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Arbitration in the Age of Blockchain

by

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Abstract

This thesis investigates the capacity of blockchain technology to transform international commercial arbitration and arbitration's ability to adapt to emerging technologies. As interconnected digital markets and social interactions rapidly expand, disputes originating from these connections increase correlatively, highlighting the need for more effective dispute resolution methods. The research encompasses the concept of arbitration, the impact of online dispute resolution mechanisms, and the influence of blockchain technology on arbitration processes. The analysis centers on the compatibility of online dispute resolution and blockchain arbitration within the international legislative framework, and whether blockchain arbitration could constitute a distinct legal order rooted in *Lex Cryptographia*. The inquiry addresses the challenges and opportunities in integrating blockchain technology into arbitration, including cybersecurity, confidentiality, and efficiency concerns, as well as the validity and enforceability of cryptographic arbitration agreements and awards. The thesis examines emerging blockchain arbitration platforms and reveals their potential to resolve small to medium-sized claims efficiently and cost-effectively, offering innovative solutions for various dispute situations. It advocates for a transitionary hybrid model, integrating blockchain arbitration within the existing legal framework without necessitating statutory reforms, thus promoting seamless incorporation and enhancing the overall dispute resolution process. Furthermore, it explores the potential development of *Lex Cryptographia* as a self-contained legal system within the blockchain ecosystem. As the global economy shifts towards the Internet of Things, the demand for an arbitration system independent of state intervention grows increasingly crucial. By establishing tailored principles and frameworks explicitly designed for blockchain technology's unique characteristics, *Lex Cryptographia* could offer a more effective and autonomous arbitration system, allowing parties to resolve disputes without reliance on traditional state-based mechanisms. Consequently, this thesis underscores the transformative potential of blockchain technology in international commercial arbitration and its ability to automate contractual enforcement and dispute resolution. The findings emphasize the necessity for harmonized international standards and best practices to ensure the legal recognition and enforceability of blockchain-based arbitration awards and the exploration of self-contained legal systems anchored in the blockchain, shaping the future of international arbitration.

I

<u>Résumé</u>

Cette thèse étudie la capacité de la technologie de la chaîne de blocks à transformer l'arbitrage commercial international et la capacité de l'arbitrage à s'adapter aux technologies émergentes. Alors que les marchés numériques interconnectés et les interactions sociales se développent rapidement, les litiges provenant de ces connexions augmentent corrélativement, soulignant la nécessité de méthodes de résolution des litiges plus efficaces. La recherche englobe le concept d'arbitrage, l'impact des mécanismes de résolution des litiges en ligne et l'influence de la technologie de la chaîne de blocks sur les processus d'arbitrage. L'analyse est centrée sur la compatibilité de la résolution des litiges en ligne et de l'arbitrage sur la chaîne de blocks dans le cadre législatif international, et sur la question de savoir si l'arbitrage blockchain pourrait constituer un ordre juridique distinct enraciné dans la Lex Cryptographia. L'enquête aborde les défis et les opportunités liés à l'intégration de la technologie de la chaîne de blocks dans l'arbitrage, y compris les préoccupations en matière de cybersécurité, de confidentialité et d'efficacité, ainsi que la validité et la force exécutoire des accords d'arbitrage et des sentences cryptographiques. La thèse examine les plateformes d'arbitrage sur la chaîne de blocs émergents et révèle leur potentiel pour résoudre efficacement et à moindre coût les réclamations de petite et moyenne importance, en offrant des solutions innovantes pour diverses situations de litige. L'étude préconise un modèle hybride transitoire, intégrant l'arbitrage sur la chaîne de blocs dans le cadre juridique existant sans nécessiter de réformes statutaires, favorisant ainsi une incorporation transparente et améliorant le processus global de résolution des litiges. En outre, cette enquête explore le développement potentiel de la *Lex Cryptographia* en tant que système juridique autonome au sein de l'écosystème de la chaîne de blocs. À mesure que l'économie mondiale s'oriente vers l'Internet des objets, la demande d'un système d'arbitrage indépendant de l'intervention de l'État devient de plus en plus cruciale. La *Lex Cryptographia*, avec des principes et cadres adaptés aux spécificités de la technologie de la chaîne de blocs, pourrait offrir un arbitrage autonome et efficace, permettant aux parties de régler leurs différends sans recourir aux systèmes étatiques traditionnels. Ainsi, la thèse met en avant le potentiel transformateur de la blockchain dans l'arbitrage commercial international, automatisant l'exécution des contrats et la résolution des litiges. Les résultats révèlent la nécessité d'harmoniser les normes internationales et d'améliorer les pratiques pour garantir la légalité et l'applicabilité des sentences arbitrales basées sur la blockchain, explorant des systèmes juridiques autonomes et influençant l'avenir de l'arbitrage international.

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List of Acronyms and Abbreviations

ADR: Alternative Dispute Resolution

Am. Rev. Int'l Arb.: American Review of International Arbitration

ARB. Int'l: Arbitration International (UK)

ASA: Swiss Arbitration Association

B.C.A.C.: British Columbia Court of Appeal

BRL: Blockchain Research Lab

Bus. Law.: Business Lawyer

Cal. L. R.: California Law Review

Can. Arb. J.: Canadian Arbitration Journal (CAN)

Can. Bus. L.J.: Canadian Business Law Journal (CAN)

CanLII: Canadian Legal Information Institute

Cass: Cour de Cassation (France's highest court in civil and criminal matters)

CCQ: Civil Code of Québec

CISG: United Nations Convention on Contracts for the International Sale of Goods

Columbia Science and Technology Law Review: Columbia Science and Technology Law Review

COVID-19: Coronavirus Disease 2019

Disp Resol J.: Dispute Resolution Journal

Duke L.J.: Duke Law Journal (USA)

E-SIGN Act: Electronic Signatures in Global and National Commerce Act

EC: European Commission

ECC: Electronic Commerce Council

ECJ: European Court of Justice

ECLI: European Case Law Identifier

EU: European Union

EWHC: England and Wales High Court

G.A. Res.: General Assembly Resolution

Harv. L. Rev.: Harvard Law Review (USA)

HKEC: Hong Kong e-Report Citations

HKIAC: Hong Kong International Arbitration Centre

ICA-ML: International Commercial Arbitration Model Law

ICANN: Internet Corporation for Assigned Names and Numbers

ICC: International Chamber of Commerce

ICCA: International Council for Commercial Arbitration

ICSID: International Centre for Settlement of Investment Disputes

IEEE: Institute of Electrical and Electronics Engineers

ILSA J. Int'l & Comp. L.: International Law Students Association Journal of International & Comparative Law

IoT: Internet of Things

ISSN: International Standard Serial Number

J Marshall LJ: John Marshall Law Journal

J.L. Innovation: Journal of Law and Innovation

LCIA: London Court of International Arbitration

LMCLQ: Lloyd's Maritime and Commercial Law Quarterly

NYC: New York Convention

NYSBA: New York State Bar Association

ODR: Online Dispute Resolution

OJ: Official Journal (of the European Union)

OJLS: Oxford Journal of Legal Studies

OUP: Oxford University Press

Pace International Law Review: Pace International Law Review

Penn St. Int'l L. Rev.: Penn State International Law Review

PIPEDA: Personal Information Protection and Electronic Document Act

QB: Queen's Bench

R.C.S.: Recueil des arrêts de la Cour suprême du Canada (Supreme Court Reports of Canada)

R.J.Q.: Recueil de jurisprudence du Québec

RJ.Q.: Recueil de Jurisprudence du Quebec (CAN)

RLRQ: Recueil des Lois Refondues du Québec (Consolidated Statutes of Quebec)

S. African LJ: South African Law Journal

SchiedsVZ: Schiedsverfahrensrecht Zeitschrift (Journal of Dispute Resolution)

SCR: Supreme Court Reports (Canada)

SSRN: Social Science Research Network

Swiss Arb. Dec.: Swiss Arbitration Decision

Switz. Trib. Fed.: Swiss Tribunal Federal

U. Tol. L. Rev.: University of Toledo Law Review

U.N. Doc.: United Nations Document

UDRP: Uniform Domain Name Dispute Resolution Policy

UMKC L Rev: University of Missouri-Kansas City Law Review

UNCITRAL: United Nations Commission on International Trade Law

Wroclaw Rev. L, Admin & Econ: Wroclaw Review of Law, Administration & Economics

X

Introduction

"The power of technology to resolve disputes is exceeded by the power of technology to generate disputes.[1]"

When Ethan Katsh[2] made this claim, he foresaw how far the alternative dispute resolution industry would travel and how online dispute resolution would become the preferred method of conflict resolution for an innumerable amount of disputants and on a multitude of subject matter. While his vision of online dispute resolution becoming the dominant method for handling various conflicts has not yet materialized, emerging technologies like blockchain bring us closer to realizing the future he predicted.

Conflict has been, throughout human history, an integral part of society, and it presents itself in all facets of human interactions and relations. While conflict itself is undesirable it nevertheless prompts the development of novel means and avenues for resolving disputes, either through excessive violence or by peaceful means[3]. These dispute-resolution avenues have evolved over the centuries, from settlement by the elderly to royal or religious institutions and finally to the institutions set up and recognized by the States[4].

As a legal phenomenon, arbitration can be traced back further than our traditional understanding of law and state. It was long before the organization of courts and the discovery of principles of law by judges that people resorted to arbitration to resolve their disputes[5]. It can even be argued that the first recorded "arbitration" can be traced back to the era of King Solomon, as

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[1] Rabinovich-Einy, Orna and and Katsh, Ethan, Blockchain and the Inevitability of Disputes: The Role for Online Dispute Resolution (2019). J. Disp. Resol. (2019).

[2] Professor Katsh is a graduate of the Yale Law School and has authored three books on law and technology, Law in a Digital World (Oxford University Press, 1995) The Electronic Media and the Transformation of Law (Oxford University Press, 1989), and, with Professor Rifkin, Online Dispute Resolution: Resolving Conflicts in Cyberspace (2001).

[3] Jacob Bercovitch, Victor Kremenyuk, I. William Zartman. 'The SAGE Handbook of Conflict Resolution', (1st edn, SAGE, 2008).

[4] Michiel Duchateau et al, Evolution in Dispute Resolution : From Adjudication to ADR (Governance & Recht), (Eleven International Publishing, 2016)

[5] See generally, Keller, American Arbitration: Its History, Functions and Achievements, 1984.

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referenced in the Old Testament in I Kings, chapter 3, verses 16-28[6]. Although the definition of arbitration, as it is understood today is different, the example of Solomon is, for the purposes of this thesis, a good example as it demonstrates how the definition of legal concepts is subject to change as technology and society move forward.

If taken back to its origins, arbitration can be found in the most primitive of societies and has been used internationally to settle disagreements between nations of the ancient world. In this regard, another notable example is the controversy between Athens and Megara for the possession of Salamis Island. The island's fate was determined by five Spartans who allocated the Island to the Athenians[7] via some form of arbitration.

Arbitration remains, to date, a fundamental testament to one's right to self-regulation and autonomy, and it can be considered one of the prized treasures of a democratic society as it reflects the values of independence, self-reliance, equality, integrity, and responsibility, all of which are invaluable to any community[8]. Above all else, arbitration is defined as a creature of agreement[9] between nations or individuals to submit their disagreements to their chosen decision-makers and to bind themselves in advance to accept the arbitrator's rulings as final.

The allure of this private model of dispute resolution comes from its fundamental characteristics, such as the possibility to obtain a rapid, discreet, and relatively low-cost disposition of the matters involved[10] and have the final award be binding on the parties[11]. Additionally, the possibility to tailor the arbitral proceedings to the parties' specific needs, such as the designation

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[6] Elkouri, Elkouri, E. A., May, K., Sanders, P. M., & Sullivan, M. T. (2016). How arbitration works / Elkouri & Elkouri. (Eighth edition / ; editor-in-chief Kenneth May, Senior Legal Editor (retired) Labor Arbitration Reports Labor Relations Reporter ; associate editors, Patrick M. Sanders, General counsel, Mungenast Automotive Family, St. Louis, MO; Michelle T. Sullivan, University of Michigan Health System, Ann Arbor, MI.). Bloomberg BNA.

[7] Figueira, M. (2020). Chronological Table: Archaic Megara, 800-500 B.C.

[8] Wolaver, E. S. (1934). The Historical Background of Commercial Arbitration. University of Pennsylvania Law Review and American Law Register, 83(2), 132-146. https://doi.org/10.2307/3308189

[9] Nafta Traders, Inc. v. Quinn, 339 S.W.3d 84 (Tex. 2011).

[10] Sturges, W. A. (1960). Arbitration—What is it? New York University Law Review, 35, 1031-1032.

[11] Park, W. W., & Paulsson, J. (1983). The Binding Force of International Arbitral Awards. Virginia Journal of International Law, 23(2), 253-286.

of the arbitrator and the applicable law, are vital components that make arbitration a valid and adequate alternative to traditional court litigation[12].

Whereas court litigation is a "one size fits all" dispute resolution mechanism whereby a government effectively states that it will resolve the dispute with the same procedures as it does with every case and will not establish new rules for new cases, arbitration does not have any inherent "rules", but rather it has limits and boundaries[13]. If disputants remain within these limits and boundaries, they are free to modify the procedure according to their specific needs and wishes. Thus, arbitration is considered to have a significant margin of freedom, allowing it to be compatible and synergistic with technological advancements from a fundamental point.

