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International Arbitration and Blockchain: Current State, Types, Characteristics and the Future Perspective

Yevhen Shcherbyna

Mykolas Romeris University, Law School, Lithuania

Abstract

The paper is devoted to the issues of the interplay of modern technologies such as blockchain and smart contracts with commercial arbitration: how these can be utilized together to achieve even more flexibility when it comes to the resolution of disputes that might occur between the involved parties. The emphasis is made on the so-called ‘on-chain arbitration’ that represents the technological solutions that offer blockchain-based dispute resolution – an alternative to conventional commercial arbitration. The pros and cons of the technology are covered in-depth.

Keywords

Commercial Arbitration and New Technologies; Blockchain and International Arbitration; Smart Contract Use in Arbitration; On-Chain Arbitration.

1 Introduction

Commercial arbitration represents a convenient dispute resolution mechanism that is alternative to classic courts and that can be attractive for disputing parties due to its flexibility and established a reputation as an effective tool especially when a dispute involves a cross-border element. In addition to the flexibility of the arbitration proceedings, the existing extensive regulatory framework that encompasses international conventions, national law, developed soft and case law of the commercial arbitration ensures that, just like in classic court proceedings, the participating parties will get an arbitral award that is recognizable and enforceable in most jurisdictions where the winning party may seek enforcement of such an award.

That being said, during the last couple of years some interesting developments in the sphere of technology occurred that might be useful for the already developed system of commercial arbitration and can increase flexibility and attractiveness of arbitration, even more, when being implemented as a part of the system. These new technologies are blockchain and smart contracts.

During the following chapters of the paper, we will see what stands behind the new technologies, how these can be applied in conjunction with the arbitration, what use-cases inspired the development of the blockchain-based dispute resolution mechanisms, etc. The latter is of particular interest to us since it represents the new interpretation of the online arbitration that is built around blockchain as a foundation. We will see how this new so-called ‘on-chain arbitration’ can be used to effectively solve the disputes that involve smart contracts as their object, what are the benefits as well as the limitations of these new technological solutions. But before we dive deeper into the mentioned problematics, it is necessary to start with the basics – the concepts of blockchain and smart contracts themselves.

2 The General Part

2.1 What Is Blockchain?

During this chapter, I will introduce the reader to the foundations of the concept of blockchain as a distributed ledger technology. Such a basic understanding is important as several subsequent chapters will be devoted to the role of blockchain in modern international arbitration.

To keep it simple, one can describe blockchain as a digital analogue of a ledger – a collection of certain data that is grouped and stored for further reference. Blockchain is a digitized version of such a ledger. But simply being digital is not enough. If blockchain possessed only this quality alone, it would have been indistinguishable from a simple digital database.¹ But there is nothing special in a database that is stored in a digital form. On top of being digitized, blockchain possesses another characteristic – it is not only digital but also

¹ KOLBER, A.J. Not-So-Smart Blockchain Contracts and Artificial Responsibility. *Stanford Technology Law Review*, 2018, Vol. 21, no. 2, p. 206.

distributed. This means that any information stored on a blockchain is being duplicated there and transmitted to multiple storage places, i.e., nodes. So, multiple instances of the same set of information exist at any given point in time. That being said, it is not uncommon to imagine that classic digital databases can also possess such a characteristic. Many of the existing online databases implement a simple redundancy policy by keeping a backup copy of any data uploaded onto such databases. Blockchain would need something more substantial to stand out from classic digital databases.² And it does have such a feature: it is also a decentralized platform – unlike many more conventional digital databases. This means that among the mentioned multiple instances of the dataset placed onto blockchain there is no master copy (or original) – every copy of the information that is stored on any given node is the authentic one. There is no separation between the main version and the backup one. This is achieved by granting the nodes equal status among them – typically every full node is treated as the source of the original information stored on it.³ Thus, typically there is no central authority within the blockchain (in most cases)⁴ that would have the power to override the data placed on such a blockchain. Finally, blockchain implements a sophisticated mechanism for the input of the data. In order to be placed onto the chain, the information needs to be ‘validated’⁵ by certain participants of the network called ‘validators’ and then be ‘packed into a block’ and added to the chain. This process of validation of the information, packing it into a block and adding the block to a ‘chain’ is where blockchain got its name – it is a chain that consists of multiple blocks of digital data. So, unlike a classic digital database, it is relatively complicated to add new information onto the chain. Moreover, the data that is already placed onto the chain benefits from the high degree of immutability. This means that if one (even

² LAMB, K. Blockchain and smart contracts: What the AEC sector needs to know [online]. *CDBB*. 2018, p. 1 [cit. 8. 4. 2021]. Available at: <https://doi.org/10.17863/CAM.26272>

³ There is a division among nodes participating in the blockchain into so-called ‘full nodes’, ‘light nodes’, ‘mining nodes’, etc., that have different status within a platform. Such a division depends on the structure and the rules of a platform. But such elaboration is excessive for the purposes of the current research.

⁴ There are certain exceptions to this rule. In the current chapter, we will be describing, predominantly, public permissionless blockchains.

⁵ There are different methods and approaches to validate the data, e.g. ‘proof of work’, ‘proof of stake’, but this information is not that relevant for the purposes of the current research.

if it is the original author of the data who put it onto the chain) wants to add any alteration to the already stored data, such a person would need to convince more than half (50% + 1, to be more precise) of the existing connected nodes⁶ to agree to that alteration and authenticate the changes to the set of data stored on the chain.⁷ The bigger the network, the harder it is to implement such a change. It is safe to assume, that it is easier to make a new input to the chain rather than try to alter the already existing one. Such a feature is what makes blockchain technology so appealing, as it guarantees the preservation of the data on the chain. It is almost impossible for a third party to corrupt the existing data.

To reiterate, blockchain possesses the following set of core characteristics:

- It is a sort of a database...
- that is distributed;
- decentralized;
- immutable;
- and functions based on the implementation of one of the multiple types of a consensus mechanism.

The mentioned set of features renders blockchain technology completely different from any previously known solution to keep digital data as it is capable to be effective even in an environment where the participants of the same network have zero trusts in each other.

That being said, blockchain as a technological solution was not initially developed with the goal to facilitate the storage of data. This capability is rather a beneficial side effect as in the first place, its creators envisioned blockchain as a platform that hosts records of transactions, transactions that reflect the fact of transfer of some monetary value. It was developed as a driver for the cryptocurrency exchange between the network participants – the bitcoin transactions. This platform was first introduced to the public in 2008 in an article named ‘Bitcoin: A Peer-to-peer Electronic Cash System’ by the authorship of *Satoshi Nakamoto*.⁸ The name Satoshi

⁶ There is a real user behind any of the nodes connected to the network.

⁷ NAKAMOTO, S. Bitcoin: A Peer-to-peer Electronic Cash System. *Bitcoin* [online]. 2008, p. 3 [cit. 8. 4. 2021]. Available at: <https://bitcoin.org/bitcoin.pdf>

⁸ Ibid.

Nakamoto is most likely a pseudonym and the real identity behind it is still unknown to this date.⁹

The invention of the first cryptocurrency in and of itself marks the beginning of the new stage of the evolution of the payment mechanisms that are essentially different from conventional fiat currencies. But this invention alone is hardly interesting for us from the standpoint of its application in alternative dispute resolution methods including international arbitration. Even being considered together with its underlying technology – the blockchain, it may be relevant only for a limited number of actors in the field of commercial social relations – the so-called ‘early adopters’ – actors that would like to implement certain cryptocurrency as a medium for their financial operations and, at the same time, opt for arbitration as a platform for the resolution of the possible disputes. Only in these limited situations can the two domains meet. However, during the following chapters, the reader will be able to see that currently, blockchain technology gains traction when it comes to its implementation into the arbitration process. That means that there has to be something more to it that would justify the increased interest in blockchain, some new feature that would extend the functionality of the platform, that would allow for the storage of the types of data that is different from hashes of financial transactions. And such an extension indeed happened with the introduction of smart contracts executable on a blockchain.

