcoin and Ethereum. While Bitcoin is limited to asset transfers, Ethereum allows users to create smart contracts that cannot be subject of fraud. Smart contract's high security standards have fostered the popularization of digital market places like OpenBazaar. In a traditional transaction effectuated through a digital market, sellers indicate in a smart contract the goods, the price, and amount of available goods. Seller then uploads the information to blockchain. an interested buyer can search on the blockchain. Within the same platform, sellers can ask buyers to make payments which will be held in escrow until the goods are delivered. When buyers provide evidence of receipt, then the funds will be released to Seller. This evidence must be provided digitally to the smart contract. When evidentiary information arrives, then the smart contract escrow releases the funds to seller. The benefit of smart contracts is that the code a user runs is not running on only one computer sitting in one location but instead, on all computers with access to the blockchain. This prevents manipulation and fosters publicity of the transactions. It provides a sense of guarantee that 1) what was written in the smart contract is actually what will occur; and 2) every blockchain investor has notice of the transactions running under a particular smart contract.

command to a condition precedent, like payment, and set forth such algorithm as a function of "*if X is met, then execute Y*" (Levi, 2018). Performance of the condition precedent, i.e. meeting X, is verified by the algorithm embedded in the smart contract itself, with no need of human commands (Krishnamachari Interview, 08.04.2019).[19]

2.4.1. Imperfect smart contracts

Computer scientist conceived the smart contracts as a conflict-proof tool to close straightforward transactions in which an embedded algorithm executes an action based on verified actions by the other party. However, smart contracts involve real people and their performances, thus, experience shows that smart contracts are far from being conflict-proof as explained below (Krishnamachari Interview, 08.04.2019).

Lack of Meeting of the Minds: Parties' agreement to enter into a smart contract may not necessarily mean that the meeting of the minds about the specific terms of the contract is satisfied. In a traditional contract setting,[20] the contract could be unenforceable in absence of meeting of the minds. However, smart contract may go ahead and execute even though the mutual assent condition is not met.[21]

Fraud or Duress: In a traditional contract, if one of the parties enters the contract under duress or fraud, the contract will not be enforceable. However, a smart contract entered into under duress or fraud will not be excusable but instead will be executed (Werbach, 2017: 369).

Absence of Consideration: A chief difference between a smart contract and a traditional contract is that, unlike traditional contracts, smart contracts may be executed without consideration. There is no standard test for consideration before executing a smart contract (Werbach, 2017: 370).

Lack of Capacity: Similar to consideration, in a smart contract setting, there is no standard test for capacity. This means that minors and people with mental deficiencies are free to enter into a smart contract or own crypto currency (Werbach, 2017: 371).

Legality: In order for a traditional contract to be enforceable, the contract must carry a legal purpose, otherwise it would be voided and unenforceable by a court. However, in a smart contract, there is no legality test, thus, the contract will be executed regardless of its purpose (Werbach, 2017: 373).

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[19] This is an escrow system implemented in smart contract. There are two types of escrow: double deposit escrow and smart contract escrow. In double deposit escrow, both Buyer and Seller agree to deposit the funds and the goods into the escrow. Smart contract has the ability to digitally verify whether the goods were delivered. In smart contract escrow where only Buyer agrees to deposit the funds which will be released to the Seller once the goods are received.

[20] Traditional contracts validity and enforceability require offer, acceptance, and consideration. The object of the contract must be legal and parties must have capacity.

[21] For example, a smart contract involving the delivery of goods through the ship "Peerless" (but in fact there are several ships called "Peerless") would execute the contract once the goods are delivered.

Based on the above, we recommend that parties should stick to a traditional contract form whenever human input or verification is needed. Although smart contracts have proved to trigger less conflicts than traditional contracts, not every agreement can be replaced with smart contracts (Werbach, 2017: 373). For example, if a smart contract implicates delivery of physical goods, then there is no way for a blockchain smart contract to verify whether the delivery in fact happened because no human verification process takes place on the blockchain. This means a smart contract is not a complete substitute for traditional contracts. Instead, smart contracts should be used in such a way where the information pertaining to the smart contract can be indisputably verified by the algorithm embedded in the smart contract itself (Jia Sympossium, 05.04.2019),[22] i.e., whether the terms and conditions precedent written in the algorithm are met (Krishnamachari Interview, 08.04.2019).[23]