The key conceptual difference between court litigation and arbitration resides in the notion of sovereignty. Whereas court litigation constitutes an expression of the State's sovereignty, arbitration does not. This means that the inherent authority of the State to oversee conduct within its territory gives state courts the competency to resolve conflicts within its jurisdictional and territorial boundaries. Court litigation is a state-provided service to individuals that is made available to everyone. On the other hand, the primacy of party autonomy in arbitration means that no one can be forced to arbitrate. All arbitration is subject to an *a priori* agreement to arbitrate, even if this agreement is incorporated by reference[14].

Although arbitration is an old legal practice, the advent of new technologies and globalization have profoundly altered many legal phenomena that the world has been accustomed to for decades. In fact, since the fall of the Berlin Wall, history seems to have accelerated, and with it, the legal structures that nation-states were familiar with have undergone specific changes created by the rapid globalization brought forth by new technologies and new conceptual perspectives[15].

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[12] Barona Vilar, S. (2019). Arbitration and ADR, components of the new Paradigm of Justice in the Modernity. Dong-A Journal of International Business Transactions Law, 24, 1-18. ISSN 2092-769X.

[13] Stipanowich, T. J. (2010). Arbitration: The New Litigation. University of Illinois Law Review, 2010(1), 1-60.

[14] Habas Sinai Ve Tibbi Gazlar Isthisal Endustri AS v. Somental SAL, EWHC, 29 (2010).

[15] Benyekhlef, K. (2015). Une possible histoire de la norme. Les normativités émergentes de la mondialisation (2nd Ed.). Montréal, Éditions Thémis.

States are slowly losing their seats as the sole legitimate power to legislate and impose norms[16]. Private actors, technology, international organizations, soft law, and guiding principles are a few of the phenomena that influence how individuals, states and institutions conduct themselves on the global market. Today, it is safe to say that technological innovations have transformed the way in which people and businesses interact and have saturated almost every aspect of our lives. Arbitration is by no means an exception to the effects of globalization and the advent of technological innovation. In fact, it could very well be said that arbitration is, by nature, the most suitable form of dispute resolution to accommodate these changes and novelties since it is characterized by the flexibility of its procedures[17] and the lack of a preconceived set of rules.

Both technology and arbitration promote themselves as tools that bypass unnecessary formalities to save time, reduce costs and increase the overall efficiency in their respective fields. Technology and arbitration are, therefore, synergistic[18] , and their collaboration opens an entirely new field of study that can still be considered to be in its infancy.

Today, with the ever-increasing number of interactions concluded over the internet, we are experiencing a profound paradigm shift in understanding dispute resolution, particularly arbitration. The progress made by technologies such as distributed ledger technology (more commonly known as "blockchain"), artificial intelligence, and online dispute resolution methods has paved the way for a new age in arbitration.

In their renowned book, *Getting to Yes*, Ury and Fisher have claimed that "conflict is a growing industry[19]. " This statement has perhaps acquired even more prevalence with the arrival

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[16] Varella, M. D. (2013, July 5). Are Private Actors Able to Produce Law? University Center of Brasilia.

[17] Faris, J. (2008). The Procedural Flexibility of Arbitration as an Adjudicative Alternative Dispute Resolution Process. De Jure, 41(3), 504-523.

[18] Zekos, G. I. (2022). Courts and Arbitration Advancements. In Advanced Artificial Intelligence and Robo-Justice (pp. 285-320). Springer, Cham.

[19] Fisher, R., Ury, W., & Patton, B. (1991). Getting to Yes: Negotiating Agreement Without Giving In. New York, p.1.

of electronic communication technologies. In today's market, dominated by liberal economic ideologies and consumeristic actors, millions of people enter the digital world to conduct business, purchase goods, services, and exchange information. As with all situations where there are people, there will be conflict[20]. These disagreements over the internet were perhaps the first ones to challenge the established boundaries of arbitration since there was no legal framework to address the questions that arose in "virtual disputes[21]".

Today, there seems to be a more coherent understanding of these disputes and ways to resolve them both formally and informally[22], notably through internal mechanisms of dispute resolution offered by service providers such as Amazon and eBay[23] or through third-party organizations utilizing technology to resolve online disputes. We will delve deeper into the functioning of these ODR systems in the upcoming chapters of the present thesis.

Apart from the fact that the effective rendering of justice is a noble goal to pursue, the implementation of techno-arbitration into the global market also impacted businesses since they are the key instruments in fostering trust, and trust is a critical component of economic success. Online marketplaces such as Amazon and eBay offer dependable remedies for their clients to ensure the future of their businesses. Similarly, resolving issues outside of court via easy, quick, and low-cost ways has an impact on the entire society and economy[24].

In small civil claims and consumer disputes, whether domestic or cross-border, there is an urgent need for out-of-court resolution procedures that may be settled online and help to reduce

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[20] Virtual Magistrate Project Provides Dispute Resolution in Cyberspace. (1996, 7). World Arb. & Mediation Rep., 76.

[21] Bordone, R. C. (1998). Electronic Online Dispute Resolution: A Systems Approach – Potential Problems and a Proposal. Harvard Negotiations Law Review, 3, 175-176.

[22] Katsch, M. E. (1996). Dispute Resolution in Cyberspace. Connecticut Law Review, 28, 953-957.

[23] Schmitz, A. J. (2022). Evolution and Emerging Issues in Consumer Online Dispute Resolution (ODR). Ohio State Legal Studies Research Paper 714.

[24] Ebner, N., & Rainey, D. (2021). ODR and Mediation. In E. Katsh, D. Rainey, & A. Abdel Wahab (Eds.), Online Dispute Resolution: Theory and Practice (2nd Ed.). Eleven Intl. Publishing.

court backlogs[25]. This urgent need is demonstrated by a multitude of national legislative bodies, including Quebec, where the Code of civil procedure[26] actively encourages and endorses alternative dispute methods to remedy the backlog issues plaguing the courts[27]. In fact, the Code of civil procedure goes further and declares in its preliminary dispositions that the recourse to alternative dispute resolution methods must be considered by the parties before engaging in court litigation[28] . The general philosophy that the Code endorses is one that prioritizes alternative dispute resolution methods over traditional litigation[29]. As of January 1st, 2016, everyone must consider using private dispute prevention and resolution (PDR) before going to court to resolve misunderstandings, problems, disputes, objections, or even conflicts[30].

When the state of administering justice at the national level is inclined towards alternative methods of dispute resolution, it would be unlikely that e-commerce and the disputes that occur within the realm of online trade would be exempt from this trend. As disputes arising in the cyber world usually involve relatively small amounts of money, traditional lawsuits are inapt and inefficient in resolving these disputes[31]. Moreover, these disputes commonly comport an international aspect which implies that in e-commerce disputes, determining the applicable law and the competent jurisdiction requires a substantial amount of effort. This renders court litigation an option that parties are unwilling to opt for[32].

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[25] Philippe, M. (2020). "Chapter 11: Access to Justice Through Online Dispute Resolution Is Not Science Fiction: A Practitioner's Perspective on the Good, the Bad and the Future". In Leonardo V. P. de Oliveira and Sara Hourani (eds), Access to Justice in Arbitration: Concept, Context and Practice (pp. 221-250). Kluwer Law International.

[26] Quebec Civil Procedure Code (RLRQ c C-25)

[27] St-Pierre, D. (2016, January 6). Le nouveau Code de procédure civile: vers un changement de culture de résolution des conflits. Centre de Justice Privée.

[28] Quebec Civil Procedure Code (RLRQ c C-25, Article 1 alinea 3)

[29] St-Pierre, D. (2017). L'obligation de considérer les modes de prévention et règlement des différends du nouveau Code de procédure civile : vers un changement de la culture de résolution des conflits.

[30] "Obligation de recourir aux modes privés de prévention et de règlement des différends." https://www.quebec.ca/justice-et-etat-civil/modes-prevention-reglement-differends/obligation-de-considerer-le-recours-aux-modes-prives-de-prevention-et-de-reglement-des-differends-prd

[31] Katsh, E., & Rabinovich-Einy, O. (2017). Digital Justice: Technology and the Internet of Disputes. Oxford University Press.

[32] Nieva-Fenoll, J. (2022). "Online dispute resolution for small claims: is this the only realistic solution?" Revista Ítalo-española de Derecho procesal.

The antagonistic relationship between the territorial model of the law that nation-states are accustomed to, and the transnational logic of e-commerce has created a situation where we are forced to rethink the rules of law free from the spatial boundaries of territories. Although the growth of information technology, with the ideological backbones of transnationalism and globalism, has fundamentally altered our lives by bringing people, ideas, and cultures closer than ever, it is also clear that the number of conflicts has increased substantially. The disruptive nature of information technologies has made it more difficult to resolve such disputes[33].

As such, seeing a paradigm shift in dispute resolution[34] is hardly surprising. After all, the medium through which the law is conveyed has an impact on its application and understanding. Therefore, new modalities of production and circulation of information call for new ways of considering and conceiving rights and obligations.

Additionally, access to justice is a fundamental right. Whereby traditional court litigation is open to all who wish to pursue another in justice, it is an arduous and lengthy process. That is one of the reasons that many online disputes remain unresolved merely because parties are reluctant to go down the road of court litigation. As such, increasing access to justice through online dispute resolution[35] is an effective way to help many people who have been reluctant to pursue justice through court litigation. In fact, individuals with low income, in distant places, or with impairments may equally benefit from online dispute resolution because they may have limited or no access to effective legal remedies[36].

As a consequence, online arbitration and, more recently, blockchain arbitration which has the goal of not only digitalizing inefficient offline processes but also changing the nature of the interaction between the parties and introducing new possibilities for obtaining resolution have been

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[33] Trudel, P. (2002). Les mutations du droit à l'âge numérique. Le devoir, édition du 4 et 5 mai.

[34] Van't Klooster, J. (2021). "Technocratic Keynesianism: a paradigm shift without legislative change." New Political Economy, 1-17.

[35] Bakhramova, M. (2022). "Online Dispute Resolution: Digitalized Disputes and Their Legal Basis." Journal of Ethics and Diversity in International Communication, 1(8), 25-29.

[36] Schmitz, A. J., Ojelabi, L. A., & Zeleznikow, J. (2022). "Researching Online Dispute Resolution to Expand Access to Justice." Ohio State Legal Studies Research Paper 680, 269-303.

gaining prevalence concerning disputes that occur outside of the physical world. Both methods have their strengths and weaknesses, and both raise questions and obstacles that need to be overcome for technology-driven arbitration to become "mainstream." For its part, blockchain arbitration, which can, to a certain extent, be considered as a sub-genre of classical online dispute resolution is a relatively new form of arbitration and can be highly beneficial for resolving disputes that occur "on-chain".

As we will further examine in the following sections of this thesis, the "hype" around blockchain technologies is primarily due to the success of bitcoin and other cryptographic monies; however, it would be a severe understatement to say that blockchain is only relevant in terms of a new economic model that encourages the use and proliferation of a decentralized currency. Blockchain technologies (or, to use an umbrella term: distributed ledger technologies) are much more than cryptocurrencies, the use cases are innumerable, and the spectrum ranges from the health sector to arbitration.

Throughout the present thesis, we will first examine how arbitration has been perceived over the ages and how today, different technologies are being used to increase the efficiency of arbitral proceedings without sacrificing its legitimacy. We will discuss the different approaches adopted by states, institutions, international and intergovernmental organizations, legal practitioners as well as the information technology industries. We will delve into the boundaries of arbitration and how these boundaries are being pushed by technologies such as blockchain and other methods of online dispute resolution by presenting both the advantages, disadvantages, and obstacles that need to be overcome so that the world of arbitration may be on par with the new advances in technology. The present thesis aims to offer an in-depth understanding of arbitration in the age of blockchain and provide insight into the future of arbitration, where it will perhaps evolve into a distinct legal order situated on the blockchain and anchored to the rules of *Lex Cryptographia*.

In this thesis, we will embark on a comprehensive exploration of international arbitration and its ongoing evolution through the influence of technology, specifically blockchain. Our analysis will unfold in four distinct titles, each addressing a significant aspect of this complex topic.

In the first title, "The Arbitral Framework," we will delve into the foundational concepts and principles of arbitration, contrasting it with sovereign jurisdictional authority, and examine the international conventions that govern the field. This will set the stage for the second title, "Evolution of Arbitration Through Technology," where we will analyze the impact of digital advancements on arbitration, focusing on Online Dispute Resolution (ODR) systems and their enforcement.

As we progress to the third title, "Blockchain Technologies & International Arbitration," we will provide an in-depth look at the technology behind blockchain and its potential synergy with arbitration. This will pave the way for our final title, "The Future of International Arbitration," where we will argue that blockchain arbitration could represent the future of the field, culminating in a self-contained, blockchain arbitral legal order that transcends state supervision.

Overall, this thesis will provide a thorough examination of the intersection between international arbitration and cutting-edge technology. By considering the potential benefits and challenges of implementing blockchain technologies in the arbitral process, we will offer a unique perspective on the future of dispute resolution in an increasingly decentralized world.