2.2 What Is a Smart Contract?

The emergence of bitcoin as the first cryptocurrency and its relatively high success as a new medium for financial exchange sparked interest in this new industry. The first competitors started to emerge – the so-called ‘altcoins’ – cryptocurrencies with the same core idea in mind – the new ‘digital cash’ but with their peculiarities such as the new set of functionalities of the blockchain systems tied to those new cryptocurrencies. Today, one of the most well-known alternatives to bitcoin blockchain is the product of *Vitalik Buterin*, a Canadian programmer of Russian descent, – the Ethereum platform with its native cryptocurrency called ‘Ether’. In 2013 he published the ‘Ethereum

⁹ BERNARD, Z. and G. KAY. The many alleged identities of Bitcoin’s mysterious creator, Satoshi Nakamoto. *Insider* [online]. 26. 2. 2021 [cit. 9. 4. 2021]. Available at: <https://www.businessinsider.com/bitcoin-history-cryptocurrency-satoshi-nakamoto-2017-12>

Whitepaper’ – the source that contains the description of the idea behind the platform and its functionality.¹⁰ There, *Vitalik* describes Ethereum as a ‘next-generation smart contract and decentralized application platform’ with the main emphasis on the possibility of its blockchain to host and operate with smart contracts and other Dapps.¹¹ This feature set is what separates Ethereum as a new type of blockchain from Bitcoin blockchain – the one that is rather limited in this regard. But to understand the nature of smart contracts and the idea of their implementation onto a blockchain, we need to trace their roots back in history as a smart contract is a phenomenon that is older than blockchain.

In the nineties, a scholar whose research interests revolved around the issues of cryptography, *Nick Szabo* publishes an article ‘Formalizing and Securing Relationships on Public Networks’ where he introduces the concept of a smart contract – a special type of contract whose main distinctive feature that separates it from the bulk of existing classic types of contracts is a certain degree of automation of its execution.¹² In his researches devoted to the problem of smart contracts, *Szabo* defined this concept as a ‘set of promises, specified in digital form, including protocols within which the parties perform on these promises’.¹³ In order to better illustrate the idea of the automation of the execution of the contract that represents the key distinctive feature of a smart contract, *Nick Szabo* compares such contracts to a so-called ‘humble vending machine’ – a machine for the distribution of soda and claims that smart contracts go beyond such functionality of the vending machine allowing users for a greater degree of autonomy in respect of the values that can be exchanged using such a tool (not just

¹⁰ BUTERIN, V. Ethereum Whitepaper. *Ethereum* [online]. 28.1.2021 [cit. 9.4.2021]. Available at: <https://ethereum.org/en/whitepaper/>

¹¹ This abbreviation stands for ‘decentralized applications’ – those that operate on decentralized distributed ledgers, i.e., blockchain.

¹² SZABO, N. Formalizing and Securing Relationships on Public Networks. *First Monday* [online]. 1997, Vol. 2, no. 9, p. 1 [cit. 10.4.2021]. Available at: <https://doi.org/10.5210/fm.v2i9.548>

¹³ SZABO, N. Smart Contracts: Building Blocks for Digital Markets. *fon.hum.uva.nl* [online]. 2018 [cit. 10.4.2021]. Available at: https://www.fon.hum.uva.nl/rob/Courses/InformationInSpeech/CDROM/Literature/LOTwinterschool2006/szabo.best.vwh.net/smart_contracts_2.html

soda cans but ‘all sorts of property that is valuable and controlled by digital means’).¹⁴

That was the first look at the nature and aspects of the functionality of the newly emerged concept that was rather limited and concentrated on the technical side of smart contracts. But that drew some attention to the technology and sparked discussions about its future perspectives. Nowadays, some scholars, predominantly those who work in the field of law criticize the comparison of smart contracts to vending machines and point out that smart contracts as a concept are hampered by their name – that in reality, such tech is neither ‘smart’ nor a ‘contract’.¹⁵ There is no universally accepted legal definition of a smart contract.

On top of that uncertainty that accompanies the concept of a smart contract, even more, confusion arises when we are dealing with the intersection of smart contracts and blockchain. As we remember from the previous subchapter devoted to the concept of blockchain, one of the reasons for the development and deployment of the Bitcoin blockchain competitors was the necessity to extend the functionality of the original blockchain. The developers of the Ethereum blockchain specifically mention the capability to host and execute smart contracts as their competitive advantage. This means that the introduction of blockchain technology boosted the popularity of smart contracts and sort of completed their formation as a tool capable enough to attract a greater audience.

Currently, scholars who approach smart contracts executable on blockchain from the legal standpoint, distinguish the following set of features that constitute the notion of a concept at hand:

- it is a computer program (or more specifically, a computer code/script) that...
- features a self-execution mechanism;
- is stored and/or executed on a distributed decentralized ledger (the blockchain element);
- requires a certain trigger to initiate the self-execution mechanism;

¹⁴ Ibid.

¹⁵ ROHR, J. Smart Contracts in Traditional Contract Law, Or: The Law of the Vending Machine. *Cleveland State Law Review*, 2019, Vol. 67, no. 1, p. 68.

- and the result of such a self-execution would be a certain alteration to the status of the involved parties¹⁶ (their rights and/or obligations, etc.).

As for the definition of a smart contract, based on its key features mentioned above, it is possible to cite the one that is laid down by *Jonathan G. Rohr* in his article ‘Smart Contracts and Traditional Contract Law, or: the Law of the Vending Machine’ that states the following: “*a smart contract is a computer protocol (code) that is stored on a blockchain (or distributed ledger) and which will be automatically executed by the nodes on the blockchain’s network upon the occurrence of specified conditions*”.¹⁷ Such a definition is particularly good for our purposes as it describes the essence of the technology while avoiding (except in the mere name ‘smart contract’) references to the contractual nature of the concept – the most controversial part where the lack of consensus among scholars is the most evident.

Previously, before the emergence of blockchain, smart contracts were technical tools that allowed their users to simply automate certain processes without any additional benefits of security of the data inputs. It was hard to justify the inclusion of those smart contracts in the contractual activity of the participating parties as regardless of the platform where such tools were executed (hardware solutions like vending machines or digital ones like computer scripts) it was technically more complicated to draft and/or compile them in comparison to the classic ‘paper’ contracts. In order to attract some user base, smart contracts would need to propose something more substantial than pure automation of their execution. And that is where blockchain technology came in handy. Decentralized distributed ledgers are created with the immutability of the inserted data in mind – the feature that is a starting prerequisite when it comes to the safety of the user information stored on such a platform. Blockchain provides stability and immutability of the data while smart contracts give automation to their users – a combination that is too sweet to stay away from it.

¹⁶ The idea of whether a smart contract can represent contractual provisions, i.e., to be treated as a contract from the legal perspective is still debatable among scholars.

¹⁷ ROHR, J. Smart Contracts in Traditional Contract Law, Or: The Law of the Vending Machine. *Cleveland State Law Review*, 2019, Vol. 67, no. 1, p. 68.

Now that we understand the basics of blockchain technology and smart contracts and how these two can be used in combination, it is time to see how that can be accustomed to the needs of alternative dispute resolution methods including commercial arbitration.