2.4.2. Current smart contract dispute resolution methods

In the wake of disputes involving smart contracts, today, blockchain users either implement dispute resolution functions into smart contracts or resort to a third-party dispute resolution company for their dispute to be heard and resolved. Recently, computer scientists have implemented alternative dispute resolution methods, whereby third parties called moderators are appointed as arbitrators.[24] They are volunteers who agree to serve as decision makers in exchange for a fee which is paid by the parties (Krishnamachari Interview, 08.04.2019).[25]

OpenBazaar blockchain developed a dispute resolution guideline (Williams, 2018)[26] where a dispute resolution protocol and the Moderator's functions are included in every smart contract on the blockchain as a variable. Moderator's functions are also coded as a "trusted" third party. By implementing a dispute resolution protocol in the smart contract, OpenBazaar's investors minimize unnecessary discussions on how to resolve conflict and the role of each party to the resolution of potential conflicts.[27]

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[22] For example, the issues arising from demurrage in ocean transportation was proposed to be solved through the use of smart contract.

[23] In traditional legal settings, you would take whatever evidence you gather about whether the conditions are met or not and present it to a judge. Whenever parties go to trial they need to show that evidence. That's a very manual process. A computer software would not be able to process the evidence that you are providing to make a decision on that.

[24] Computer scientists call these third parties as moderators, however, technically they perform the role of an arbitrator.

[25] This function of dispute resolution was added to the smart contracts afterwards.

[26] OpenBazaar provides its users with the following dispute resolution guideline: *"When a buyer and seller have agreed on a product and a price, the buyer sends their funds to an escrow address, which is a 2-of-3 multisig[26] address with one key controlled by the buyer, one key controlled by the seller, and one key controlled by a moderator that has been agreed upon by both the buyer and the seller. On the "happy path", the seller delivers the goods, then the buyer releases the funds to the seller (with the buyer and seller signing the payout transaction from the escrow address). In the event that the seller does not deliver the goods as promised, the buyer pleads their case to the moderator, and the buyer & moderator can send the funds from escrow back to the buyer. In the (very common) case where the buyer receives their goods but doesn't release the funds to the seller, the seller presents their case to the moderator"*

[27] However, this requires the moderator to be responsive in resolving the dispute without causing any delay.

In a smart contract, similar to the format agreement proposed by Professor Krishnamachari,[28] the dispute resolution guidelines set forth by OpenBazaar would apply as follows: the public key of each party *(Buyer, Seller, Moderator)* is added to the smart contract. Buyer initiates the "send funds" function and sends the funds to the smart contract itself and waits for the goods to be delivered. Here, nobody in the real world has possession of the funds because the funds are under the control of the smart contract, which works as an automated escrow agent.

In an ideal transaction, when the Seller sends the products and the Buyer acknowledges satisfactory receipt, both Seller and Buyer sign with their public keys, and complete the transaction by releasing the funds to Seller. Up until here, there is no dispute, thus, the Moderator's signature is not required. However, If Seller does not deliver, but agrees to return the funds back, both Buyer and Seller sign with their public keys for Buyer to get funds back. In another scenario where the Moderator comes in place, Buyer and Seller disagree as to signing none of the "release funds" functions. Here, Moderator will decide as to which way the funds should be released. If the Moderator finds that the Seller is at fault, then the Moderator sings the "release funds to Buyer" function and Buyer gets the refund, and vice versa. In some cases, they may even split the funds into two if the Moderator decides to do so.

Under the blockchain based guidelines, the Buyer choses the moderator/arbitrator from the list of moderators provided. In doing so, the Buyer is first recommended to reach out to the possible moderator/arbitrator and question his/her capability of settling disputes (OpenBazaar, 15 April 2019). At this point, anybody can become a moderator on the network.