TITLE I : The Arbitral Framework

In this first title, we will conduct an examination of the phenomenon of arbitration and alternative dispute resolution methods; the first subsection will be devoted to understanding what exactly arbitration is **(A)** followed by the rules of arbitration and the agreement to arbitrate **(B)** which will lead us to question the notion of sovereign jurisdictional authority and how it compares to the private autonomy that arbitration utilizes **(C)**. We will then examine the contemporary framework and international conventions on arbitration **(D)** and conclude the title by examining the ideological divergence between nationalism and globalism and how it affects our understanding of the traditional concepts of justice **(E)**.

A-) What is Arbitration?

To properly comprehend how technologies such as online dispute resolution procedures and blockchain-based arbitration can contribute to the evolution of arbitration, we first need to examine the concept of arbitration as a whole. We need to understand the limits, purpose, and role of arbitration and how it compares to more conventional dispute resolution methods.

Arbitration is defined simply as a private dispute resolution mechanism based on an agreement whereby two or more parties agree to be bound by the decision of one or more independent and impartial arbitrators[37] who, after a fair hearing and per the rules that the parties agreed upon[38], make a binding award[39] and its most fundamental principle is party autonomy[40]. No one may be forced to arbitrate, and any party in an arbitral proceeding must have given prior authorization for the dispute to be resolved through arbitration. Another equally important aspect of arbitration is that it "precludes litigation", that after an agreement to arbitrate has been concluded, parties may only submit their dispute to a court if all the parties agree to do so[41]. Should

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[37] Mediation and arbitration - Province of British Columbia. https://www2.gov.bc.ca/gov/content/justice/about-bcs-justice-system/mediation.

[38] Barin, Babak, and Marie-Claude Rigaud. L'arbitrage consensuel au Québec - Recueil de jurisprudence, 3rd Edition. Yvon Blais, 2013.

[39] Quebec Civil Procedure Code (RLRQ c C-25, Article 620).

[40] Paulsson, Jan. The Idea of Arbitration. OUP Oxford, 2013. pp. 29-33.

[41] Boxer Capital Corp. v. JEL Inv. Ltd., (2015) 366 B.C.A.C. 127 (CA).

a party decide to litigate their case in court, they would be unable to do so if the dispute at hand is arbitrable and a valid arbitration agreement is present between the parties[42].

As we will see in detail in the upcoming sections, the principal advantages of arbitration are seen as follows;

- **Neutrality**[43]: In the context of international arbitration, neutrality has two aspects[44]. The first is that arbitration is a neutral forum where none of the parties have the "home advantage" of their domestic court[45], and the second relates to the nationality of the arbitrator. As a general rule of thumb, individuals seeking resolution of their conflict via arbitration are recommended to select arbitrators that are of different nationalities from those of the disputants to assure the impartiality of the arbitrator[46].
- **Speed**: Arbitration is, compared to court litigation, a much more rapid and expeditious process[47].
- **Finality**: Unless the parties have expressly convened to the contrary, an arbitral award is not subject to appeal, thus rendering it final between the parties[48].
- **Enforceability**: Once the tribunal renders a valid arbitral award, it can be recognized and enforced by courts.
- **Expertise:** Given the parties' ability to choose their arbitrators, thus having the faculty to select someone that is knowledgeable regarding the dispute at hand.
- **Flexibility:** Parties are generally free to modify the arbitral process to their needs and wants.

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[42] Derbushev, German. "Res Judicata and Arbitral Awards." LL.M. Thesis, March 29, 2019.

[43] Feebily, Ronan. "Neutrality, Independence and Impartiality in International Commercial Arbitration, a Fine Balance in the Quest for Arbitral Justice." 7 Penn St. JL & Int'l Aff 1 (2019).

[44] Franck, Susan D. "The Role of International Arbitrators." 12 ILSA J. Int'l & Comp. L. 499 (2006).

[45] Timmer, Laurens J.E. "The Quality, Independence and Impartiality of the Arbitrator in International Commercial Arbitration." 78 Arb 348 (2012).

[46] Bishop, Doak and Reed, Lucy. "Practical Guidelines for Interviewing, Selecting and Challenging Party-Appointed Arbitrators in International Commercial Arbitration." 14 Arb. Int'l 395 (1998).

[47] Berger, K. P. "The Need for Speed in International Arbitration." 25 Journal of International Arbitration 595 (2008).

[48] Kerr, A. J. "Some Questions Relating to Fraud in Agency." 111 S African LJ 291 (1994).

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- **Confidentiality** Arbitral processes are generally private in the sense that hearings are not open to the public, and decisions are usually not published[49].

Although these aspects make arbitration the preferred method of dispute resolution in many cases[50], there are certain drawbacks of arbitration as well, such as the limits to arbitral jurisdiction, limitations to arbitral power, lack of appeal, and possibly the lack of expertise of arbitrators in arbitration[51] which we will elaborate upon in the upcoming chapters.

Even though we define arbitration as a private, rule-based, third-party dispute resolution method, this definition does not quite encapsulate what can and cannot be considered arbitration. Would, for example, a fistfight with a referee as the arbitrator constitute an arbitral proceeding? Certainly not. As we have previously mentioned, limits and boundaries are what genuinely defines an arbitration. As long as parties stay within these limits, they can resolve their disputes in any particular way they desire, and it would still be considered arbitration. This is a fascinating aspect of arbitration since it means that as long as the procedure's minimum requirements are respected, all methods should result in an arbitral award that can be recognized and enforced.

The enforceability of an arbitral award is crucial for a successful arbitral procedure. For a party to obtain the enforcement of the decision rendered by an arbitral tribunal, the award must be recognizable under the jurisdiction where the enforcement is sought[52]. This situation entails that traditional arbitration is nevertheless connected to the judicial system of states. In and of itself, arbitration does not have the mechanisms to enforce an arbitral award and, in almost all scenarios, requires the intervention of a state to force a party to do or refrain from doing something[53]. Since it is a private adjudication system, a party may refuse to comply with the arbitrator's decision of

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[49] Bennett, Daniel R. and Hodgson, Madeleine A. "Confidentiality in Arbitration: A Principled Approach." 2016-2017 3 McGill Journal of Dispute Resolution 98, 2016 CanLII Docs 135.

[50] Mazirow, Arthur. "The Advantages and Disadvantages of Arbitration as Compared to Litigation." (2014).

[51] Robin, Guy. "The Advantages and Disadvantages of International Commercial Arbitration." Int'l Bus. LJ (2014): 131.

[52] Vicente, Dario Moura. "Requirements for the Enforceability of Arbitral Awards: A Comparative Overview." Forthcoming in Judicial Control over Arbitral Awards: Scope, Vacation, and Public Policy (2019).

[53] Sport Maska Inc. v. Zittrer (1988) 1 SCR 564.

the arbitrator(s). In that case, the party seeking enforcement must bring their award to a court for it to be recognized, and a judge may order the enforcement of the decision.

As suggested above, one of the most important advantages of arbitration is that it allows parties to establish their dispute resolution procedure rather than being bound by the regulations of any singular national court system[54]. This, looking from a historical perspective, is a relatively new understanding of arbitration as, previously, it was not uncommon for courts to refuse the enforcement of an arbitral award if it differed significantly from court procedure since these procedures were seen as crucial instruments in rendering justice. In fact, the strict approach previously adopted by the courts can be seen in Quebec as well, where, before the 1965 revision of the Code of Civil Procedure, the courts considered illegal the arbitration clause that foresaw adjudication via arbitration for a future dispute. This approach was enshrined in a decision of the Court of Appeal of Quebec in 1962[55] and by the Supreme Court of Canada in 1964, whereby arbitration was seen as a potential menace to the administration of justice and, as such, contrary to public order[56].

However, this conception has evolved over the years. To promote arbitration and become an arbitration-friendly hub in the eyes of the international community, national courts are now more prone to recognizing and enforcing arbitral agreements and awards as long as the fundamental fairness of the arbitration is respected. Additionally, it has been confirmed on multiple occasions by the Supreme Court of Canada that consensual arbitration is not a system of justice inferior to the public civil justice system[57] but rather a private mode of justice evolving in a similar way and responding to specific and legitimate needs for the litigant[58]. The Supreme Court has equally overturned its previous decision of 1964 in 1983, where the court has made it clear that the arbitration clause for a future dispute, legalized since 1965, has been definitively recognized

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[54] How are arbitral proceedings conducted - iPleaders. https://blog.ipleaders.in/arbitral-proceedings-conducted/

[55] Vinette Construction Ltée c. Dobrinsky, (1962) B.R. 62, 69.

[56] National Gypsum Co c. Northern Sales Ltd (1964) R.C.S. 144,151.

[57] Desputeaux c. Éditions Chouettes (1987) inc. [2003] 1 R.C.S. 178.

[58] GreCon Dimter inc. c. J.R. Normand inc. [2005] 2 R.C.S. 401.

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by all the courts in Quebec[59]. These examples clearly indicate the paradigm shift regarding arbitration and how its perception has been evolving in a pro-arbitration manner over the years[60].

To summarize, arbitration is a private dispute resolution mechanism based on an agreement whereby two or more parties agree to be bound by the decision of one or more independent and impartial arbitrators. Arbitration has several advantages, including neutrality, speed, finality, enforceability, expertise, flexibility, and confidentiality, making it the preferred method of dispute resolution in many cases. However, there are certain drawbacks to arbitration, such as limits to arbitral jurisdiction, limitations to arbitral power, lack of appeal, and possibly the lack of expertise of arbitrators in arbitration. Enforceability is crucial for a successful arbitral procedure, and in order for a party to obtain enforcement of the decision rendered by an arbitral tribunal, the award must be recognizable under the jurisdiction where enforcement is sought.

National courts are now more prone to recognizing and enforcing arbitral agreements and awards as long as the fundamental fairness of the arbitration is respected in order to promote arbitration and become an arbitration-friendly hub in the eyes of the international community. Additionally, emerging technologies such as online dispute resolution procedures and blockchain-based arbitration can contribute to the evolution of arbitration.

Now that we have given an overview of what arbitration is, its defining characteristics, and how it has been utilized over the years as the preferred method of alternative dispute resolution between disputants, it is time to delve into how arbitration is structured, what the boundaries of arbitration are and how the agreement to arbitrate is a crucial part of any arbitration proceeding.

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[59] Zodiak International v Polish People's Republic, 1983 1 SCR 529.

[60] Antaki, Nabil N. "Regard intime sur l'état de l'arbitrage au Québec il y a 25 ans." In Fréderic Bachand & Fabien Gélinas (eds.), D'une réforme à une autre: Regards croisés sur l'arbitrage au Québec. Cowansville: Éditions Yvon Blais, 2013, at 9-27.

B-) Rules of Arbitration & the Agreement to Arbitrate

In the upcoming chapters of the present thesis, we will be delving into how technology is being incorporated into arbitration and how it effectively changes the arbitral landscape. In order to understand the impact and significance of online dispute resolution procedures, blockchain arbitration, and relevant technological methods such as crowd-based voting, anonymous arbitrators, and aspects related to the applicable law to both the dispute and the procedure, we must first examine the laws and rules applicable to arbitration, followed by the rules regarding the agreement to arbitrate.

Principally, arbitration is a dispute resolution method that can be tailored to fit the needs of the parties. Even the question of applicable law is determined according to the parties' wishes. In fact, we can have, in a singular arbitral proceeding, multiple laws that govern different aspects of the arbitration. The most pronounced difference is between the applicable substantive law and the procedural law. Substantive law can be defined as the law that regulates the relationship between the parties. For example, in an arbitral proceeding between two contractors, the arbitrator(s) will decide on the applicable substantive law, which will be the contract law of a specific jurisdiction[61].

Procedural law, on the other hand, is the law that guarantees that the substantive law between the parties will be applied to the dispute in an impartial and foreseeable way. Procedural law governs in a conflict, for example, the collection of evidence, submission of documents, the language of the proceeding, and the questioning of the witnesses[62]. This procedural law is governed by what is called the *lex arbitri* (the seat of the arbitration), which dictates where the arbitration is "legally" taking place[63]. As an example, disputants may be sitting in a conference room in Istanbul and conducting an arbitral proceeding, and the law of the seat can be in Montréal. Thus, the physical and legal locations of the proceeding can be radically different. Although arbitration is a private dispute resolution method that does not require state judges to resolve the

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[61] Born, Gary B. International Arbitration: Law and Practice. Kluwer Law International BV, 2021.

[62] *Id* at 42

[63] Utnes, Allan Endre. "Lex arbitri: The implications of the arbitral seat." Master's thesis, 2018.

dispute, it nevertheless requires courts to enforce the arbitral awards. As such, the arbitration links itself to the system of a particular state through the *"lex arbitri"*.

The role of the arbitral seat is crucial in supporting international arbitration[64]. However, the separation of the physical and legal location of an arbitral proceeding raises several questions, especially about the applicable procedural law in disputes that occur over the internet or on the blockchain[65]. The rules for conducting the arbitration are typically set out in the national laws of the country where the arbitration is legally held. For example, the Quebec law that regulates the matter can be found in articles 2638 to 2643 in the Civil Code of Quebec[66]. However, because online arbitration has only a virtual presence, the question of where the online arbitration took place arises[67].