2.3 The Interplay of Smart Contracts and Blockchain With International Arbitration

There are several instances where blockchain and smart contract technologies can intersect with commercial arbitration: these typically include disputes over cryptocurrencies; use of blockchain and/or smart contracts for the needs of arbitration process, e.g., as information storage tools; alternative online dispute resolution that is built with the utilization of blockchain technologies in mind, etc. Some of the mentioned use-cases would be relatively easy to implement into the day-to-day activities connected with the arbitration, others would require the rethinking of the functionality process of the whole system of alternative dispute resolution (examples of such technological solutions would be covered more in-depth in the subsequent chapters).

Disputes that involve cryptocurrencies and blockchain technology as an object. The simplest possible point of intersection of the commercial arbitration and blockchain technology is the possibility of disputes that could arise over transfers of cryptocurrencies or the functionality of smart contracts.¹⁸ Taking into consideration that bitcoin, as the most well-known cryptocurrency and various altcoins such as Ether, are on the rise and experience high degree of interest towards them, it is quite easy to imagine that the holders of such assets could end up in a dispute over the storage or transfer of cryptocurrencies. Knowing that the legal status of cryptocurrencies and smart contracts is mostly unset and inconsistent across various jurisdictions, it is likely that conventional courts would not become the first option for the disputing parties to rely on. The first tool would likely be mediation followed by commercial arbitration, especially if there is a cross-border element involved. Such a tool is attractive for potential disputing parties due to a number of reasons such as the relative flexibility of the arbitration

¹⁸ ROGERS, J. and A. IBRAHIMOV. Cryptocurrencies and Arbitration: A match made in heaven? *International Arbitration Report.*, 2018, no. 10, p. 25.

as well as the advantage of the global enforcement of arbitral awards – one of the most valuable benefits of this type of dispute resolution methods.¹⁹

That being said, regardless of the mode of operation of such an arbitration process, being it conducted online or offline, the arbitrators would need to consider the peculiarities of the functionality of the mentioned technologies. As we mentioned earlier, one of the key characteristics of blockchain is the immutability of the data that is already added to the chain. This may pose some significant hurdles when we are dealing with the potential arbitral awards that would rule contractual activities between the disputing parties void and would require the reimbursement of spent coins. It is technically impossible to ‘reverse’ a smart contract or a blockchain transaction to its state prior to the value transfer. This is not even mentioning the potential problem with the legal validity of an arbitration clause if such a clause exists in the form other than in writing (as a part of a conventional written contract).²⁰

Blockchain as a storage option for arbitral awards and other materials.

This is a purely utilitarian option – to use blockchain’s unique features such as immutability for the needs of arbitration for storing important data there. At first glance, it may seem counterintuitive to use such a complicated technology for the storage of data instead of relying on more conventional options such as cloud storage or internal physical servers that are used as databases. But blockchain allows for the storage of data and it is arguably more secure when it comes to the protection of sensitive data from data breaches and hacks. Hacks to gain access to the data associated with arbitration proceedings and to compromise the arbitral institutions already happened as it was the case with the data breach of the website of the Permanent Court of Arbitration in The Hague.²¹ By virtue of being

¹⁹ Ibid.

²⁰ JEVREMOVIĆ, N. 2018 In Review: Blockchain Technology and Arbitration. *Kluwer Arbitration Blog* [online]. 27. 1. 2019 [cit. 12. 4. 2021]. Available at: <http://arbitrationblog.kluwerarbitration.com/2019/01/27/2018-in-review-blockchain-technology-and-arbitration/>

²¹ PETERSON, L.E. Permanent Court of Arbitration Website Goes Offline, With Cybersecurity Firm Contending That Security Flaw Was Exploited in Concert With China-Philippines Arbitration. *Investment Arbitration Reporter* [online]. 23. 7. 2015 [cit. 14. 4. 2021]. Available at: <https://www.iareporter.com/articles/permanent-court-of-arbitration-goes-offline-with-cyber-security-firm-contending-that-security-flaw-was-exploited-in-lead-up-to-china-philippines-arbitration/>

decentralized, distributed and boasting the immutability of the data stored on it, blockchain-based storage may become quite a compelling option. Especially taking into consideration the resistance of the whole system to the corruption of individual nodes as it would require the attacker to gain control over 50% of the network's mining power (for 'proof of work' systems) to be able to make alterations to the data stored on a blockchain. Even then it is still impossible to perform such a malicious activity secretly as it will be visible to the whole participants of the system.²²

Currently, the market of blockchain storage is expanding as multiple providers offer their blockchain-based storage solutions, e.g., Storj, Sia, and Filecoin.²³

Blockchain-based dispute resolution platforms. In comparison to the previous use-cases where blockchain and/or smart contracts can be used to facilitate the arbitration process without altering its nature, this option represents the next step of involvement of digital technologies into dispute resolution. It requires a significantly higher degree of integration of blockchain into arbitration proceedings altering some processes, e.g., submission of evidence, communication with a tribunal, decision-making, etc., up to the point where the resulting mix of law and technology can raise questions of the legal validity of such proceedings and legal recognition of the arbitral awards. Scholars and practitioners whose research interests revolve around the topics of blockchain-based solutions for online arbitration raise some doubts on whether these new creatures can be called arbitration platforms in the first place and whether their awards can be enforced as typical arbitration awards.²⁴ We will be diving deeper into this problem in further chapters of the current paper. For now, it is important to mention that there are multiple blockchain-based platforms for dispute

²² SAYEED, S. and H. MARCO-GISBERT. Assessing Blockchain Consensus and Security Mechanisms Against the 51% Attack. *Applied Sciences* [online]. 2019, Vol. 9, no. 9, p. 5 [cit. 15. 4. 2021]. Available at: <https://www.mdpi.com/2076-3417/9/9/1788>

²³ SHEHATA, I. Three Potential Imminent Benefits of Blockchain for International Arbitration: Cybersecurity, Confidentiality and Efficiency. *YAR – Young Arbitration Review*, 2018, Vol. 7, ed. 31, p. 34.

²⁴ BANSAL, R. Enforceability of Awards from Blockchain Arbitrations in India. *Kluwer Arbitration Blog* [online]. 21. 8. 2019 [cit. 16. 4. 2021] Available at: <http://arbitrationblog.kluwerarbitration.com/2019/08/21/enforceability-of-awards-from-blockchain-arbitrations-in-india/>

resolution that target clients who operate with smart contracts in their contractual activity.²⁵

3 The Special Part

3.1 Types of Arbitration That Can Be Used for Solving Disputes That Involve Smart Contracts: Off-Chain Arbitration vs. On-Chain Arbitration

Now, that we have a basic understanding of what the decentralized ledger technology is and how blockchain and/or smart contracts can come in handy for international arbitration, it is time to dive deeper into the specific areas where these new technological solutions can be applied when it comes to the arbitration process. The existing pool of scientific researches in the relevant sphere is concentrated on the two big groups of application of blockchain to alternative dispute resolution mechanisms: the off-chain and on-chain arbitration.

There is no universally agreed distinction between the off-chain and on-chain arbitration as well as a firmly established definition of the phenomenon at hand, however, some of the scholars and practitioners who refer to these types of arbitration in their works understand them as the tools that can help automate or even modify arbitration by benefiting from the inclusion of the blockchain technology into the arbitration process.²⁶ The main distinction line here lies in the degree of such involvement of technology. On-chain arbitration relies on the use of blockchain-based solutions in the decision-making process and/or the procedure of the execution of an arbitral award while off-chain arbitration benefits from the blockchain or smart contracts as tools for facilitation of, for example, the process of appointment of an arbitrator or arbitrators but without the intervention of tech into the process of arbitration that would alter the course of human

²⁵ JEVRMOVIĆ, N. 2018 In Review: Blockchain Technology and Arbitration. *Kluwer Arbitration Blog* [online]. 27. 1. 2019 [cit. 12. 4. 2021]. Available at: <http://arbitrationblog.kluwerarbitration.com/2019/01/27/2018-in-review-blockchain-technology-and-arbitration/>

²⁶ SZCZUDLIK, K. 'On-chain' and 'Off-chain' Arbitration: Using Smart Contracts to Amicably Resolve Disputes. *Newtech.law* [online]. 4. 6. 2019 [cit. 17. 4. 2021]. Available at: <https://newtech.law/en/on-chain-and-off-chain-arbitration-using-smart-contracts-to-amicably-resolve-disputes/>

conduct during the ‘hearing’ of a case and decision-making.²⁷ As the idea of inclusion of a blockchain element into the arbitration process is novel, the dividing line between the concepts of on and off-chain arbitration is rather blurred.