3. ADVANTAGES OF ARBITRATION IN SMART CONTRACT DISPUTES

Arbitration, overall, is "a non-national and neutral dispute resolution forum which enables parties to nominate a tribunal of industry or technical specialists to efficiently and effectively resolve disputes" (Arbitrationblog, 2017). One of the reasons why arbitration is accepted worldwide is neutrality. In a

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[28]A smart contract proposed by Professor Krishnamachari:

> *Add parties (Buyer, Seller, Moderator)*
> *Send funds ( )*
> *Sign and release funds to Seller ( )*
> *Sign and release funds to Buyer ( )*
> *Sign and split funds ( )*

Smart contracts have set of variables to store data and test functions which will have associated descriptions to execute programming to trigger transactions. Here, the variables are buyer, seller, and moderator. In addition to that, users need to have a set of functions such as "add parties", "send funds", "release to seller", "release to buyer". At the outset, all the parenthesis remains blank. Parenthesis are used to describe functions in computer science. In a smart contract, the object to the contract need not be specified given that such information is irrelevant to the execution of the algorithms' commands. The object to the contract may be described either in a traditional form contract or an ancillary smart contract. While parties are free to include descriptive language of the object in the smart contracts, opting out necessitates using a traditional form contract describing the object of the contract.

transaction where parties belong to different jurisdictions, parties tend to be reluctant to subject themselves to a foreign jurisdiction. In order words, neither party would be willing to attend the other party's national court system. Therefore, arbitration is the ideal dispute resolution method for smart contract disputes involving parties from different jurisdictions.

First, arbitration provides a safe space for blockchain users to avoid centralized legal systems, which effectuates one of the ultimate reasons for blockchain based transactions, i.e. to protect its users from centralized authorities' cyclical debacles.

Second, arbitration is more appropriate for blockchain disputes because it is uncertain how different court system will approach this new technology, especially those unfriendly to blockchain based transactions.

Third, because smart contracts are constituted by coding language,[29] traditional judges cannot properly interpret such a language. Therefore, while traditional litigation would necessitate to heavily resort to computer programming experts, an arbitration panel can be constituted by programming experts who would have full understanding of the smart contract's underlying coding language.

4. A CRITIQUE ON CURRENT SMART CONTRACT DISPUTE RESOLUTION METHODS

The following sections will examine the deficiencies of the current smart contract dispute resolution methods and propose solutions to potential hurdles in arbitration proceedings involving smart contracts.

4.1. Agreement to Arbitrate

As a main element of arbitration, first, there must be party consent to arbitrate. In other words, consent to arbitrate is necessary for a party to be bound to go to arbitration (Blackaby, 2015). By doing so, parties give up their rights to resort to national courts; instead, they agree to resolve the conflict privately outside national courts (Moses, 2017). In case of international commercial arbitration, United Nations Convention on the Recognition and Enforcement of Foreign Arbitral Awards ("*NY Convention*") Art. 2 states to this effect (Moses, 2017):

> *"Each Contracting State shall recognize an agreement <u>in writing</u> under which the parties*
> *undertake to submit to arbitration ..."*

For the purposes of proving that parties indeed consented to arbitrate, NY Convention requires that consent must be given in writing. Accordingly, NY Convention Art. 2 defines that,

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[29] For example, Solidity is a programming language used in Ethereum and other blockchain platforms to implement smart contracts.

> *"The term "agreement in writing" shall include an arbitral clause in a contract or an arbitration agreement, signed by the parties or contained in an exchange of letters or telegrams."*

In practice, there are two ways of giving consent to arbitration. Parties either include an arbitration clause in the original contract before the dispute or enter into a submission agreement after the dispute (Blackaby, 2015: 72).[30] Submission agreements are detailed compromises which set forth the rules as to the establishment of arbitral tribunal, procedure, description of the conflict to be arbitrated, and substantive law (Blackaby, 2015: 15). However, submission agreements are very rare as parties generally cannot agree on anything after a dispute arises (Moses, 2017: 20).

Whether arbitration clause or submission agreement, consent to arbitrate must be given in writing. UNCITRAL Model Law Art. 7 (2) also supports this:

> *"(3) An arbitration agreement is in writing if its content is **recorded in any form**, whether or not the arbitration agreement or contract has been concluded orally, by conduct, or by other means.*

> *(4) **The requirement that an arbitration agreement be in writing is met by an electronic communication if the information contained therein is accessible so as to be useable for subsequent reference**…"*

The validity of agreement to arbitrate comes into place when one of the parties wishes to go to court instead of pursuing arbitration. This is very common when one party claims the agreement to arbitrate is invalid because it was never signed. The question as to the validity of an agreement to arbitrate will eventually lead to setting aside the arbitral award or make the arbitral award unenforceable (New York Convention, Art. 5 (1) (a)). Therefore, it's important to establish that the agreement to arbitrate was not only in writing but also signed (Moses, 2017: 22).