The most important consequence of the seat of arbitration is that the State where the parties have chosen to legally conduct the arbitration determines how the arbitration can and cannot be undertaken[68]. The legal framework of the seat of arbitration provides a safety net. It establishes the base rules that govern aspects such as the constitution of the tribunal and the conduct of the proceedings. It can be said that the seat grants the arbitral procedure a base infrastructure upon which parties are free to build. As such, in arbitration-friendly jurisdictions, parties are usually free to derogate from these rules and tailor them according to their needs. Another critical aspect that the seat determines is the "nationality" of the award. If the legal seat was, for example, Quebec, courts of other nations where enforcement is sought will treat the award as foreign as per article 1 of the Convention on the Recognition and Enforcement of Foreign Arbitral Awards, more commonly known as the New York Convention[69].

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[64] Reisman, W. Michael, et al. International Commercial Arbitration, 156. 1997.

[65] Allen, Darcy WE, Aaron M. Lane, and Marta Poblet. "The governance of blockchain dispute resolution." Harv. Negot. L. Rev. 25 (2019): 75.

[66] Civil Code of Quebec: Articles 2638 to 2643.

[67] Lanier, Tiffany J. "Where on Earth Does Cyber-Arbitration Occur? International Review of Arbitral Awards Rendered Online." ILSA Journal of International & Comparative Law 7, no. 1 (2000).

[68] Abang, Ashu Billy Manners. "The Seat of Arbitration: To What Extent Does It Influence Important Aspects of the Arbitration Process?" Int'l JL Mgmt. & Human. 5 (2021): 918.

[69] Convention on the Recognition and Enforcement of Foreign Arbitral Awards, 10 June 1958, 330 UNTS 3.

Again, this also raises questions about awards rendered in an online dispute resolution platform or blockchain-based arbitration platform where the award rendered does not necessarily tie back to a state. These questions that are fundamental to the present thesis will be examined thoroughly in the upcoming chapters.

The assistance and safety net aspects of the seat of arbitration are fundamental; they allow states to remain outside of the arbitral sphere while at the same time providing it with mechanisms that allow for its proper conduct[70]. The power of the arbitrator is derived from the consent of the parties in an arbitral proceeding; this means that an arbitrator does not possess the enforcement power that a state employs. To coerce, for example, non-parties to assist the arbitration by way of testimonies or to compel a non-cooperative party into following the orders of an arbitrator, state courts must intervene. Once a state court issues a decree in conformity with the demands of an arbitrator, the person for whom the order is issued must comply because, at that moment, non-compliance means an outrage against the court.

As we have mentioned, the parties are free to choose the law applicable to their dispute. This is made possible through the choice of law clauses incorporated into their initial contract; although a standard choice of law clause may read as follows; "The applicable law to the present contract shall be the law of Quebec" parties are nevertheless allowed to choose multiple applicable laws if that is what they deem necessary. Such a complex choice of law may read as follows; "The applicable law to the present contract shall be the law of the State of California and Quebec" and although nothing is preventing the parties from opting for such a clause, it may lead to a situation where there may be no way of performing the transaction without violating one of the chosen laws, therefore, leading to a contract legally impossible to perform[71]. Another interesting way of using two different laws to govern the dispute is known as a *depaçage,* where the parties select one law to govern a certain aspect of their contract and another to govern a different aspect[72].

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[70] Henderson, Alastair. "'Lex arbitri', procedural law and the seat of arbitration: Unravelling the laws of the arbitration process." Singapore Academy of Law Journal 26, no. Special Ed. (2014): 886-910.

[71] Channel Tunnel Group Ltd v. Balfour Beauty Construction Ltd, [1992] 1 QB 656; [1993] 2 WLR 262.

[72] Özkan, Işıl. "Uluslararası Ticari Tahkimde Uygulanacak Hukuk." Public and Private International Law Bulletin 40, no. 2 (2020): 831-858.

For the purposes of the present thesis, an aspect worth highlighting regarding the choice of law in an arbitral process is the choosing of A-national substantive rules. Instead of national regulations, parties are also free to choose the application of a law that does not belong to any national legal order[73]. Such law is often referred to as stateless or transnational law. The *lex mercatoria* or "law merchant" is the most well-known of these a-national laws. In the upcoming chapters of the present thesis, we will discuss the effects of *lex mercatoria* and its evolution over time. We will also discuss how a new substantial law denominated *lex cryptographia* by scholars may be the basis for a new arbitral legal order anchored in the blockchain can become a reality[74].

Another essential aspect that defines an arbitral proceeding is the arbitration agreement which is defined as a contract by which the parties undertake to submit a present or future dispute to the decision of one or more arbitrators to the exclusion of the courts[75]. Arbitration is a creature of consent, and the agreement to arbitrate is the mechanism by which the parties bind themselves to present their dispute to arbitration when such dispute occurs[76]. In a way, the arbitration agreement transforms the parties' consent into a binding force.

The concept of a "valid" arbitration agreement deserves our attention. It is also worth mentioning the doctrine of separability, which proposes that an arbitration clause in a contract is, in fact, a separate contract from the one in which it is contained[77]. This principle is equally enshrined by the Civil Code of Quebec, which stipulates in its article 2642 that "An arbitration agreement contained in a contract is considered to be an agreement separate from the other clauses of the contract and where the arbitrators find the contract to be null, the arbitration agreement is not for that reason rendered null[78]."

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[73] Patrikios, Antonis. "Resolution of cross-border e-business disputes by arbitration tribunals on the basis of transnational substantive rules of law and e-business usages: the emergence of the lex informatica." U. Tol. L. Rev. 38 (2006): 271.

[74] Patiño, G. Cosío. "Lex Cryptographia Guidelines for Ensuring Due Process in Transnational Blockchain-Based Arbitration: Study on the Kleros Model." Transnational Dispute Management (TDM).

[75] Civil Code of Quebec: Article 2638.

[76] Aragaki, Hiro N. "Arbitration: Creature of Contract, Pillar of Procedure." Pillar of Procedure 8, no. 5 (May 3, 2018).

[77] Rosen, Janet A. "Arbitration under Private International Law: The doctrines of separability and competence de la competence." Fordham Int'l LJ 17 (1993): 599.

[78] Civil Code of Quebec: Article 2642.

By signing a contract with an arbitration clause in it, parties have, in fact, concluded two separate agreements. The reasoning behind this doctrine is quite understandable; by consenting to an arbitration agreement, parties convene to resolve disputes arising out of their contract by way of arbitration. However, if the arbitration clause and the main contract were to be considered as a singular contract, the obligation to arbitrate becomes one of the contract's obligations.

As such, if the contract is declared to be null and void, so would the agreement to arbitrate. This is where the separability doctrine ensures the arbitration clause's survival. In the event of termination of the main contract, by treating the arbitration clause as a separate contract from the main contract in which it is contained, we ensure that the party's agreement to resolve their dispute via arbitration remains intact and unaffected[79]. Consequently, problems ailing the initial contract do not influence the survival of the arbitration agreement, and even disputes regarding the validity of the main contract are resolved through arbitration. For example, even in the case of a contract that is void and without legal effect, if the said contract contains a valid arbitration agreement, the invalidity of the main contract has no bearing on the parties' obligation to arbitrate. As such, the arbitration agreement remains a separate and enforceable contract.

On the other hand, if there exists a dispute regarding the validity of the arbitration agreement, we apply the doctrine of *compétence-compétence,* which gives both state courts and the arbitral tribunal the power to determine whether there exists a valid and enforceable arbitration agreement[80]. When a court is seized by such a question, it will render a "declaratory judgment" by which it states whether there exists a valid and binding agreement to arbitrate or not. When an arbitral tribunal is seized by the same question, it is, unlike in a court, a preliminary matter to be cleared up before proceeding with the arbitration rather than the primary subject matter of the proceedings. This question is usually raised by the party which hopes to terminate the arbitration, and the tribunal determines its own jurisdiction to hear the case or not.

Another vital notion to be discussed is "arbitrability" since it limits what arbitration can and cannot be. It implies that although parties are free to resolve their disputes via arbitration, some sorts of

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[79] Todorović, Ilijana. "A Closer Look at the Doctrine of Separability in Arbitration." IUS Law Journal 1, no. 1 (2022).

[80] de Cossío, Francisco González. "The Compétence-Compétence Principle, Revisited." Journal of International Arbitration 24, no. 3 (2007) [J.Int'l Arb.].

disputes are not arbitrable either because the seat of the arbitration prohibits such disputes from being taken to arbitration or because such disputes are, by nature, not suitable to be resolved by arbitration[81] such subjects include for example in Quebec law, family law and disputes related to the capacity of persons[82]. Although parties are free to conclude an arbitration agreement and proceed with the arbitration, if the dispute at hand is non-arbitrable, the compulsory force of the seat will not be assisting the arbitration. What this means is that the eventual award will not be enforceable, and if there are problems with the arbitration, the courts will not take it upon themselves to assist the parties.

This notion of arbitrability finds itself in the New York Convention as well. Although this instrument is fundamentally designed to be arbitration-friendly, it nevertheless stipulates in its Article II (1) that the obligation to recognize an agreement to arbitrate only extends to agreements "concerning a subject matter capable of settlement by arbitration". In a similar vein, it stipulates in its Article V(2)(a) that the recognition and enforcement of an award can be refused by the courts of a state if the "subject matter of the difference is not capable of settlement by arbitration" under that State's law. Even though such provisions can be seen in the most arbitration-friendly instruments, there is no strict definition regarding what constitutes an arbitrable dispute and what does not. This is generally left to each jurisdiction's discretion; the most notable examples of areas deemed non-arbitrable are competition law disputes[83], bankruptcy, family law, and employment disputes. The rationale behind this is that for some areas of law, private adjudication is an insufficient method for delivering justice. As such, state courts must retain a monopoly over resolving these disputes[84].

To summarize, in this section, we discussed the laws and rules applicable to arbitration, including the differences between substantive law and procedural law and the role of the arbitral seat. The seat of arbitration is the State where the parties have chosen to legally conduct the

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[81] Mistelis, Loukas A. Arbitrability: international & comparative perspectives. Vol. 19. Kluwer Law International BV, 2009.

[82] Civil Code of Quebec: Article 2639.

[83] Mitsubishi Motors Corp. v. Soler Chrysler-Plymouth, Inc., 473 U.S. 614 (1985) [Mitsubishi], and see also ; C-126/97, Eco Swiss China Time Ltd v Benetton International NV, ECLI:EU:C:1999:269 [Eco Swiss].

[84] Lew, Julian DM. "Competition Laws: Limits to Arbitrators' Authority." In Arbitrability: International and Comparative Perspectives, edited by Loukas A Mistelis and Stavros L Brekoulakis, 241 (Kluwer 2009).

arbitration, and it determines how the arbitration can and cannot be undertaken. The legal framework of the seat provides a safety net. It establishes the base rules that govern aspects such as the constitution of the tribunal and the conduct of the proceedings. The section also highlights the importance of the choice of law clause in an arbitral process, where parties are allowed to choose the law applicable to their dispute. It further explains that parties can opt for multiple applicable laws or use different laws to govern various aspects of their contract. The section also mentions the concept of A-national substantive rules, where parties can choose rules that are not based on national laws to govern their dispute.

Now that we have discussed how arbitration is a procedure defined by its limits and boundaries and that we have examined how a valid agreement to arbitrate is the foundation upon which this consensual mechanism of the dispute resolution process is built, it is now time to move on to the examination of the relationship between the sovereign jurisdictional authority of nations and private autonomy of arbitral tribunals.

C-) State Jurisdictional Authority and Arbitral Autonomy

With the advent of modern states, the jurisdictional authority exercised by the courts became an expression of sovereignty[85]. As a result, the rendering of justice became monopolized by the apparatus of state courts. So much so that, historians argue that the foundations of national states can be found in the establishment of state courts as "quasi-monopolist" in the exercise of their power[86].

This idea is such a common understanding today that jurisdiction is often used interchangeably with the notion of the State itself[87]. As these notions became inseparable, justice and the power to render justice became a question of public interest rather than a private issue. Although this monopolistic understanding of state power and justice being intrinsically tied is now the *status quo,* private adjudication has nevertheless been a valid alternative to the evolution of the

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[85] Beer, S. "Modern Political Development." In Patterns of Government: The Major Political Systems of Europe, New York: McGraw-Hill, 1973.

[86] Digital Dispute Resolution. In The Cambridge Handbook of Lawyering in the Digital Age, edited by Ortolani, P. and Janssen, A.U., pp. 140-158.

[87] Ortolani, Pietro. "The Judicialisation of the Blockchain." (August 14, 2018).

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concept of justice. It is often forgotten that private adjudication pre-dates nation-states[88] and that in the Middle Ages, the *jus dicere* (administration of justice) was considered a private matter. It seems today that this ancient understanding that justice does not necessarily rely on a sovereign power is on its way back to becoming the preferred method of administering justice for many.

The main reason behind this return of arbitration as the preferred method of dispute resolution[89], especially in international trade, is the proliferation of arbitral institutions and the fact that people in business prefer the speed[90], flexibility[91], expertise[92], confidentiality[93], and efficiency offered by arbitration over national systems of justice. However, before trying to understand the impact of new technologies, such as the blockchain on private justice and its exercise, it is helpful to examine the concept of jurisdiction from a larger perspective.