Yet, I find this division line to be important, because when taken to the extreme, it can significantly alter the process of the decision-making in the arbitration as we will be able to observe during the subsequent chapter devoted specifically to the issues of the development and implementation of the on-chain arbitration into the existing framework of classic dispute resolution mechanisms.

3.1.1 The Off-Chain Arbitration

While the off-chain arbitration, for example, the offline or online arbitration that has a certain degree of involvement of smart contracts and blockchain technologies may seem like a classic procedure that would only benefit from such automation of processes, from the fusion of technology and legal practice brings its challenges and raises concerns.

Let us construct a fictional illustration of social relations between the parties who eventually end up in a dispute and rely on blockchain technologies to facilitate the resolution of such a case. Say, we have a situation when two contractual parties decide to regulate their commercial relations using smart contracts instead of conventional written ones. These parties draft a body of a smart contract that includes an arbitration clause and even provide for a certain sum in a certain cryptocurrency to be deposited in a version of an escrow account designed specifically for potential dispute situations. The arbitration clause prescribes that in an event of a dispute between the parties and inability to solve it amicably, the case proceeds to a classic off-chain arbitration. A certain chunk of the operational funds (in cryptocurrency) are locked specifically for the purpose of the possible dispute. In case no such dispute arises during the term lifespan of a smart contract, the funds return to the accounts of both parties. Should there be any non-performance

²⁷ PHORA, D. and A. RAJ. Blockchain Arbitration – The Future of Dispute Resolution Mechanisms? *Cambridge International Law Journal* [online]. 16.12.2019 [cit. 16.4.2021]. Available at: <http://cilj.co.uk/2020/12/16/blockchain-arbitration-the-future-of-dispute-resolution-mechanisms/>

on the side of any party, these funds will be used for the enforcement of the arbitral award. Apart from this automation mechanism, everything else is conventional: the parties decide on the composition of the arbitral tribunal, pick the arbitration institution, chose the applicable substantive and procedural law and conduct a classic arbitration proceeding.

The potential **points of concern** in such a fictional situation are numerous: 1) the validity of the arbitration clause; 2) the governing substantive law (especially in case of a cross-border element); 3) the problems with self-execution of a smart contract, especially in a case such a contract is declared null and void; 4) the recognition and execution of an arbitral award; 5) the errors in the smart contract that occurred during the draft stage; 6) the problems of a proper interpretation of the contractual terms, etc. The list can go on. All these legal concerns can be structured into two groups: a) those attributed to the **unclear legal status** of smart contracts and contractual tools.²⁸ This includes the **problem of the legal recognition of smart contracts**: the technology is rather novel and there is no comprehensive legal regulation that could clarify the status of this tool. There is no uniformity among scholars and practitioners on how to treat smart contracts: as a variation of a classic written contract; as a specific form of a digital type of a contract; as something of its own nature, etc. If these are treated as equal to classic contracts, what to do with different rules on the required elements of a contract that exist in Common and Civil law jurisdictions, e.g., the requirement of the *consideration* in Common Law vs. the concept of *causa (cause)* in Civil Law countries (how to determine its existence or absence in case of a smart contract), etc.²⁹

Another problem here is the **question of the validity of the arbitration clause** that is drafted on a smart contract. This is due to the current requirement of the United Nations Convention of 10 June 1958 on the Recognition and Enforcement of Foreign Arbitral Awards (“New York Convention”) that provide for some specific mandatory requirements for arbitration

²⁸ SCHMITZ, A. J. and C. RULE. Online Dispute Resolution for Smart Contracts. *Journal of Dispute Resolution* [online]. 2019, Vol. 103, no. 2, p. 110 [cit. 18. 4. 2021]. Available at: <https://scholarship.law.missouri.edu/facpubs/726>

²⁹ TIKNIŪTĖ, A. and A. DAMBRAUSKAITĖ. Understanding Contract Under the Law of Lithuania and Other European Countries. *Jurisprudence* [online]. 2011, Vol. 18, no. 4, p. 1394 [cit. 16. 4. 2021]. Available at: <https://repository.mruni.eu/handle/007/11062>

agreements and arbitral clauses that are parts of commercial contracts.³⁰ Para. 2 and 3 of Art. II of the New York Convention state the following:

*“1. Each Contracting State shall **recognize an agreement in writing** under which the parties undertake to submit to arbitration all or any differences which have arisen or which may arise between them in respect of a defined legal relationship, whether contractual or not, concerning a subject matter capable of settlement by arbitration.*

*2. 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.**”³¹*

As we can see from the article mentioned above, the requirement for an arbitral clause or an arbitration agreement to be in writing has a certain degree of flexibility to it as it allows an ‘exchange of telegrams’ to be qualified for a written form thus permitting some level of digitization of communications between the parties in these matters. Still, it has no indications as regards the possibility of communications between the parties that are happening on a blockchain via smart contracts to qualify for the requirement of a ‘written form’. This poses difficulties for the parties who desire to rely solely on smart contracts to regulate their contractual relations including the arbitration option in a case of a dispute.

In practice, such a requirement has been relaxed with the issuance of the Amendments to the Model Law on International Commercial Arbitration made by the UNCITRAL (“UNCITRAL Model Law”) in 2006 where Art. VII provides that the wording ‘electronic communication’ between the parties should encompass the broader range of tools than just telefax or so as long as such information in an electronic communication ‘is accessible so as to be usable for subsequent reference’.³² Since the publication of the 2006 Amendments to the UNCITRAL Model Law, various national courts started interpreting the requirement of the Art. II para. 2 of the New

³⁰ SZCZUDLIK, K. ‘On-chain’ and ‘Off-chain’ Arbitration: Using Smart Contracts to Amicably Resolve Disputes. *Newtech.law* [online]. 4. 6. 2019 [cit. 17. 4. 2021]. Available at: <https://newtech.law/en/on-chain-and-off-chain-arbitration-using-smart-contracts-to-amicably-resolve-disputes>

³¹ Art. 2 para. 2 and 3 New York Convention.

³² Art. VII UNCITRAL Model Law on International Commercial Arbitration with amendments as adopted in 2006.

York Convention more broadly when enforcing the arbitral awards indicating, for example, that such a New York Convention's requirement 'can take various forms and the term must be given a functional and pragmatic interpretation'.³³ That being said, it is still unclear as to whether courts and arbitration tribunals will be utilizing the same degree of flexibility when deciding on the validity of the arbitration clause/agreement that is drafted as a part of a smart contract.