Current smart contract dispute resolution mechanisms pose a unique hurdle in connection with giving consent to arbitrate as it is not always clear when exactly the parties agree to arbitrate. This is commonplace especially when it is not specifically indicated in the smart contract that the disputes arising therefrom would be resolved by binding arbitration.[31]

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[30] United Nations Commission on International Trade Law, *UNCITRAL Model Law on International Commercial Arbitration 1985: with amendments as adopted in 2006* (Vienna: United Nations, 2008), available from www.uncitral.org/uncitral/en/uncitral_texts/arbitration/1985Model_arbitration.html. [hereinafter UNCITRAL Model Law] Art. 7 (1) "*An arbitration agreement may be in the form of an arbitration clause in a contract or in the form of a separate agreement.*"
[31] Depending on the type of smart contract, in our fact pattern, at issue is a permissionless multisig smart contract where the parties gave their consent for arbitration at the stage of "*sign and release funds.*"

In application of the above to a smart contract dispute, parties should agree to arbitrate in writing pursuant to NY Con. Art 2. By reference to the language of "*recorded in any form*" and "*accessible so as to be useable for subsequent reference*" under UNCITRAL Model Law, we believe that a coding language in the smart contract by which the parties consent to arbitrate satisfies the writing requirement. Basically, parties to a smart contract may give their consent to arbitrate either by adding a codded arbitration clause into the original smart contract, or by submission agreement after a dispute arises, which will set forth the details as to the establishment of the arbitral tribunal, procedure, description of the conflict to be arbitrated, substantive law. We believe that the submission agreement can be in the form of a traditional agreement in a natural language. The actual smart contract should be modified and include a reference to the submission agreement.

4.2. Designation of Seat

The designation of the seat is important in a traditional arbitration because 1) it gives a nationality to the arbitral award, 2) it will generally govern the arbitration procedure also known as *lex arbitri* (Moses, 2017: 51). Therefore, parties are inclined to select the seat at an arbitration friendly state of which arbitration laws would not extremely intervene the arbitration process (Moses, 2017: 51). Otherwise, the arbitration process will be clashed by the local rules of the seat (Moses, 2017: 51).

Ideally, the seat should be designated at the beginning of the transactions. Otherwise, the arbitration tribunal picks one for the parties. In practice, parties generally chose the seat in a neutral country that does not relate to any of the parties. This is important because the authority to hear an application to set aside arbitral award is given to the national courts of the seat. In selecting the seat, parties should consider the reciprocity requirement of NY Convention because several states agreed that they will only enforce arbitration awards made in another contracting state of NY Convention (New York Convention, Art. 1 (3)). This becomes important at the enforcement stage which will be explained below (Moses, 2017: 52).

Furthermore, the seat can also be important in several other ways during the arbitral proceeding. For instance, the law of the seat may require involvement of its national court systems in circumstances such as, appointing arbitrators (UNCITRAL Model Law, Art. 11), challenging arbitrators (UNCITRAL Model Law, Art. 12, 13.), providing assistance where a difficulty arises in the process of termination of the mandate of an arbitrator or the arbitrator's withdrawal from the arbitral tribunal (UNCITRAL Model Law, Art. 14.), issuing an interim measure of protection or an interim attachment before or during the arbitral proceeding (UNCITRAL Model Law, Art. 17 (J)), enforcing arbitral measures through the execution offices of the seat (UNCITRAL Model Law, 17 (H) and (I)), assisting in evidence taking in case the parties fail to provide evidence requested by the arbitrators UNCITRAL Model Law, Art. 27), etc.

In application of the designation of seat to a smart contract dispute, the parties will sacrifice from the benefits of the functions of the national legal systems. Seat selection is important because the law of the seat determines whether a dispute can be arbitrated (Blackaby, 2015: 168). When the seat of the arbitration is in a country where the legal system does not recognize crypto currencies as legal instrument, the parties against whom the arbitral award is made will likely challenge the award based on public policy standards. Therefore, it is recommended to pick a country that is the familiar with and amicable to smart contract transactions. For instance, Brazil's legislative body prohibited investments in cryptocurrency and declared that cryptocurrencies are not financial assets (Terrien, 2018).