After the fall of the Roman empire, how jurisdiction was imagined and applied resembles our contemporary understanding of arbitration more than the notion of state justice[94]. Justice and the way it was rendered in the medieval ages is disconnected from the sovereign powers of the period, and those who resolved disputes were seen as professionals offering a private service to disputants rather than an extension of the state apparatus[95]. This closely resembles our current understanding of arbitrators[96]. In fact, the argument that equates arbitrators to "private judges" (which is not factually accurate since, unlike judges, the jurisdictional authority of arbitrators does

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[88] Marrella, F. and Mozzato, A. Alle origini dell'arbitrato commerciale internazionale. L'arbitrato a Venezia tra Medioevo ed età moderna (Padua: Cedam, 2001).

[89] Cuniberti, G. Rethinking International Commercial Arbitration: Towards Default Arbitration (Cheltenham: Elgar, 2017).

[90] Berger, K. P. "The Need for Speed in International Arbitration." Journal of International Arbitration 25, no. 5 (2008): 595.

[91] Hanefeld, I. and Hombeck, J. "International Arbitration between Standardization and Flexibility – Predictability and Flexibility Seen from a Client's Perspective." SchiedsVZ 13, no. 1 (2015): 20.

[92] Bühler, M. "Technical Expertise: An Additional Means for Preventing or Settling Commercial Disputes." Journal of International Arbitration 6, no. 1 (1989): 135.

[93] Hwang, M., Chung, K., Cheng Lim, S. and Hui Wong, M. "Defining the Indefinable: Practical Problems of Confidentiality in Arbitration (Second Kaplan Lecture, 17 November 2008)." In International Arbitration: Issues, Perspectives and Practice: Liber Amicorum Neil Kaplan, edited by Hong Kong International Arbitration Centre, 21 (Deventer: Kluwer, 2018).

[94] Chase, L. Law, Culture and Ritual: Disputing Systems in Cross-Cultural Context (New York University Press, 2005).

[95] Benyekhlef, K., Une possible histoire de la norme (Thémis, Montreal, 2008).

[96] Jivraj v Hashwani, [2011] UKSC 40.

not derive from political power) stems from the long-held understanding that arbitrators and judges are functionally equivalent[97]. Both arbitrators and judges are tasked with the resolution of disputes and the reinstatement of parties' rights and obligations by applying the law to the question of the conflict.

The pre-nation state theory of jurisdiction results from a complex interaction of variables. Politically the most preponderant variable is that the presence of a powerful political entity with monopolistic control over a defined territory is required for the concept of jurisdiction as a manifestation of sovereignty. In medieval times this type of solid political entity did not exist; in fact, there was a multitude of different authorities exercising power. Obviously, the jurists of the era did not understand jurisdiction as a component of public authority. Additionally, the "defined territory" aspect that is usually associated with jurisdiction did not exist in its modern form until much later. It can even be said that until the advent of colonialism, power was not organized on a geographical basis[98].

As political power organized itself in a hierarchical structure where the sovereign oversaw a centralized system of courts and the State established itself as the essential set of infrastructure for exercising power[99], the conception of jurisdiction radically transformed. When decisions rendering justice were seen as a private event, the legitimacy of such these decisions was linked to the quality of the reasoning made by the one who rendered the decision.

Perhaps the monumental moment where justice, jurisdiction, and State linked together was the enactment of *ordonnance civile* of 1667 by the French King Louis XIV[100]. By this ordonnance, it was decided that the same set of sovereignly legislated norms applied to all French judges and that all non-conforming judgments would be considered null and void[101]. This idea of

[97] Basedow, J., "EU Law in International Arbitration: Referrals to the European Court of Justice" (2015), 32 J. Int'l Arb. 367 at 384-385.

[98] Ford, Richard, "Law's Territory (A History of Jurisdiction)", (1999), 868-872.

[99] Ortolani, Pietro, The Judicialisation of the Blockchain (August 14, 2018).

[100] Klimaszewska, Anna, "The Ordinance of 1667: Ideology of Modern Codification as a Political Tool of Louis XIV", (2016) 5 Wroclaw Rev L, Admin & Econ 128.

[101] Picardi, N, La giurisdizione all'alba del terzo millennio (2007), Giuffrè, 128-136.

centralization of power and its effect on jurisdiction can equally be found in the political and ideological works of the era. Jean Bodin, with his use of the term *puissance publique* when describing the notion of Republic[102], Samuel Pufendorf when describing jurisdiction as a component of sovereignty[103], and Montesquieu when he argued that rendering justice was one of the fundamental powers of the State[104], all relied on this centralistic dynamic that presented itself with the hierarchization of power.

A similar approach was also adopted regarding the definition of a judge. For Diderot, a judge is a "magistrate constituted by the sovereign, to render justice in his name to those who are subject to him[105]". As the French saying goes, *"le juge est la bouche de la loi"* and since the law was the direct expression of the will of the sovereign, the judge would be construed as an extension of the ruler itself, deriving its legitimacy from the sovereign's legislative authority, imposing power on the monarch's behalf.

Although this centralistic and hierarchical conception of jurisdiction is still highly dominant, over the last fifty years, we have witnessed a shift regarding the monopoly of the State over the administration of justice[106]. This monopoly has been relaxed as arbitration became the preferred method for dispute resolution for many conflicts[107], and the shift from public to private adjudication was inevitable.

The growth of international commerce and especially the rise of online transactions has created the perfect medium for the development of international arbitration. Additionally, today the courts are more inclined to adopt a *laissez-faire* attitude *vis-à-vis* arbitration and even encourage it. Arbitral awards are less likely to be annulled or set aside, and it is pretty uncommon

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[102] Bodin, J, Les six livres de la république (1576), Jacques du Puys, 1.

[103] Pufendorf, S., De jure naturae et gentium libri octo (1672), Londini Scanorum, 906-919.

[104] Montesquieu, De l'esprit des lois (1748), Bk XI, ch VI, Barillot.

[105] Jaucourt, L de, (1765) "Juge (Droit moral)" in Encyclopédie ou dictionnaire raisonne des sciences, des arts et des métiers, vol 9, 5, Faulche.

[106] Benyekhlef, K & Gélinas, F., (2005) "Online dispute resolution", 10 Lex Electronica, No 2.

[107] Stone Sweet, A. & Grisel, F., (2017) The Evolution of International Arbitration: Judicialization, Governance, Legitimacy, Oxford University Press, 35-79.

to see a dispute relitigated after an arbitral tribunal renders a decision on the case[108]. As such, the growth of arbitration has been aided by legislators' liberal attitudes as well as the necessity of a rapid and relatively low-cost method of adjudication, which has gradually relinquished the notion that state courts have a strict monopoly on the resolution of disputes. Instead, national legal systems have taken a supporting stance, ensuring that arbitral awards are valid and enforceable as long as they meet certain procedural conditions.

To summarize, the establishment of state courts as "quasi-monopolist" in the exercise of their power is considered the foundation of national states, and the jurisdictional authority of the courts became an expression of sovereignty. Private adjudication, like arbitration, which was considered a private matter in the Middle Ages, is now becoming the preferred method of administering justice for many due to the proliferation of arbitral institutions and the benefits of speed, flexibility, expertise, confidentiality, and efficiency. The pre-nation state theory of jurisdiction is disconnected from the sovereign powers of the age, and those who resolved disputes were seen as professionals offering a private service to disputants.

The centralistic and hierarchical conception of jurisdiction is still extremely dominant. However, the growth of international commerce and the rise of online transactions have created the perfect medium for the growth of international arbitration. The development of arbitration has been aided by legislators' liberal attitudes as well as the necessity of a rapid and relatively low-cost method of resolving disputes. Today, the courts are more inclined to adopt a laissez-faire attitude vis-à-vis arbitration and even encourage it.

Now it is important to scrutinize another critical matter that has enabled the rise of arbitration and the generally accepted view of it by the courts. In this next chapter, we will look at the international treaties that have quite successfully created a uniform understanding of the bounds, limits, and capabilities of arbitration and national legislation that aims at facilitating arbitration. An example in this regard is the Code of Civil Procedure of Quebec which stipulates

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[108] Dedezade, T., (2006) "Are You In? Or Are You Out? An Analysis of Section 69 of the English Arbitration Act 1996: Appeals on a Question of Law", 2 International Arbitration Law Review, 56.

in its first article that parties must consider private prevention and resolution processes before referring their dispute to the courts[109].

D-) Layers of Rules: The Contemporary Framework and International Conventions

To quote Palombo, Battaglini, and Cantisani, "There are layers of rules that apply to the arbitration process[110]". The first layer of these rules is the arbitration agreement; the second is the arbitration rules chosen by the parties. These rules can be selected from those that are established by the prominent arbitration institutions of the world, such as the London Court of Arbitration (LCIA), the International Chamber of Commerce (ICC), or the ADRIC arbitration rules, which are enacted by the alternative dispute resolution institute of Canada to establish clear, modern and common-sense procedures under which effective arbitrations can be conducted. The next layer of rules that apply to the arbitration process is the national laws, that is to say, the law of the *lex arbitri* and the applicable substantive law.

Today, in order to achieve consistency and clarity in international commerce, many nations and jurisdictions adopted the UNCITRAL Model Law on International Commercial Arbitration[111] *en lieu* of the law of the *lex arbitri*. In fact, today, legislation based on the Model Law has been adopted in 85 States in a total of 118 jurisdictions[112], including Quebec, where the Model Law was adopted in 1986. However, it is worth noting that since the Model Law is a non-binding international treaty, states that opt to adopt its provisions have the possibility to amend its contents before incorporating it into their state legislation. As such, it would be factually inaccurate to state that it creates complete harmonization amongst signatory states, yet it is still considered to be a major success in establishing a certain degree of unison[113]. Consequently, when the parties convene to choose, for

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[109] Quebec Civil Procedure Code (RLRQ c C-25) : Article 1 alinea 3.

[110] Palombo, A., Battaglini, R., & Cantisani, L. (2021). A Blockchain-Based Smart Dispute Resolution Method. In L. DiMatteo, A. Janssen, P. Ortolani, F. De Elizalde, M. Cannarsa, & M. Durovic (Eds.), The Cambridge Handbook of Lawyering in the Digital Age (Cambridge Law Handbooks, pp. 122-139).

[111] UNCITRAL Model Law on International Commercial Arbitration (1985), with amendments as adopted in 2006.

[112] Status: UNCITRAL Model Law on International Commercial Arbitration
https://uncitral.un.org/en/texts/arbitration/modellaw/commercial_arbitration/status

[113] Anderson, K., (2004) "Testing the Model Soft Law Approach to International Harmonization: A Case-Study Examining the UNCITRAL Model Law on Cross-Border Insolvency", 23 Aust. YBIL, 1.

example, Quebec's *lex arbitri,* it is, in fact, the model law (or a variation of it) that they are choosing. The next layer is the international arbitration practices such as IBA Rules on Taking Evidence and IBA Rules of Ethics or the UNCITRAL Notes on Organizing Arbitral Proceedings. Although these rules are not binding, they serve as guiding principles for both the parties and the arbitral tribunal[114].

The final layer is comprised of binding international treaties, the most important of which is the United Nations Convention on the Recognition and Enforcement of Foreign Arbitral Awards, or as it is more commonly referred to as the New York Convention. Although it is a relatively short document with only sixteen articles, as noted by the British judge Michael Mustill, it is the "single most important pillar on which the edifice of international arbitration rests[115]". The best illustration of its success is the exponential increase in world trade after its adoption. In fact, before the international community's widespread acceptance and incorporation of the Convention, the resolution of international trade disputes was based on international litigation, which was highly unsatisfactory and inadequate. The rules of enforcement of the arbitral awards were subject to the private international law rules of different legal systems, thus making international trade an area extremely difficult for foreign commercial parties to interpret and navigate.

This international instrument is signed by over 160 state parties and essentially governs the recognition and enforcement of arbitration agreements and awards. The Convention is mainly responsible for the widespread use of international arbitration as a means of resolving disputes today[116]. The Convention obliges contracting states to recognize and enforce foreign arbitration awards as they do domestic awards by effectively transforming the foreign arbitration ruling into a national court-enforceable judgment. Another important goal of the Convention is to ensure that contracting states enforce lawful arbitration agreements by staying judicial proceedings initiated in violation of such agreements[117]. Article II of the Convention deals with the enforcement of arbitration agreements and

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[114] Von Segesser, G., (2010) "IBA Rules on the Taking of Evidence in International Arbitration, The", 28 ASA Bull, 735.

[115] Greenwood, L., (2019) "A New York Convention Primer, What the Convention aims to accomplish and what advocates and arbitrators need to know about it", Dispute Resolution Magazine, September 12.

[116] *Id* at 88

[117] Kronke, H., Nacimiento, P., & Otto, D., (2010) Recognition and Enforcement of Foreign Arbitral Awards: A Global Commentary on the New York Convention, Kluwer Law International BV.

stipulates the conditions to be in the presence of a valid agreement to arbitrate. Any and all arbitration agreement that is in compliance with Article II of the Convention, regardless of whether any applicable national arbitration legislation has a stricter form requirement, must be implemented by the courts of a contracting state. It is clear that the New York Convention is a crucial component of international commercial arbitration and, of course, by extension, Online arbitration and potentially blockchain arbitration. We will examine the effects of the New York Convention's arbitral framework on the use of new technologies in the upcoming sections of the present thesis.