The **issues of the interpretation of the provisions of smart contracts** also fall into this category of concerns. How to know whether the parties to the contract reached a consensus over all the binding elements of the contract? This question may become quite complicated if we take into consideration that the human language needs to be transcribed into computer code – 'translated from human to computer language' as a smart contract operates within the 'IFTTT' logic³⁴. This also introduces an intermediary – a programmer. Parties to a contract can draft contractual provisions if these are relatively simple. If the cross-border element is involved, or if the monetary value of the contract is significant, etc., the parties may refer to lawyers to help draft a contract. Smart contracts require not only lawyers but also programmers to launch such a contract and to ensure that no errors are present in the code of the body of the contract. Such a presence of an additional middleman adds to the potential errors due to a 'human factor'. This situation increases the potential misunderstandings regarding the intentions of the parties and subsequently may lead to a dispute being brought before an arbitral tribunal. The described reality adds additional hurdles in arbitration proceedings, as currently there is no established practice of interpretation of contractual provisions in a form of a computer code and arbitrators will likely need to involve programmers to help them to interpret smart contracts – a time-consuming and costly practice.³⁵

³³ Court of Appeal of Manitoba (Canada) of 11 December 2002, *Sheldon Proctor vs. Leon Schellenberg*, Case AI02-30-05317.

³⁴ IFTTT stands for 'if this then that' – this is the typical operating logic of a computer script.

³⁵ ROGERS, J., H. JONES-FENLEIGH and A. SANITT. Arbitrating Smart Contract Disputes: Negotiation and Drafting Considerations. *International Arbitration Report*, 2017, no. 9, p. 23.

Those referred to the **nature** of a smart contract and blockchain. During the chapters of the general part of the research, we analyzed the key features of blockchain technology and smart contracts that distinguish these two tools from the other technological solutions. The two of those that are interesting for us in the current section are the **blockchain's immutability feature and the smart contracts' self-execution**. Even though our fictional example of a contract between the parties provides for the arbitration clause and the reservation of a certain sum of coins for the purposes of potential dispute resolution, the problem remains – a typical smart contract is self-executable and will continue to operate regardless of the parties having a dispute. In case the arbitral tribunal recognizes such a contract null and void, it is impossible to simply reverse the state of the parties' social relations to the point prior to entering contractual relations. Sure, smart contracts as technology constantly evolve and become more sophisticated: the modern versions of smart contracts can 'monitor the situation in an off-chain world' through the so-called 'oracles'³⁶ that act as portals to the web. A smart contract may be able to 'detect' that the parties brought a case before an arbitral tribunal and, in that situation, 'pause' its execution.³⁷ However, it is unlikely that a smart contract would be programmed in a way that allows it to 'self-destruct' and/or 'rewind' to the stage before its launch (even though it may be technically possible to draft it that way). Even if it is possible, modern smart contracts are inalienable from the blockchain on which they operate. Since a blockchain is designed with the idea of immutability of the data stored on it, it would be burdensome if not impossible to revert the already registered transactions in case an award issued by an arbitral tribunal recognizes the smart contract from our fictional scenario as null and void (at least in case of a public permissionless blockchain). Most likely, it would require the creation of a new smart contract to 'reimburse' the losses that the injured party incurred.

³⁶ Oracles. *Ethereum.org* [online]. 2021 [cit. 21. 4. 2021]. Available at: <https://ethereum.org/en/developers/docs/oracles/>

³⁷ OPENLAW. Controlling Autonomy: A New Tool to Stop Smart Contracts Once Executed. *Consensus* [online]. 8. 8. 2018 [cit. 22. 4. 2021]. Available at: <https://media.consensus.net/controlling-autonomy-a-new-tool-to-stop-smart-contracts-once-executed-bc9de699bca0>

As we can see from this chapter, smart contracts can make the contracting activity of the participating parties easier by automating the execution of such contracts. On top of that, smart contracts can contain arbitration clauses and provide the parties with the possibility to address the potential disputes. Arbitration, as one of the most flexible and convenient tools to solve disputes, can be a good option for such tech-savvy users. That being said, the current state of development of the mentioned technologies as well as the existing legal framework regarding blockchain and smart contracts raises many concerns that need to be addressed to let the practice of resolving such disputes via arbitration disseminate globally.

3.1.2 The On-Chain Arbitration

As it was mentioned earlier, the so-called ‘on-chain’ arbitration is a completely different creature, unlike the solutions for the facilitation of the arbitration procedure that is conducted off-chain, on-chain arbitration is represented by the online platforms that are designed specifically to conduct the arbitration proceedings utilizing distributed decentralized ledgers and smart contracts for those purposes. Among the most well-known solutions for this are platforms like Kleros, Aragon, Jur.io, etc. Developers of these platforms advertise that their products are capable of automation of the process of dispute resolution where smart contracts and blockchain technologies are involved and that such solutions can be cheaper and less time consuming than more conventional dispute resolution mechanisms. It is achieved by the incorporation of the automated dispute resolution mechanism directly into the body of a smart contract.³⁸

The idea of an on-chain arbitration platform, in general, revolves around the mixture of capabilities of smart contracts to automate processes, blockchain’s immutability feature, use of crypto tokens and the application of game-theory principles to achieve the decision that is deemed to be just on the one hand and achievable by the logical thinking on the other hand.³⁹

³⁸ METZGER, J. The Current Landscape of Blockchain-Based, Crowdsourced Arbitration. *Macquarie Law Journal* [online]. 2019, Vol. 19, p. 87 [cit. 16. 4. 2021]. Available at: https://www.mq.edu.au/__data/assets/pdf_file/0010/866287/Blockchain-Based-Crowdsourced-Arbitration.pdf

³⁹ *Ibid.*, p. 94.

The practical implementation of such an on-chain dispute resolution mechanism can be the following: the participating parties draft a smart contract that would regulate their contractual relations and include there an arbitration clause. The funds, allocated by the parties for the purposes of the execution of this particular contract, are being locked in a smart contract (similar to an escrow account). In case of a dispute, the parties refer to such an on-chain dispute resolution platform which opens the call for the participation of the judges as volunteers. When the panel is composed, the judges cast their votes for the outcome of the case: the case is being decided on a majority basis – the option that gains most of the votes prevails. Those judges who ended up being a majority gain some financial compensation for their participation in the case hearing while those who ended up being a minority – lose their money (in a cryptocurrency). The cryptocurrency donation is a mandatory prerequisite for an arbitrator to join the case (these donations form the fund for subsequent compensation for those arbitrators who sided with the majority when casting their votes).⁴⁰

Taking into consideration the typical situation of a lack of trust among both the contracting parties⁴¹ and the arbitrators⁴² that participate in the decision-making process via these on-chain platforms, the idea of utilizing game-theory principles is rather effective. Certain scholars that analyze the phenomenon of the emergence of the on-chain arbitration platforms and the logic behind their functionality indicate underline

⁴⁰ BUCHWALD, M. Smart Contract Dispute Resolution: The Inescapable Flaws of Blockchain-Based Arbitration. *University of Pennsylvania Law Review* [online]. 2020, Vol. 168, no. 5, p. 1389 [cit. 16.4.2021]. Available at: https://scholarship.law.upenn.edu/cgi/viewcontent.cgi?article=9702&context=penn_law_review

⁴¹ Smart contracts executable on a blockchain can be a popular option for the regulation of contractual social relations between the parties in a setting where there is a lack of trust (due to the technological characteristics of the mentioned technologies, e.g., immutability feature of a blockchain and the self-execution nature of smart contracts) as the parties may be contracting remotely from distant locations and their real names and background can be hidden behind their ‘digital identity’.

⁴² Their real names and identities can also be hidden from the parties that brought a claim before the ‘digital tribunal’ as well as from the other participating arbitrators in the panel.

the crucial role of the so-called ‘Schelling point’⁴³ – a theory that a group of people that find themselves in a trustless setting, in case they need to reach a consensus over some issue, will rely subsequently on a certain ‘focal point’⁴⁴ to come to such a consensus.⁴⁵

Now, to better understand the practical implementation of the described ideas, let’s take a closer look at some of the on-chain arbitration platforms as a proof of concept that the theories mentioned earlier actually work.