In the current smart contract dispute resolution mechanisms, there is no available recourse to challenge moderator's decision if the parties disagree with the moderator's decision. Compared to the ways of challenging arbitral awards, the current smart contract dispute resolution mechanisms are risky since they are automatically executed and heavily rely on trust on the moderator. Therefore, we recommend that the challenge of moderator's decision should also be made available in the smart contract dispute resolution.

4.3. Party Identification

In the traditional arbitration setting, party identification is important for several reasons. First, the parties are represented by attorneys during the course of arbitration and attorneys need to know whom they are representing to properly develop an attorney-client relationship. Second, clarity as to the party identification is necessitated since party's consent to arbitrate is a key element of arbitration. Third, tribunals render arbitral awards after examining whether the consenting parties had legal capacity to consent to arbitrate (NY Convention, Art (1) (a)).

In application of party identification to a smart contract dispute, in our example, if Ashley is transacting on blockchain, she may want to know with whom she is transacting. As explained above, the party identification is not necessarily revealed on the blockchain platform. Depending on the type of the blockchain, parties may choose whether or not to reveal their identification. Therefore, we suggest that parties to a smart contract who want to benefit from arbitration, are bound to create smart contracts on permissioned blockchain platforms. On the contrary, if parties enter into a smart contract on a permissionless blockchain platform, then it would be unlikely to conduct an arbitration since the party identification is not revealed on permissionless blockchain platforms. Best practices suggest that investors who want to benefit from arbitration should enter into smart contracts on a permissioned blockchain platform, or if entered on a permissionless blockchain, parties should disclose their identification on the smart contract by adding such needed information to the smart contract coding language.

4.4. Arbitrator Selection and Qualifications

Arbitrator's qualifications are important because they are conferred the decision-making power by the parties. Properly qualified arbitrators in a specific area are likely capable of rendering better informed arbitral awards. In practice, arbitrators should have sufficient knowledge and experience in the substance of the subject matter of the arbitration to render a proper decision (Moses, 2017: 128). To this end, an arbitrator should be fluent in the language of the arbitration to be able to understand the core points of the dispute to be arbitrated (Moses, 2017: 130). While it is not necessary to pick an arbitrator who has a law degree, in a setting requiring tribunal, it is favorable to have one lawyer arbitrator in the panel. In a specific field that requires expertise, it is helpful to have an expert in that specific field for the other arbitrators to understand the technical issues (Moses, 2017: 129).

In application of the above to a smart contract dispute, an arbitrator not only need to have expertise on blockchain but also need to be fluent in both natural language and coding language to be able to understand the smart contract. parties' languages (Garrie, 2018). For instance, the following plain language structure, "*Seller shall deliver to Buyer one-hundred (100) red widgets,*" can be translated into a smart contract language as follows:

> *"function transferFrom(address _SELLER, address _BUYER, uint256 _100) public returns (bool success) require(_100 <= allowance[_SELLER] [msg.sender]); allowance[_SELLER][msg.sender] -= _100; _transfer(_SELLER, _BUYER, _100); return true;"* (Garrie, 2018).

Accordingly, finding qualified arbitrators able to read code language is difficult; therefore, we suggest that arbitrators should be selected among certified smart contract developers who can read coding language. A dropdown list that indicates the area and level of expertise of each moderator can be created because an automated selection system, a dropdown list of moderators, would be more efficient for the blockchain investors. Similarly, no legal background requirement is needed to become an arbitrator to a smart contract dispute. However, it is recommended and would be helpful to appoint at least one lawyer. Lastly, we believe that all of these qualifications should be stated in the smart contract upon party's agreement.

4.5. Power of Arbitrators

The power of arbitrators is granted by the parties through arbitration clauses (Blackaby, 2015: 307) or by operation of law. While the parties confer to arbitrators the decision-making power, the law confers powers that can be exercised only by the national courts, i.e. the coercive power of national courts. Parties cannot confer powers they lack, exclusive to the courts, like using police force. It necessarily follows that arbitrators need the supplemental laws to use coercive power to enforce their decisions over property and persons (Blackaby, 2015: 308).