Besides the United Nations Convention on the Recognition and Enforcement of Foreign Arbitral Awards, other treaties that support arbitration on a global level include the European Convention on International Commercial Arbitration, which can be seen as the European counterpart of the New York Convention since it deals with party's right in arbitration and reasons for refusing to recognize or enforce an arbitral award. Equally, the Inter-American Convention on International Commercial Arbitration, more commonly referred to as the Panama Convention, which was adopted by the Governments of the Member States of the Organization of American States (OAS), is similar to the New York Convention in terms of purpose[118]. Although the Panama Convention is designed after the New York Convention, several differences can be discerned. The four most crucial ones are its (i) field of application, (ii) referral by courts of arbitration, (iii) conditions to be fulfilled by the petitioner, and (iv) the applicability of the IACAC Rules[119]. It is, however, unnecessary to delve further into details regarding the Panama Convention for the purposes of the present thesis.

To summarize, the arbitration process involves layers of rules, including the arbitration agreement, arbitration rules chosen by the parties, national laws, international arbitration practices, and binding international treaties such as the United Nations Convention on the Recognition and Enforcement of Foreign Arbitral Awards (New York Convention). The New York Convention is a crucial component of international commercial arbitration as it obliges contracting states to recognize and enforce foreign arbitral awards and lawful arbitration agreements. Other treaties that support

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[118] Sanders, P., "A Twenty Years' Review of the Convention on the Recognition and Enforcement of Foreign Arbitral Awards" (1979) 13:2 Int'l L 269.

[119] Van Den Berg, A. J., "The New York Convention 1958 and Panama Convention 1975: Redundancy or Compatibility?", Arbitration International, 5, 3 (1989), 214-229.

arbitration on a global level include the European Convention on International Commercial Arbitration and the Inter-American Convention on International Commercial Arbitration (Panama Convention).

The debate between national and global/transnational law is also important to the evolution of arbitration, particularly with the rise of disruptive technologies like blockchain. The impact of these technologies on national justice systems will be of interest moving forward.

Now that we have localized where arbitration traditionally stands and how its boundaries have been drawn up both by national legislative bodies and the international community, it is necessary to delve into the debate between national and global/transnational law. The conclusions reached through this debate will lead us to our next point of interest, which is the evolution of arbitration through disruptive technologies such as the blockchain, its relocation to the virtual world, and the impact of such technologies on national systems of justice.

E-) From National to Global: An Ideologic Divergence

As stated by Susan Strange, "The tremendous increase in international capital flows, both in trade and investment, foreshadowed a future where multinational firms could function freely, forming their own regulatory frameworks and escape the limits of state-made legislation[120]". Although these words were directed at international corporations, today, the same applies to a multitude of subjects. Individuals, groups, corporations, and organizations are all inclined to adopt a worldview that revolves around globalism and transnationalism. Even with the recent developments related to the Covid-19 pandemic forcing states to "close down" and restrict practices of globalism, it is nevertheless clear that there is an exponential increase in international transactions compared to a century ago.

In fact, the Westphalian understanding of centralization and state sovereignty is in decline. A great divide between the nationalistic and global/transnational can be seen in almost all areas of life and governance. As the trend of individualism which defines our generation rises, it seems quite inevitable

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[120] Strange, S., The Retreat of the State: The Diffusion of Power in the World Economy (Cambridge University Press 1996).

that nationalistic and centralistic approaches are bound to lose popularity and become outdated. As goods, services, and means of communication became readily available to the general public, we have reached a post-Westphalian point that is marked by self-regulation where physical distance, language, or legislation do not pose an obstruction to human interaction[121].

To understand what is meant by nationalism and transnationalism, it is useful to define them as the following: nationalism is the idea that the central position of the State as the monopolistic system of governance should be safeguarded against the forces that are defined as "globalization". On the other hand, the defenders of transnationalism stipulate that the Westphalian ideology of states as separate, self-contained, and self-governing entities is an archaic form of governance and that such a system is flawed and inefficient when contextualized in today's technologically, culturally, and economically interconnected world[122].

Although some authors[123] predicted a future where technology would pave the way for the transnational ideology to overpower and take over national and international legal systems, such a dramatic event is yet to occur. To this day, nations continue to provide the intellectual and institutional foundations on which we construct our notions of power. However, this does not mean that the arguments in favor of globalism were (or are) in vain; in fact, it would be accurate to state that the era of the law as a sole state product is in decline and is leaving its place to regulatory standards that are a-national and borderless[124].

The fundamental idea behind transnationalism relies on the observation that the boundaries of a State are inadequate to respond to the needs of reality[125]. The intricate web of events and activities that occur across national borders makes it so that sharp segregation of public and private spheres of

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[121] Nguyen, D. and Alexander, J., "The Coming of Cyberspacetime and the End of the Polity" in Cultures of Internet: Virtual Spaces, Real Histories, Living Bodies (ed. Shields, Rob, Sage 1996), 99.

[122] Blatter, Joachim and Schlenker, Andrea, "Between nationalism and globalism: Spaces and forms of democratic citizenship in and for a post-Westphalian world", University of Lucerne, Department of Political Science, Working Paper Series "Global Governance and Democracy", Paper 6 (2013).

[123] Virilio, Paul, La Bombe Informatique (Galilée 1998), 17.

[124] Rodrik, D., The Globalization Paradox: Democracy and the Future of the World Economy (Norton 2011), 200-201.

[125] Shaffer, G., "Transnational Legal Process and State Change", Law & Social Inquiry, 37, 2 (2012), 229-264.

law is becoming less and less meaningful. To respond to the reality of a globalized world, it is required to diminish the distinction between public and private international law, as well as to broaden the scope to include non-state normative systems[126].

The relevance of transnationalism to international arbitration and its future is apparent[127]. Transnational law has been (and is being) produced using a problem-solving strategy in which unique regulatory solutions are developed to meet specific requirements[128]. Likewise, international arbitration has evolved as a neutral forum for the resolution of cross-border economic disputes that could not be satisfactorily settled before state courts. The rising acceptance of global law practices and developing technological solutions have ushered in a new area of opportunities where it is now possible to design complex systems to prevent and resolve disputes via alternative dispute resolution methods, namely arbitration. Until the present, technology in the field of ADR has been viewed more or less as a convenient system that ameliorates efficiency. Convenience and efficiency describe the current state of affairs as the implementation of digital technology in the field of ADR. It would be wrong, however, to assume that these goals will be the sole reason for the adoption of these technologies.

New technologies alter not simply the way we do things but also the way we conceptualize the possibilities as well[129]. Alternative dispute resolution was not merely a more efficient approach than what occurred in court, and it will become evident that Online Dispute Resolution and, more specifically, Blockchain arbitration is not only a more efficient process than ADR as time goes on but rather the preferred method of adjudicating disputes that occur in a decentralized global marketplace[130]. Online Dispute Resolution and Blockchain arbitration might very well prove to be the next step in the evolution of arbitration that will usher in a new perspective and a new legal order.

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[126] Schultz, T., Transnational Legality: Stateless Law and International Arbitration (Oxford University Press 2014).

[127] Sweet, A. S. and Grisel, F., The Evolution of International Arbitration: Judicialization, Governance, Legitimacy (Oxford University Press 2017).

[128] Koh, H. H., "Why Transnational Law Matters", Penn St. Int'l L. Rev. 24 (2005), 745.

[129] Vermeys, N. W. & Benyekhlef K., "ODR and the Courts" in Mohamed S. Abdel Wahab, Ethan Katsh & Dan Rainey (eds.), Online Dispute Resolution: Theory and Practice (Eleven International Publishing, 2012), 295.

[130] Allen, D. W. E., Lane, Aaron M., & Poblet, Marta, "The Governance of Blockchain Dispute Resolution", 25 Harv. Negot. L. Rev. 75 (2020).

To summarize, there has been a shift towards globalism and transnationalism, where individuals, groups, corporations, and organizations operate beyond the limits of state-made legislation. This has led to a decline in the Westphalian understanding of centralization and state sovereignty, as well as a divide between nationalistic and global/transnational approaches. The rise of individualism and technological advancements have made it easier for people to interact and conduct international transactions, leading to a post-Westphalian point marked by self-regulation. While the era of the law as a sole state product is in decline, nations still provide the intellectual and institutional foundations of power.

The idea behind transnationalism is that the boundaries of a state are inadequate to respond to the needs of reality and that the sharp segregation of public and private spheres of law is becoming less meaningful. This is relevant to international arbitration, which has evolved as a neutral forum for the resolution of cross-border economic disputes. The rise of technology has opened up new opportunities to design complex systems for alternative dispute resolution, such as Online Dispute Resolution and Blockchain arbitration, which could become the preferred method of adjudicating disputes in a decentralized global marketplace. Overall, technological advancements are altering not only the way we do things but also the way we conceptualize the possibilities of the future of arbitration and legal order.

In this first title, we explained that arbitration is a private dispute resolution mechanism that offers benefits such as neutrality, speed, finality, enforceability, expertise, flexibility, and confidentiality. However, we have equally stated that there are drawbacks, including limits to arbitral jurisdiction and power, lack of appeal, and possibly the lack of expertise of arbitrators in arbitration. Enforceability is critical for a successful arbitral procedure, and the award must be recognizable under the jurisdiction where enforcement is sought. National courts are becoming more arbitration-friendly and recognizing and enforcing arbitral agreements and awards as long as the fundamental fairness of the arbitration is respected. Emerging technologies such as online dispute resolution procedures and blockchain-based arbitration can contribute to the evolution of arbitration.

The laws and rules applicable to arbitration, including the differences between substantive law and procedural law, and the role of the arbitral seat, are crucial to the arbitral process. The seat of

arbitration determines how the arbitration can and cannot be conducted. The legal framework of the seat provides a safety net and establishes the base rules that govern the proceedings. The choice of law clause is also essential, allowing parties to choose the law applicable to their dispute, opt for multiple applicable laws, or use different laws to govern various aspects of their contract. The concept of A-national substantive rules, where parties can choose rules that are not based on national laws to govern their dispute, is also discussed.

Arbitration has been aided by the growth of international commerce and the rise of online transactions, creating the perfect medium for the development of international arbitration. The New York Convention is a crucial component of international commercial arbitration as it obliges contracting states to recognize and enforce foreign arbitration awards and lawful arbitration agreements. The impact of disruptive technologies like blockchain is also important to the evolution of arbitration, particularly the debate between national and global/transnational law. Moving forward, we will delve deeper into the practical applications of technology in dispute resolution. In this regard, the following chapter will focus on the evolution of arbitration through technology (**II**).

TITLE II: Evolution of Arbitration Through Technology

The landscape of dispute resolution is changing as a result of technological advancements. A diverse set of unique and complicated interactions accompanied the fusion of the physical and virtual world. It has also brought with it a need for new dispute resolution and prevention processes. In this second title, we will start with an examination of digital technology and the blurring of traditional boundaries of international arbitration **(A)**. We will then move on to an assessment of Online Dispute Resolution systems and their shortcomings **(B)**, followed by an examination of the arbitral framework and the theory and application of Online Dispute Resolution systems **(C)**, followed by an analysis of the recognition and enforcement of digital arbitral awards **(D)**.

A-) Digital Technology: Blurring of Traditional Boundaries of International Arbitration

In the beginning, Online Dispute Resolution was used as a synonym for the resolution of conflicts that occur in the virtual world. The purpose of such platforms was to prevent and resolve disputes that arise over online markets. One of the most well-known platforms in this regard is

eBay's ODR mechanism; it boasts an extremely high success and usage rate[131]. The main reason behind its success is that eBay has been able to resolve disputes rapidly and at a minimal cost by examining patterns of disputes and designing a system that can handle a vast number of conflicts with repetitive case merits[132], and the fact that it can remove individuals from the platform if they do not abide by the decision. This is an essential aspect since it is an example of the influence of coercive power in a dispute resolution system. If the platform can enforce its decisions, it almost immediately becomes more successful. This is particularly important for the purposes of our thesis since, as we will examine, with blockchain arbitration, one of the main selling points is that the system is able to automatically enforce its own decisions without the need for exterior support.

Additionally, eBay has structured its system so that the data obtained from the disputes can be studied and the collected results can be implemented into eBay's system, thereby limiting the number of future conflicts that may result from similar issues; this aspect of eBay's ODR system proves that technology has reached a phase where tools no longer only compensate the human error factor but also replace it with their own more accurate assessment of the facts.

Today, however, there is a rising trend of resolving disputes occurring in the real world by means of Online Dispute Resolution. This expansion of ODR into the traditional conflict scene was the result of the development and acceptance of ODR in new settings, such as government agencies[133], the EU regulatory framework[134], and international bodies[135] , and perhaps the final surge of ODR in terms of usage and acceptance has been the result of the Covid-19 pandemic which has forced many legal practitioners, businesses, and organizations to accommodate themselves to conducting their affairs behind screens with minimal human interaction. The Covid-19 pandemic has fundamentally altered the view towards online mediums and digital

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[131] Rabinovich-Einy & Katsh, Online Dispute Resolution: Resolving Conflicts in Cyberspace (Jossey-Bass, 2001), at 169-175.

[132] Rule, C., "Designing a Global Online Dispute Resolution System: Lessons Learned from eBay", 13 U. St. Thomas LJ 354 (2016).

[133] Schiavetta, S., "Online Dispute Resolution, E-Government and Overcoming the Digital Divide" (2005).