Aragon Network. The developers of this platform advertise it as a one-stop-shop solution: from the creation of a DAO that stands for Decentralized Autonomous Organization and is composed of a multitude of smart contracts that are tied together, to the administration of the disputes that involve smart contracts or a blockchain element. The branch that is responsible for handling the disputes is called *Aragon Court*.⁴⁶ In case of a dispute, the jurors are selected to adjudicate such a case based on a draft model, i.e., they are picked from the pool of the persons that volunteered to participate in the dispute resolution. In order to participate in the pool of potential jurors, the volunteer needs to submit a certain sum of money in the form of the specifically developed local token called ANJ⁴⁷. A volunteer ‘bet’ a certain amount of ANJs to increase his/her chances of being selected to adjudicate a dispute. Once the jurors are selected, they review the evidence submitted by the disputing parties via the Aragon system and vote for the outcome of the case. The result of their vote, say 2 in favour of party A and 1 in favour of the party B, constitutes a preliminary

⁴³ This is a classic illustration of a type of cooperative behaviour of an individual in an environment with a lack of communication between the participants. The modern on-chain arbitration solutions are built around this idea that since a rational actor typically wants to maximize his/her gains, it is predictable that such an actor will always gravitate towards the fairest solution of the dispute as it is the only strategy that would bring him/her the maximum amount of tokens.

⁴⁴ SCHELLING, T. C. *The Strategy of Conflict*. Cambridge, MA.: Harvard University Press, 1960, p. 57.

⁴⁵ SCHMITZ, A. J. and C. RULE. Online Dispute Resolution for Smart Contracts. *Journal of Dispute Resolution* [online]. 2019, Vol. 103, no. 2, p. 110 [cit. 18. 4. 2021]. Available at: <https://scholarship.law.missouri.edu/facpubs/726>

⁴⁶ Aragon White paper. *GitHub* [online]. 18. 7. 2019 [cit. 24. 4. 2021]. Available at: <https://github.com/aragon/whitepaper>

⁴⁷ Stands for Aragon Network Juror. Not to be confused with ANT – Aragon Network Token – the main cryptocurrency of the platform. ANJs are used only by the jurors to participate in case hearings.

ruling – a decision that can be appealed by the disagreeing party for a certain amount of additional fee (when drafting a smart contract, the contracting parties must deposit collateral⁴⁸ in the form of ANT that is reserved specifically for the situations of a dispute). When all the adjudication rounds are settled, the winning party gains the reward and the participating jurors face their outcome: the juror that sided with the losing party will also lose his/her ANJs which will be added to the general sum of ANJs in this particular case and distributed evenly between the jurors who cast their votes for the party who ended up winning the case.⁴⁹ This approach of depriving the jurors who sided with the majority while casting the votes of their rewards is a perfect illustration of an incentivization scheme described earlier as a Schelling point and is used for promoting jurors to adjudicate fairly (in line with what is understood by a juror as a ‘subjective truth’) as it is the only way in such a system for a juror to gain profit and subsequently increase his/her reputation and chances of being selected again.⁵⁰

Kleros. Another on-chain arbitration platform that relies on a similar set of rules and approaches towards dispute resolution that involve smart contracts is Kleros. This is a France-based company that launched specifically as an online dispute resolution platform for resolving smart contract disputes but currently expanded to incorporate multiple products such as a P2P (peer-to-peer) transactions marketplace.⁵¹ The idea behind this platform is quite similar to the one developed by Aragon: the disputing parties lodge a claim, provide collateral in the form of cryptocurrency (Ether in our case), the jurors that want to adjudicate this case submit their ‘bets’ in the form of the local platform’s token (Pinakion or PNK in this case) to increase their chances of being selected. After the votes being cast in favour of one of the disputing parties, the jurors who sided with the winning party collect their PNKs back + those Pinakions from the jurors

⁴⁸ METZGER, J. The Current Landscape of Blockchain-Based, Crowdsourced Arbitration. *Macquarie Law Journal* [online]. 2019, Vol. 19, p. 94 [cit. 16. 4. 2021]. Available at: https://www.mq.edu.au/__data/assets/pdf_file/0010/866287/Blockchain-Based-Crowdsourced-Arbitration.pdf

⁴⁹ Become a Juror for Aragon Court. *Aragon.org* [online]. [cit. 25. 4. 2021]. Available at: <https://anj.aragon.org/#learn>

⁵⁰ Aragon Court. *Aragon Help Desk* [online]. [cit. 25. 4. 2021]. Available at: <https://help.aragon.org/article/41-aragon-court>

⁵¹ About Kleros. *Kleros.io* [online]. [cit. 25. 4. 2021]. Available at: <https://kleros.io/about>

who sided with the losing party (the implementation of the Schelling point incentivization scheme in practice).⁵² On top of that, the jurors who ruled in favour of the subsequent winner of the case will also have their cut from the sum in ETH (Ether) deposited by the disputing parties as collateral.⁵³ In comparison to other competitive platforms, Kleros can boast a well-developed structure and technical advancement as it not only has the system of hierarchically arranged sub-courts for the resolution of different kinds of disputes but also has the decentralized application or DApp ready for use. On top of that, the internal token that is used for jurors' system of reputation – PNK can be purchased on various token exchanges such as Bitfinex or Ethfinex.⁵⁴ If we look at the webpage of the Kleros's Dispute Resolver – a specifically designed portal that displays the statuses of the pending cases, we will find a variety of different disputes ranging from the demands for a refund for a purchase of a pet that turned to be of 'unacceptable quality' to the tenancy disputes.⁵⁵ This indicates that a platform is capable of attracting various consumers from those who argue over small claims to the more substantial ones.

Jur. This platform, just like its competition, promises to provide affordable and easy access to online dispute resolution.⁵⁶ The solution itself represents an on-chain arbitration platform that functions utilizing the game theory incentivization schemes like the already mentioned Schelling Point to compensate participating jurors for their participation in the adjudication process. However, unlike Kleros and Aragon, Jur platform provides for a slightly different approach towards the redistribution of the tokens (JUR token in our case). Previously, we described the scheme where the tokens were distributed evenly between the participating jurors who sided with the winning majority when casting their votes. Jur platform opts for

⁵² LESAEUGE, C., F. AST and W. GEORGE. Kleros White paper. *Kleros.io* [online]. 2019, p. 2 [cit. 26. 4. 2021]. Available at: <https://kleros.io/assets/whitepaper.pdf>

⁵³ *Ibid.*, p. 8.

⁵⁴ METZGER, J. The Current Landscape of Blockchain-Based, Crowdsourced Arbitration. *Macquarie Law Journal* [online]. 2019, Vol. 19, p. 100 [cit. 16. 4. 2021]. Available at: https://www.mq.edu.au/__data/assets/pdf_file/0010/866287/Blockchain-Based-Crowdsourced-Arbitration.pdf

⁵⁵ Kleros Dispute Resolver. *Kleros.io* [online]". [cit. 27. 4. 2021]. Available at: <https://resolve.kleros.io>

⁵⁶ Justice Decentralized. *Jur.io* [online]. [cit. 27. 4. 2021]. Available at: <https://jur.io>

a different approach: the funds of the jurors who sided with the minority are still redistributed among those who sided with the majority, but not evenly. Only those jurors who voted earliest and whose votes were in favour of the subsequent winner of the case get their tokens back plus the tokens of all other jurors. In practice, this looks the following way: say we have the panel consisting of 7 jurors. The decision is split: 5 in favour of the claimant and 2 in favour of the respondent. In such a case, those jurors who sided with the respondent lose their tokens. These tokens are being added to the general pile of tokens of all jurors. The resulting sum will be redistributed evenly between not 5 but only 3 of the jurors who voted in favour of the claimant and who were the fastest out of the 5 to cast their votes.⁵⁷