The excess of the above-mentioned powers may be a ground for challenging the arbitral award and the award being set aside (Model Law, Art 34). In other words, if the grounds for setting aside arbitral award in the arbitration laws of the seat include the arbitrators exceeding their powers, it may lead the arbitral award to be set aside.

In application of the above to a smart contract dispute, at issue is whether a moderator exceeds his/her power by ruling on a smart contract dispute. To prevent future confusions, parties should explicitly confer the authority provided to the moderator in the specific coding language of the smart contract. By doing so, the smart contract can be a power conduit to avoid a future set aside.

4.6. Institutional Support

When parties decide to resolve their future conflict through arbitration, they should also decide whether the arbitration is to be administered by an institution or ad hoc.

Institutional arbitration is administered according to the rules of an arbitration institution (Blackaby, 2015: 44), such as International Chamber of Commerce ("ICC"), International Centre for Settlement of investment Disputes ("ICSID"), London Court of International Arbitration ("LCIA"), or International Centre for Dispute Resolution by American Arbitration Association ("ICDR"). Additionally, there are industry based specialized arbitral institutions, such as Grain and Feed Trade Association ("GAFTA"), London Maritime Arbitration Association ("LMAA"), Federation of Oils, Seeds and Fats Association ("FOSFA"), London Metal Exchange ("LME") (Moses, 2017: 14). Institutional arbitration is advantageous insofar as it provides certainty regarding the administration of arbitration, such as timely appointment of the arbitrators, arbitration fees and expenses, etc (Blackaby, 2015: 45).

In an ad-hoc arbitration, parties may opt out of selecting an arbitration institution to conduct said arbitration (Blackaby, 2015: 42). Parties moreover are free to shape the administration of arbitration (Blackaby, 2015: 44). Parties also do not need to pay administration fees and expenses (Moses, 2017: 10). Although the majority of ad-hoc arbitrations are conducted pursuant to the United Nations Commission on International Trade Law Arbitration Rules ("UNCITRAL Arbitration Rules"), parties can establish their own set of rules to be followed during the course of arbitration (Blackaby, 2015: 42).

In application of the above to a smart contract dispute, given the nature of blockchain platforms, we believe that ad-hoc arbitration is ideal for smart contract disputes.[32] For decentralized disputes not relying

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[32] However, China requires the appointment of an arbitration institution in the arbitration agreement. This means the ad-hoc arbitration will be deemed invalid. Article 16 of the People's Republic China Arbitration Law reads that "*An arbitration agreement shall contain the following particulars: ... (3) a designated arbitration commission.*"; Article 18 of the People's Republic China Arbitration Law reads that "*If an arbitration agreement contains no or unclear provisions concerning . . . the arbitration commission, the parties may reach a supplementary agreement. If no such supplementary agreement can be reached, the arbitration agreement shall be null and void.*"

on any centralized laws or authorities, an ad-hoc arbitration, where the parties will be free to establish their own set of rules for the administration of arbitration, is recommended. Additionally, similar to industry based specialized arbitral institutions, forming a platform whereby users of smart contracts on a particular blockchain can have their arbitration administered is recommended.

Today, arbitration institutions and third-party companies started to create model rules for blockchain disputes.[33] For instance, while JAMS launched a set of model rules for blockchain arbitration in September 2018 (Jams, 2018), Sagewise, a third-party dispute resolution company, provides dispute resolution methods outside the smart contract (Sagewise, 27 March 2019).

4.7. Enforcement

NY Convention requires the signatory states to enforce not only the arbitration agreements but also the arbitration awards made within the NY Convention territory (New York Convention, Art. 1). After an arbitral award is rendered, a losing party should comply with it (Model Law, Art. 34 (2)). Otherwise, to enforce the arbitral award, the winning party will need to seek judicial assistance of the national courts of the place of enforcement (Moses, 2017: 225). The grounds for non-enforcement are listed exhaustively under the NY Convention (New York Convention, Art. 5). These are namely party incapacity (New York Convention, Art. 5 (1)(a)), invalidity of arbitration agreement (New York Convention, Art. 5 (1)(b)), lack of notice or fairness (New York Convention, Art. 5 (1)(b)), excess of authority (New York Convention, Art. 5 (1)(c)), not complying with the parties' agreement (New York Convention, Art. 5 (1)(d)), awards that had been set aside (New York Convention, Art. 5 (1)(e)), arbitrability (New York Convention, Art. 5 (2)(a)), and public policy (New York Convention, Art. 5 (1)(b)). As for the arbitrability ground, each state determines the type of disputes that are resolved through arbitration. Typically, commercial and contractual disputes are arbitrated (Moses, 2017: 241). Similarly, as for the public policy ground, the enforcement of arbitral award may be denied on the ground that enforcement of such award violates the laws related public policy of the state of enforcement.