[134] Cortes, P., "A New Regulatory Framework for Extra-Judicial Consumer Redress: Where We Are and How to Move Forward", Legal Studies (forthcoming 2014).

[135] Rule, C., Rogers, V., & Duca, L. D., "Designing a Global Consumer Online Dispute Resolution (ODR) System for Cross-Border Small Value – High Volume Claims – OAS Developments", 42 Uniform Commercial Code Law J. 3 (2010).

communication; it has "forced our hands" to develop more robust software to accommodate the rising need and demonstrated the inefficiencies of traditional ADR.

ADR has generally been praised for its ability to resolve disputes face-to-face, which is why it has been a challenge to implement the idea of using technological tools to work with parties at a distance[136]. Nevertheless, with the expansion of such systems into traditional ADR, practitioners have realized that technological tools and software applications can enhance their abilities and present professionals of the ADR community with novel alternatives for effective and efficient arbitration[137]. As the line between online and offline blurs, our conception of what is possible to do in the virtual space is also expanding, thereby making ODR a valid alternative for complex disputes that occur offline[138].

The growth of ODR has brought forth with it the question of its difference from traditional dispute resolution forums. For many, the uniqueness of ODR revolves around two main features: The ability to take out physical distances from the equation and the "intelligence of the machine". The attractiveness of these elements stems from the fact that they add additional flexibility, efficiency, and expertise, which are qualities generally prized by arbitration. This synergy between arbitration as a dispute resolution method and technology that offers to enhance the main benefits of arbitration has taken ODR beneath the spotlight of the international community, and it may potentially lead to a transition of a significant portion of ADR becoming ODR since intelligent software and tools that ODR offers to its users are usually not available for traditional ADR[139]. These software tools make it so that the speed of communication in a dispute is radically accelerated[140] , and they have allowed the creation of procedures for automated negotiation, online mediation, and technology-assisted arbitration.

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[136] C. Rule, Online Dispute Resolution for Business: B2B, ECommerce, Consumer, Employment, Insurance, and Other Commercial Conflicts, Jossey-Bass, San Francisco, 2002, pp. 83-84.

[137] Tyler, M.C., "Online Dispute Resolution" in M. Malkia & A. Anttiroiko (eds.), Encyclopedia of Digital Government (2007), at 1268-1274.

[138] Katsh, E. & Rifkin, J., Online Dispute Resolution: Resolving Conflicts in Cyberspace (Jossey-Bass, 2001), 7.

[139] Zekos, Georgios I., "From ADR to ODR" in Advanced Artificial Intelligence and Robo-Justice (Springer, Cham, 2022) at 261-284.

[140] Rabinovich-Einy, O. "Balancing the Scales: The Ford-Firestone Case, the Internet, and the Future Dispute Resolution Landscape" (2006) 6 Yale Journal of Law & Technology 29-30.

A prominent example in this regard is "Smartsettle," which is a web-based negotiation technology that facilitates settling monetary disputes between two or more parties[141]. Smartsettle advertises itself as a tool that automates the manual, time-consuming, and inefficient settlement process. It makes it easier for organizations to settle financial disputes by comparing the parties' submissions to determine if they are in the range of a mutually acceptable settlement. If not, it prompts the parties to submit their next offer. If yes, the parties arrange payment. The system utilizes a double-blind system where neither party is able to see the other party's offer or demands unless a settlement is reached.

As for technology-assisted arbitration, one of the examples is the World Intellectual Property Organization (WIPO). WIPO is in the process of developing a system of online arbitration where, through electronic tools, the parties will file requests by completing digital forms, submit documents and conduct information exchanges through secure channels. Afterward, the parties, the neutrals[142] , and the Center will use electronic means of communication, thereby reducing the loss of time. The WIPO facility will generate automatic notifications and databases to facilitate further the archiving of documents, and unique financial databases will support any financial transaction that occurs during the proceedings[143].

The mechanism of online arbitration is similar to traditional arbitration in principle. The claimant who desires to resolve their dispute via online arbitration initiates the process by submitting a statement of claim to the ODR provider, including the relevant facts, and seeks remedies[144]. The claim is submitted using the designated ODR provider's website. Where parties agree to settle the conflict via online arbitration, the arbitration agreement is also filed with the claim. After the initial filings have been made, documentary evidence is also submitted to the

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[141] https://www.smartsettle.com/

[142] The members of the WIPO List of Neutrals range from highly specialized practitioners and experts with specialized knowledge in the areas of patents, trademarks, copyright, designs, trade secrets, data or other form of intellectual property that is the subject of the dispute, to seasoned commercial dispute resolution generalists.

[143] https://www.wipo.int/amc/en/arbitration/online/index.html

[144] Rafal, M. Regulation of Online Dispute Resolution: Between Law and Technology (2005).

platform. An example in this regard is the "onlineARBITRATION" platform which accepts all disputes where the claim is at least $5,000.00[145].

Once the claim is initiated, the platform contacts the respondent using the contact information provided by the claimant, advising the respondent of the claim, as well as urging the respondent to agree to online arbitration. As soon as the respondent notifies their consent, they will file an answer to the claim describing the relevant factors for their defense[146]. Afterward, parties select their arbitrators from the list of arbitrators accredited by the ODR provider whose names are displayed on the platform's website. The next step would be the hearings, where videoconferencing is the preferred method of conducting said hearings. By this method, parties can be heard, seen, and testimonies of witnesses can be taken[147]. Once the hearing is concluded, the arbitrators review all the evidence and issue an award which will be communicated to the parties via e-mail or by posting the award on the website of the ODR provider[148].

After observance of these methods and systems by the ADR community, it was revealed that the apparent advantages of ODR, like cost and time efficiency,[149] were simply the tip of the iceberg[150]. In fact, supplementary benefits such as the ability of modern technologies to overcome disputant prejudices and assist parties in finding better, *Pareto-efficient* outcomes were revealed to both the parties and the creators of ODR systems through trial and practice[151]. Traditional arbitration on the other hand has been steadily receiving criticism regarding characteristics it has hailed previously. In fact, according to the 2015 Queen Mary/White & Case International Arbitration Survey, respondents indicated that the cost (68%), lack of insight into

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[145] Online Arbitration Process Rules. Available at www.onlineabritration.net

[146] FINRA: Arbitration Process.

[147] Jaberi, M.S. "Online Arbitration: A vehicle for dispute resolution in Electronic commerce".

[148] Schultz, T., Kaufmann-Kohler, G., Langer, D., Bannet, Y. "Online Dispute Resolution: The state of the art and the issues" (2001).

[149] Schmitz, Amy J. "Drive-Thru Arbitration in the Digital Age: Empowering Consumers through Binding ODR" (2010) 62:1 Baylor L Rev 178.

[150] Benyekhlef, Karim. "La résolution en ligne des différends de consummation: un récit autour (et un exemple) du droit postmoderne" in Pierre-Claude Lafond, ed, L'accès des consommateurs à la justice (Quebec: Éditions Yvon Blais, 2010) 89-117.

[151] Thiessen, E.M. & McMahon, J. "Beyond Win-Win in Cyberspace" (2000) 15 Ohio State Journal on Dispute Resolution.

arbitrators' efficiency (39%), and lack of speed (36%) were among the worst characteristics of international arbitration[152].

ODR's ability to assist parties in "finding" the optimal solution resides in its use of the fourth party[153]. In the context of ODR, the concept of fourth party (the first three being the Plaintiff, the Defendant, and the Jury/Arbitrators) is used to define the use of information and communication technologies[154]. The fourth party can assist the parties in numerous ways. A notable example is the use of "Big Data" during the dispute resolution process. In traditional ADR, the data obtained from cases are usually discarded, thus preventing the accumulation of jurisprudence, but the examination and use of this data is crucial if efficiency is to be increased[155]. By processing the information that previous ODR processes produce, the platform can incorporate mechanisms that facilitate the obtention of results[156] , such as showing the disputants and the arbitrators the data it has acquired and suggesting possible settlement scenarios. In this sense, the term "fourth party" means how the platform is programmed can positively impact the resolution of disputes.

To summarize, Online Dispute Resolution (ODR) was initially designed to resolve conflicts in virtual markets such as eBay, which has a high success rate due to its ability to resolve disputes at minimal cost and enforce its decisions rapidly. ODR has now expanded to resolving real-world conflicts due to the development and acceptance of ODR in new settings, government agencies, EU regulatory framework, international bodies, and the Covid-19 pandemic, which has forced legal practitioners and organizations to accommodate themselves to conducting their affairs online.

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[152] Queen Mary/White & Case International Arbitration Survey, 2015.

[153] Woolf, B. et al., "The Fourth Party: Improving Computer-Mediated Deliberation through Cognitive, Social and Emotional Support."

[154] CIarb, "Dispute Resolution by a Fourth Party - An Overview," Features, 12 June 2018, https://www.ciarb.org/resources/features/dispute-resolution-by-a-fourth-party-an-overview/#:~:text=This%20fourth%20party%5B1%5D%20is,and%20commercial%20disputes%5B2%5D.

[155] Rifkin, J., "Online Dispute Resolution: Theory and Practice of the Fourth Party," Conflict Resolution Quarterly, vol. 19, no. 1 (2001), 117-124.

[156] Gaitenby, A., "The Fourth Party Rises: Evolving Environments of Online Dispute Resolution," University of Toledo Law Review, vol. 38 (2006), 371.

ODR has unique features, such as taking out physical distances from the equation and the "intelligence of the machine," which can enhance arbitration by adding flexibility, efficiency, and expertise. Technological tools and software applications can present professionals with novel alternatives for effective and efficient arbitration, making ODR a valid alternative for complex offline disputes. ODR can offer intelligent software and tools that traditional ADR does not have, accelerating the speed of communication in a dispute and allowing the creation of procedures for automated negotiation, online mediation, and technology-assisted arbitration. Examples of these tools include Smartsettle, a web-based negotiation technology that facilitates settling monetary disputes, and the World Intellectual Property Organization (WIPO) developing an online arbitration system.

As demonstrated, the line between traditional ADR and ODR has been blurred; what was once deemed to be used exclusively in conflicts occurring in the virtual world has now exceeded its boundaries and seeped into the physical world. Although ODR poses great advantages that will allow for the further proliferation of international trade and reduce the procedural obstacles for resolving disputes, there are nevertheless shortcomings of such systems as well. In this next chapter, we will examine these disadvantages and follow our research by leaning into the question of how the current arbitral framework accommodates or is unable to accommodate the innovations brought forth by ODR systems.

B-) Online Dispute Resolution Systems and Their Shortcomings

The emergence of new paradigms in alternative dispute resolution is by no means a new matter; in fact, technology-driven "self-enforcement" has existed since the 1990s[157]. One of the early adopters of such dispute resolution systems has been the Internet Corporation for Assigned Names and Numbers (ICANN)[158]. In order to resolve trademark-based disputes relating to domain names, ICANN has been using a Uniform Domain-Name Dispute-Resolution Policy. The goal of

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[157] Benyekhlef, K. & Gélinas, F., "Online dispute resolution", Lex Electronica, vol. 10, no. 2, 2005.

[158] Thornburg, E.G., "Fast, cheap, and out of control: Lessons from the ICANN dispute resolution process", J. Small & Emerging Bus. L., vol. 6, 2002, at 191.

this policy is mainly to prevent cybersquatting[159] by setting up criteria that allow a trademark owner to register a complaint and, as a result, acquire the domain name's cancellation or transfer to its rightful owner. However, ICANN does not deal with such complaints with an internal mechanism; instead, it outsources resolving these disputes to external dispute resolution service providers[160]. Although there are many similarities, such as the exchange of written defenses[161], and the adjudicators' obligations regarding impartiality and independence, it would be inaccurate to qualify the UDRP procedures as arbitral proceedings since they produce no preclusive effects, and the outcomes are not such that can be recognized and enforced by national courts. In fact, the UDRP also recognizes that the parties maintain the right to take their conflict to any national court with jurisdiction over the case, regardless of whether UDPR proceedings have been initiated or completed[162]. Nevertheless, ICANN's infrastructure allows the adjudicators the power to exert control over the disputed domain names through technological methods; it can cancel the domain name or transfer it to the other party. This decision is subject to modification since the case can be re-adjudicated in court, even though this is relatively rare[163].

Although ICANN is an interesting case to study since it can be qualified as one of the first organizations to successfully implement an ODR system to resolve the disputes that occur within its domain of work, its domain is quite limited[164]. Numerous criteria must be considered to understand what makes an ODR system successful.

The success of an ODR system is, first and foremost, dependent on its ability to establish trust and awareness among its users[165]. It must make itself available for both the disputants and

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[159] Cybersquatting: If, for instance, a party operating in bad faith registers a domain name referring to a trademark for the purpose of preventing the trademark owner from registering it, this behavior is defined as cybersquatting.

[160] List of Approved Dispute Resolution Service Providers, www.icann.org/resources/pages/providers-6d-2012-02-25-en

[161] Rules for Uniform Domain Name Dispute Resolution Policy, Art(s). 3 and 5.

[162] UDRP, n. 37 at Art. 4(k).

[163] Thornburg, E.G. "Going Private: Technology, Due Process and Internet Dispute Resolution." 34 UC Davis Law Review 151 (2000) 224.

[164] eResolution was one of the four organisations, alongside WIPO, the National Arbitration Forum (NAF) and CPRADR, approved by ICANN to decide, following a challenge, which party was most entitled to a particular domain.