Such a mechanism of redistribution of tokens is developed to sort of ‘fix’ the theoretical flaw of the Schelling Point: without such a procedure, the jurors that vote later than their colleagues might cast their votes based following the already established majority even though they might agree with the arguments of the losing party (from the legal standpoint). This mechanism will not be able to prevent all types of ‘abuse’ of the platform but combined with the practice of flexible voting time (when the deadline for jurors to cast their votes can be automatically extended under certain circumstances) can deter the participating jurors from executing the so-called ‘last-minute attack on the majority’.⁵⁸

Another distinctive feature of the Jur platform is the operation in their activity with the new variation of a smart contract, namely ‘smart legal contract’. This concept represents an idea of a merge between classic written contracts and smart contracts where the best of the two worlds (legal recognition from the classic contracts and automation and self-execution from smart contracts) coincide for more efficiency and user flexibility. Jur is not a pioneer in this realm as the concept of a smart legal contract

⁵⁷ METZGER, J. The Current Landscape of Blockchain-Based, Crowdsourced Arbitration. *Macquarie Law Journal* [online]. 2019, Vol. 19, p. 100 [cit. 16.4.2021]. Available at: https://www.mq.edu.au/__data/assets/pdf_file/0010/866287/Blockchain-Based-Crowdsourced-Arbitration.pdf

⁵⁸ Jur AG White paper. *Jur.io* [online]. 2019, p. 40 [cit. 28.4.2021]. Available at: <https://jur.io/wp-content/uploads/2019/05/jur-whitepaper-v.2.0.2.pdf>

existed before the creation of the platform and revolves around the concept of a ‘Ricardian contract’⁵⁹, but Jur developers claim that they created various ‘detailed templates’ with a high degree of automation where users can ‘drag and drop’ the needed provisions that they would like to see in their contract.⁶⁰

Also, unlike, for example, Kleros, Jur developers designed their platform in a way as to allow the resolution of the disputed stem from contractual relations governed not only by smart contracts but also classic conventional natural language contracts thus making this solution suitable for a wider range of use-cases.⁶¹

As we can see from the mentioned examples, despite the relative novelty of the concepts of blockchain and smart contracts, the market of the on-chain dispute resolution platforms is already represented by a number of competing solutions that were able to find their niche and attract the user-base. In light of the growing digitization of the processes, conventional arbitration institutions may want to adopt the experience from these new technological solutions to be more attractive to potential clients.

3.2 Advantages and Drawbacks of On-Chain Arbitration Platforms in Comparison to Conventional Commercial Arbitration

Positive sides. Based on the specifications of the technological solutions in the sphere of blockchain-based dispute resolution and the logic behind the idea of on-chain arbitration, we can deduce several advantages of these types of procedures in comparison to the conventional dispute-resolution mechanisms. First of all, on-chain dispute resolution platforms are attractive to their users due to the **automation of the enforcement procedure** of the arbitral awards rendered on-chain. This is due to the self-executory

⁵⁹ A concept of a Ricardian contract was introduced by Ian Grigg in 2004 and represents an idea of a contract that can be easily readable by people and by programs at the same time, i.e., contains human language semantics and machine identifiers in a form of a computer language. It should be both: ‘readable by humans and parsable by programs’. See GRIGG, I. The Ricardian Contract. *Iang.org* [online]. [cit. 28. 4. 2021]. Available at: https://iang.org/papers/ricardian_contract.html

⁶⁰ Jur AG White paper. *Jur.io* [online]. 2019, p. 18 [cit. 28. 4. 2021]. Available at: <https://jur.io/wp-content/uploads/2019/05/jur-whitepaper-v.2.0.2.pdf>

⁶¹ *Ibid.*, p. 56.

nature of modern smart contracts executable on a blockchain ledger as these allow for a decision of jurors to be executed without delays after its proclamation. In this regard, it is even questionable whether it is correct to describe the procedure that commences after a jurors' decision as an 'enforcement' of an award as it is frequently referred to as a part of the 'recognition and enforcement' of conventional arbitral awards. These kinds of awards are executed automatically without the need for any 'external authorisation' of this process. The researchers who analyze the peculiarities of the functionality of one of the on-chain dispute resolution platforms Kleros, make an emphasis on this distinction.⁶²

The other positive sides of the on-chain arbitration systems that stem directly from the mentioned automation of the processes are **savings of time and costs** when compared to the classic arbitration procedures. The submission of a claim, selection of jurors, collection of evidence and the voting process is rather fast and simple. All of the platforms that provide solutions for blockchain-based dispute resolution that were described in the previous chapters describe in their whitepapers and user guides a description of how is the process of dispute resolution being organized and what steps it involves. Some platforms, e.g., Jur build their advertisement around the fact that their approach to dispute resolution allows them to reduce the time and costs required for case hearings indicating that the average time to close a dispute on their platform amounts to 60 days.⁶³ In contrast, the ICC's 2019 dispute resolution statistics indicate the average time for a case to reach a final award to be between 6 to 26 months. Not to mention that this is true for the expedited procedures – the ones that are suitable for rather small claims.⁶⁴ The relatively short average duration of the dispute resolution process on the blockchain-based arbitration platforms also influences the financial expenses of the disputing parties. The on-chain arbitration is cheaper than conventional dispute resolution since the shorter

⁶² NAROZHNY, D. Is Kleros Legally Valid as Arbitration? *Kleros.io* [online]. 12. 6. 2019 [cit. 28. 4. 2021]. Available at: <https://blog.kleros.io/is-kleros-legally-valid-as-arbitration/>

⁶³ Meet the Open Justice Platform. *Jur.io* [online]. [cit. 28. 4. 2021]. Available at: <https://jur.io/products/open-justice/>

⁶⁴ ICC. Dispute Resolution Statistics. *International Chamber of Commerce* [online]. 2019 [cit. 29. 4. 2021]. Available at: <https://iccwbo.org/media-wall/news-speeches/icc-releases-2019-dispute-resolution-statistics/>

amount of time required for obtaining an award means that the disputing parties can resume their contractual activity sooner and spend less money for any kind of legal services.

Finally, based on the characteristics of the blockchain technology and smart contracts, e.g., the self-execution of a contract and the automatic implementation of an arbitral award, the on-chain dispute resolution platforms has become an attractive tool for those people who implement smart contracts in their contractual activities and whose disputes are rather small. Such blockchain-based dispute resolution platforms can offer their customers prompt and inexpensive resolution of **small claims** thus occupying a niche of their own with conventional arbitration being reserved for more substantial disputes that involve bigger risks and operate with larger sums of money at stake.

Weak aspects. Unlike the previously mentioned attractiveness of the blockchain-based arbitration platforms for the resolution of small disputes, the disadvantage of on-chain arbitration solutions is their **poor suitability for larger and more complex claims**. This is due to several reasons. First of all, the qualification of the participating arbitrators is hard to verify. Kleros, Jur and other similar solutions have a detailed description of the process of the selection of the volunteers for the position of jurors.⁶⁵ The problem is, there are no formal requirements on things like the education, working experience, reputation, etc., of the potential jurors. This means that the disputing parties can only guess how qualified and experienced the selected panel of jurors is. This is partially due to the peculiarities of the functioning of the blockchain-based dispute resolution platforms. The volunteers who want to participate in these platforms as jurors, need to have at least some basic understanding of the functionality of the blockchain technology, smart contracts, cryptocurrencies and tokens, all this – just to be able to register on such platforms and submit their candidacy for the selection process. We can call this ‘the minimum technical knowledge threshold’ – the new requirement for these ‘jurors of the digital age’. It is obvious, that there are far fewer arbitrators in the world who can be both qualified and experienced

⁶⁵ See white papers of the respective platforms. Many of them have special chapters devoted to the process of the selection of jurors.

from the standpoint of the legal profession and, at the same time, – from the technical side than there are experts in these fields taken separately. For now, in case an arbitrator is proficient in his/her craft (from the legal profession standpoint), he/she is better off sticking to a conventional arbitration rather than trying to gain technical knowledge and entering the realm of on-chain arbitration. Such a situation dictates the relatively flexible requirements for the qualification of the jurors participating in these new technological solutions.