Since blockchain developers' concern involved creating a decentralized platform free of strings attached to any national legal system, programmers did not consider creating algorithms linking a smart contract to the legal court system of any jurisdiction. They purport to keep the national courts out of the smart contract disputes. Consequently, while enforcement of traditional arbitral awards involves national courts, moderator's decisions in a smart contract dispute resolution setting does not require the involvement of national courts. The absence of national court's intervention stems from the fact that the moderator's decision is enforced upon moderator's electronic signing. Therefore, the nature of smart contract eliminates

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[33] These rules are not made public yet.

the need for application for enforcement as the decision of the moderator is enforced immediately once s/he signs a certain function according to his/her decision (Krishnamachari Interview, 08.04.2019).

5. CONCLUSION

Traditional legal systems are not suitable to resolve disputes arising from smart contracts as smart contracts were conceived to be bound by no legal system. Eventually, the traditional arbitration platforms require the national court involvement at some point either at the end of the arbitral proceeding or throughout the arbitral proceeding. However, this defeats the decentralized nature of blockchain based smart contracts.

As mentioned above, the nature of the smart contract transactions is decentralized which means the power is shifted from government to the people. Since the idea is to create a platform separate from state regulations, the disputes arising therefrom should also be separated from national court systems. Therefore, we may need to leave our understanding of traditional arbitration where the national court involvement is required. To this end, we believe that a decentralized arbitration should be conducted without national courts involvement.

Given that currently there is no development of decentralized arbitration guidelines, we believe that smart contract dispute resolution methods should be implemented in smart contract itself at the beginning of the execution. To this end, we suggest the following in writing smart contracts and execution thereof:[34]

- Users should be explicit in giving consent to resolve their conflict through arbitration either by adding a codding arbitration clause in the original smart contract or by submission agreement which can be in the form of traditional contract.
- Users should choose the seat in a state which is fairly liberal and friendly towards the blockchain transactions.
- Users should create their smart contracts on a permissioned blockchain. If the smart contract is created on a permissionless blockchain, then users should make sure that party identification is revealed.
- Users should select the arbitrator before entering into the smart contract. Both users should reach out to the arbitrator and ask certain questions as to his/her ability to resolve such conflicts.
- Users should be careful in selecting the arbitrator who can understand and read coding language to form an arbitration panel constituted by programming experts.

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[34] iOlite is a platform where non-programmers are allowed to write smart contracts and design blockchain applications by using their natural language.

- Once the users agree on the arbitrator, they should later name the arbitrator in the smart contract and add a coding language where both parties explicitly agree on the arbitrator's authority to resolve the conflict;

- Users should pick ad-hoc arbitration, creating their own rules for the administration of the arbitration. If ad-hoc arbitration is not preferred, users should pick an arbitration institution that has a blockchain industry arbitration institution.

- Users should try to keep the court system out of the dispute resolution methods as much as possible as it is uncertain whether the traditional courts will be welcoming or not of smart contracts.

Overall, the current smart contract dispute resolution guidelines and protocols implemented in smart contracts have positively impacted the investors transacting on blockchains and accomplished several goals. Still, traditional arbitration rules should adjust to be suitable to resolve disputes arising from smart contract transactions. In the alternative, current smart contract dispute resolution methods should also evolve by either implementation of arbitration rules in the smart contracts on the blockchain, or development of a blockchain based arbitration institution specialized in arbitration of smart contract disputes. Perhaps, these improvements and adaptations will engender a completely decentralized arbitration system suitable for the resolution of decentralized markets dealing with smart contracts on blockchain platforms.

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