The situation described above is only getting magnified by the **absence of the regulatory framework** when it comes to on-chain arbitration. When we are dealing with conventional dispute resolution, especially if a dispute involves a cross-border element, there exists a combination of national, international legislation, soft law and a developed case-law basis that regulates social relations in the sphere of commercial arbitration. This includes the New York Convention, the UNCITRAL Model Law, the ICC Rules of Arbitration, etc. When it comes to the on-chain arbitration, its situation is different: there is no regulatory framework in place that could serve as a guide for participating parties. This is due to the novelty of the technology itself and the lack of recognition of it in the arbitration community as an alternative tool to conventional dispute resolution. This is probably the most significant drawback of the on-chain arbitration as this ‘legal grey area’ can scare away the potential clients and deters the development of the technology.

Lastly, I can determine another potential disadvantage of the blockchain-based dispute resolution platforms. The one that has to do with the mode of functioning of a smart contract – the so-called **‘IFTTT logic’ of smart contracts’ execution**. Smart contracts are drafted using programming languages⁶⁶. This means that to represent contractual provisions in a smart contract, the drafters need to reflect them in a computer code variation. This can be done by transcribing the human language logic into the computer one. This can be achieved through the ‘if this – then that, else – that’

⁶⁶ One of the typical programming languages that are used for drafting smart contracts is Solidity.

approach – a typical logic that a computer code operates with.⁶⁷ This places certain constraints on the degree of flexibility when drafting contractual provisions on a smart contract. On the one hand, such an approach simplifies the execution phase of a smart contract lifespan as it is predictable how a smart contract will behave when it is launched. On the other hand, not every typical contractual provision can be presented in an IFTTT logic. Take, for example, such rather vague concepts as standards of behaviour in contractual social relations like ‘the reasonable person of the same kind’, ‘utmost good faith’, etc. These are impossible to transcribe into a computer code because the former are human language constructs that have a high degree of flexibility and involve human judgment, while the latter is a language that is based on strict and inflexible logic. In case the disputing parties who regulate their contractual relations via a smart contract bring a claim before an on-chain arbitration platform, they might end up in a conundrum on how to interpret the intent of the parties to a contract. They might disagree on certain expectations that they had from their contractual rights and obligations when drafting a smart contract, but once that contract is launched it is the machine that will ‘interpret’ all the contractual provisions according to its ‘if-then-else’ logic. This illustration emphasises how rigid and inflexible smart contracts can be when it comes to the composition of contractual provisions that the parties want to embed on them.

3.3 The Future Perspectives and Predictions for the Interplay Between International Arbitration and Smart Contracts Executable on a Blockchain

Describing any possible future perspectives of a novel technology means entering uncharted territory as it is impossible to predict what will be the state of development of a given technological solution and peoples’ attitude towards it a couple of decades from now. That being said, based on the previously outlined pros and cons of the on-chain arbitration solutions as well as their functionality, we can already note that these platforms

⁶⁷ NZUVA, S. Smart Contracts Implementation, Applications, Benefits, and Limitations. *Journal of Information Engineering and Applications* [online]. 2019, Vol. 9, no. 5, p. 68 [cit. 29. 4. 2021]. Available at: <https://www.iiste.org/Journals/index.php/JIEA/article/view/49776>

grabbed some prospective consumers' attention. The number of cases that these platforms process is smaller than the one in conventional arbitration but blockchain-based dispute resolution has become attractive for people who want to implement smart contracts and blockchain technology in their business activity.

The number one problem that prevents the further growth of these platforms is the lack of a legal framework, i.e., the clear 'rules of the game'. Should this situation change in the future, we will likely see the exponential growth of on-chain dispute resolution platforms in the following decade. Without that, the market share of these new technological solutions will remain rather negligible.

I envision that the current trend remains for a couple of years with on-chain arbitration slowly gaining traction in parallel to conventional dispute resolution options and continues to remain under the radar of the big players and investors. Afterwards, if and only if smart contracts as a technology experience a surge in popularity (and this can happen if the process of transcription of contractual provisions into a computer language simplifies to the level that it becomes relatively easy for a non-tech expert, i.e., an average user to operate with it, for example, by creating a user interface that would allow to 'drag and drop' contractual provisions from a list of typical ones onto a smart contract with the further automatic compilation of them into a bytecode, etc.), it is possible that on-chain arbitration will become a competitor to the classic commercial arbitration. In that case, a gradual merge between the two is also possible – with the aim to take all the best from two worlds: take the flexibility and automation of a dispute resolution from on-chain arbitration and legal recognition and regulatory framework from the conventional arbitration.

As for now, the two concepts are just designed for different cases and cannot be mutually interchanged.

4 Conclusion

This research aimed to outline the interconnection of the new technologies, namely a blockchain and a smart contract with the international commercial

arbitration: to illustrate how the new technological solutions can facilitate and enrich the conventional arbitration proceedings introducing certain automation to the sometimes lengthy process of a dispute resolution. We started with the description of the idea behind the concepts of a blockchain and a smart contract, their structuring elements and peculiarities of functionality. Afterwards, we looked at the theoretical use-cases and practical applications of the new tech to the world of international commercial arbitration and found out that there are several levels at which the integration of the two worlds can occur: from pure functional ones, e.g., the use of blockchain as a storage for the data that is generated by the arbitration organizations to the ones that change the whole concept of the provision of the dispute resolution services such as arbitration platforms which functionality is grounded on the blockchain technology.

A certain part of the paper was devoted to the illustration of the differences between the two distinct approaches on how the blockchain and smart contracts can be implemented in the arbitration process besides the mere storage solutions, namely the distinction between the so-called ‘off-chain’ and ‘on-chain’ arbitration. It was emphasized that the off-chain arbitration, even though it represents a conventional arbitration but with the presence of the blockchain, cryptocurrency or smart contract element as a part of a dispute, introduces some specific requirements to the level of technical expertise on the side of arbitrators in addition to their qualification as lawyers. This situation allows us to draw a distinctive line between a conventional arbitration and an off-chain arbitration that involves a blockchain element.

The largest part of the paper was devoted to a very specific newly emerged category of services in the field of dispute resolution – the phenomenon of ‘on-chain’ arbitration – the idea that a dispute resolution may be conducted on a distributed decentralized ledger, i.e., blockchain. We found out that an on-chain arbitration revolves around the emergence of the technological solutions that provide for the possibility to not only solve disputes online with the involvement of volunteering jurors but also to allow for the automatic execution of arbitral awards without leaving blockchain and the need to refer to courts for the recognition and enforcement of such awards. This new method of arbitration is especially attractive for the parties who want

to implement smart contracts into their contractual activity and who have relatively small claims.

Finally, it was underlined that the newly emerged on-chain arbitration system is far from being perfect with its pros and cons that are specific to these new technological solutions with one of the biggest concern being the lack of a legal framework that would regulate the activity of such platforms. The prediction was made that the further evolution and dissemination of on-chain arbitration is dependent on the successful implementation and development of the regulatory framework in this field.

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Contact – e-mail

yeshcherbyna1@stud.mruni.eu

ORCID

0000-0002-5400-6403