[165] Melamed, James C. "Online Dispute Resolution." Preparing for the Future 41 (2019) 14.

practitioners and garner their trust. According to Schultz, "ODR needs architecture of confidence, something that will create tangible features, social contexts, and predictable remedies in case a problem occurs[166]". This trust can be achieved through the implementation of protective measures that prevent unauthorized individuals from accessing the data contained within the system, by providing information about the neutrals of the system, such as the arbitrators or the mediators, and by describing the process understandably and transparently[167]. Another crucial aspect of a successful ODR system lies in the expertise of its neutrals[168]. Besides being practitioners of alternative dispute resolution methods, these techno-arbitrators must be knowledgeable about the system that they are utilizing to resolve disputes. By acquiring the proper technical know-how, the professionals of the ADR community can alleviate some of the limitations and obstacles of ODR[169].

Although the benefits of ODR described in the previous sections and the aspects that allow for the creation of a successful ODR system make it seem that ODR is without problems, this would be an inaccurate statement. Whereas it is cost-efficient, fast, convenient, and is gaining momentum in terms of usage, there are nevertheless challenges that arise which must be addressed. Critics point out that the lack of face-to-face encounters in online arbitration makes it so that the traditional dynamics of ADR are lost[170]. Instead of parties facing each other and expressing their arguments in a semi-formal setting, they are locked behind screens which diminishes the "feel" of an arbitral process. The "richness" of face-to-face meetings is lost since communication between components of the process is often expressed non-verbally[171] , and certain authors estimate that this lack of face-to-face encounter makes it more difficult for arbitrators to create an environment of confidence and makes it harder for parties to trust in the legitimacy of the arbitral procedure[172].

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[166] Schultz, T. "Does Online Dispute Resolution Need Governmental Intervention? The case for Architectures of Control and Trust." North Carolina Journal of Law x Technology, vol. 6 (2004) 71, 73.

[167] Hang L.Q. "Online Dispute Resolution Systems: The Future of Cyberspace Law." Santa Clara Law Review, vol. 41, no. 31, article 4 (2001) 862-863.

[168] Zheng, Jie. "ODR Procedural Standards." In Online Resolution of E-commerce Disputes, 211-279. Cham: Springer, 2020.

[169] Jaberi, M.S. "Online Arbitration: A vehicle for dispute resolution in Electronic commerce".

[170] Eisen, J.B., "Are We Ready for Mediation in Cyberspace?" (1998) BYU L. Rev. 1350 at 1312-13.

[171] Katsh, E., "The New Frontier: Online ADR Becoming a Global Priority" (2000) Dispute Resolution Magazine at 8.

[172] Marvey, I., "Online Dispute Resolution: What Future?" (2001).

Even though these arguments hold certain merit, in our view, they are outdated. The Covid-19 pandemic has demonstrated that many interactions that are traditionally conducted in person can be done digitally without sacrificing any crucial aspects. Physical presence is not inconsequential when the parties and arbitrators are able to communicate efficiently.

Perhaps a more pressing challenge posed by ODR systems relates to the matter of security, which has three major components; (i) Confidentiality, (ii) Integrity, and (iii) Availability[173]. The principal challenge that ODR must face is to convince its users that the data transferred and acquired is not tampered with and that no one but the authorized parties has had (or could have) access to it[174].

One of the reasons why parties opt for alternative dispute resolution methods is because of the high level of confidentiality offered by such methods. This is not an easily solvable dilemma, as even the most secure systems, such as the blockchain, are vulnerable to hacks and security breaches which we will examine in the following chapters of the present thesis. Should the correspondences, evidence, or any other electronically transmitted document be the target of a hacker, the confidence of all the parties involved in the ODR system would be shaken. However, specific measures can be taken to decrease the likelihood of a security breach radically.

One such measure is the utilization of a "digital signature[175]". A digital signature is synonymous with a fingerprint in the digital world. It is a unique code that binds the signer and the document, thereby ensuring the authenticity of the material[176].

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[173] International Organization for Standardization, ISO/IEC 27000:2018 Information technology - Security techniques - Information security management systems - Overview and vocabulary (2018).

[174] Draper, C. & Raymond, A., "Ethical Technology Risk: How to Identify What Is Reasonable Data Protection for ODR" (2019) IJODR 6 at 144.

[175] Jeretina, U. Consumer Online Dispute Resolution (ODR)–As a Key Cultural Change–Mechanism for Innovative Public Administration in EU. (2019).

[176] Jha, P. ODR System and Its Stumbling Blocks. SSRN 3891498, (2021).

The use of digital signatures as an equivalent of traditional pen and paper signatures has been recognized in many jurisdictions and international instruments such as the United Nations Commission on International Trade Law Convention on the Use of Electronic Communications in International Contracts or simply the ECC[177] , which was adopted on 23 November 2005. We will examine the relevance of this concept of technological neutrality in the upcoming sections.

To summarize, this section discusses the emergence of technology-driven online dispute resolution (ODR) systems and the challenges they face, such as establishing trust and expertise of neutrals while addressing security concerns. Despite these challenges, ODR systems have been successful in resolving disputes more efficiently and cost-effectively, especially in light of the Covid-19 pandemic. This is achieved through the use of protective measures, the expertise of neutrals, and the implementation of digital signatures to address security concerns.

Understanding the benefits and challenges of ODR systems is relevant to blockchain-based arbitration, as both systems prioritize efficiency, cost-effectiveness, and accessibility. Incorporating best practices from technology-driven ODR[178] systems can enhance the effectiveness of blockchain-based arbitration and improve dispute resolution in the context of blockchain transactions. By leveraging blockchain technology to provide a secure, transparent, and immutable platform, blockchain-based arbitration can benefit from the lessons learned by ODR systems in terms of automation, online communication, and data analytics to streamline the dispute resolution process. Ultimately, both ODR systems and blockchain-based arbitration aim to provide an effective and efficient platform for resolving disputes.

Now that we have discussed what makes an ODR system successful and what are the potential shortcoming of such systems and why understanding these aspects is relevant in the context of blockchain arbitration, it is now time to examine the arbitral framework and the theory and application of ODR systems. By delving into the mechanics of ODR, we can understand how

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[177] United Nations Commission on International Trade Law Convention on the Use of Electronic Communications in International Contracts was established to provide a procedural framework for the global recognition of international contracts entered into by electronic methods.

[178] Benyekhlef, Karim & Nicolas Vermeys. "Best Practices in the Field of Cyberjustice" in Carlos Gregorio, ed., Seminar on Recent Trends and Good Practices in the Application of Electronic Technology to Judicial Processes (E-Justice).

the current arbitral framework can accommodate (or diverge from) these technology-driven systems of alternative dispute resolution.

C-) The Arbitral Framework and the Theory and Application of ODR systems

There seem to be two interpretations of ODR[179], the first being a broad conception whereby ODR is defined as being the utilization of digital tools to ease communication and dispute resolution[180] and the second interpretation which can be seen as a more traditional approach that defines ODR as a process that "utilizes the internet as a more efficient medium for parties to resolve their disputes through a variety of ADR methods" and that "brings disputing parties together 'online' to participate in a dialogue about resolving their dispute[181]".

Through trial and error, it seems to be a universal experience that "when a new online technology is created for any process, the initial impulse is to create online mirror images of the "live" or offline process[182]". On the other hand, however, when a process becomes digital and moves to the virtual world, its *ethos*[183] seems to mutate. This phenomenon has been observed in ADR and ODR as well. Even though the initial perception was that of a traditional approach whereby ODR was seen simply as the online version of ADR, it is not ODR's sole purpose to bring ADR into the virtual world but rather to alter the nature of parties' interactions thereby creating novel opportunities to achieve dispute resolution[184]. Consequently, today the broad interpretation of ODR seems to be more prevalent.

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[179] Vermeys, N. W. & Benyekhlef, K., ODR and the Courts, in Mohamed S. Abdel Wahab, Ethan Katsh & Dan Rainey (eds.), Online Dispute Resolution: Theory and Practice, La Haye, Eleven International Publishing, (2012) at 295.

[180] Hörlne, J. Online Dispute Resolution, in R. Bernstein, J.A. Tackaberry & A.L. Marriott, Bernstein's Handbook of Arbitration and Dispute Resolution Practice, Volume 1 (4th edn.), London, Sweet & Maxwell 2003 at 782.

[181] See http://cyber.law.harvard.edu/olds/ecommerce/disputestext.html

[182] Katsh, E. & Rainey, D. ODR and Government, in M. S. A. Wahab, E. Katsh & D. Rainey (eds.), Online Dispute Resolution: Theory and Practice (The Hague, Netherlands: Eleven International Publishers, 2012) at 260.

[183] The characteristic spirit of a culture

[184] Zekos, Georgios I. From ADR to ODR. In Advanced Artificial Intelligence and Robo-Justice, pp. 261-284. Springer, Cham, 2022.

The altered nature of arbitration through technology brings with it numerous questions regarding the impact of digitalization. Most importantly, the question that needs answering is to know whether the arbitral framework currently in place can accommodate the novelties of e-proceedings, e-arbitration agreements, e-awards and whether the ODR proceedings are able to respect the fundamental principles of due process, equality of arms, and the overall fairness criteria established for traditional arbitration.

Like any arbitral proceeding, online arbitration comes to life via the arbitration agreement. The source of an arbitral proceeding has specific form provisions that must be respected if the arbitral agreement is to be considered valid and binding. Electronic arbitral agreements are testing the boundaries of such requirements. In the following subsection, we will examine the validity of e-arbitration agreements.

i-) Validity of E-Arbitration Agreements

The first parameter is the "in writing" requirement which stipulates that arbitration agreements must be concluded in writing[185]. Although this question and the question regarding the validity of e-signatures is no longer considered as being an issue, similar questions will undoubtedly re-emerge with the advent of blockchain based arbitration. As such, it is necessary to revisit this historical debate.

The New York Convention expressly states in its Article II paragraphs one and two that: "*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*" and that "*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*". Numerous national legislation regulate the same issue with similar expressions regarding the "in writing" requirement, for example article 2640 of

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[185] International Council for Commercial Arbitration ICCA's Guide to the Interpretation of the 1958 New York Convention: A Handbook for Judges https://cdn.arbitration-icca.org/s3fs-public/document/media_document/judges_guide_nyc_english_2018_reprint.pdf

the Civil Code of Quebec stipulates that "*An arbitration agreement shall be evidenced in writing; it is deemed to be evidenced in writing if it is contained in an exchange of communications which attest to its existence or in an exchange of proceedings in which its existence is alleged by one party and is not contested by the other party*[186]".

The form requirements contained in the New York Convention are from an era where "telegrams" represented the pinnacle of technology. As technology progressed, the wording of these decades-old provisions became problematic[187]. Questions arose as to whether the meaning of telegrams could be extended, what constitutes a valid "signature" in the sense of Article II, or whether the New York Convention should be amended to revise its provisions to include the technologies that were non-existent at the time of the Conventions redaction. This latter proposal was dismissed, and given the success of the Convention, it was decided that an amendment would be undesirable and impractical[188].

Electronic arbitration agreements can take several forms, the most common of which are declarations by e-mail or via a web-based service. Usually, in the case of a web-based service or application, the users are confronted with a click-wrap[189] or browse-wrap[190] type agreement. In a click-wrap agreement, the user clicks on the "agree" button, and the click constitutes the consent which allows the web service to proceed to the next step. A browse-wrap agreement usually presents itself as a downloadable file or a hyperlink that can be clicked on, which equally acts as a consent mechanism[191].

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[186] Article 2640 of the Civil Code of Quebec.

[187] del Rosal Carmona, Rafael Carlos. "Algorithmic Dispute Resolution: Will the Decision of a Robo-arbitrator Fall under the New York Convention?." In Legal Challenges in the New Digital Age, pp. 198-214. Brill Nijhoff, 2021.

[188] See Report of the Working Group on Arbitration on the work of its thirty-third session, A/CN.9/485, paras. 60 et seq.

[189] A click-wrap or clickthrough agreement is a digital prompt that offers individuals the opportunity to accept or decline a digitally mediated policy. Privacy policies, terms of service and other user policies, as well as copyright policies commonly employ the clickwrap prompt.

[190] Browse-wrap agreements are online contract or license agreements commonly used by websites which state that by using the website the user assents to the site's Terms and conditions, often presented via a hyperlink.

[191] Bergram, Kristoffer, Bezençon, Maingot, Gjerlufsen, and Holzer. "Digital Nudges for Privacy Awareness: From consent to informed consent?." In ECIS, 2020.

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As the present thesis focalizes on international arbitration, we will examine how an e-arbitration agreement functions in an international setting. As a preliminary step, it is helpful to glance at the rules governing the conclusion of contracts that are similar to domestic arbitration agreements. Even though article V(1)(a) of the New York Convention offers a cause for refusing to recognize and enforce an arbitral award, the conflict of law rule entrenched in this article also applies to article II of the Convention. As is the case with UNCITRAL's Model Law article 34{2}{a}{i}, unless the parties have chosen another jurisdiction, the law of the place of arbitration determines the formation and validity of the arbitration agreement. As a result, the assessment of electronic declarations under that statute can be referenced.

As such, the law which has been decided upon also governs the inclusion of an arbitration clause in general terms and conditions. This situation is generally uncontested under the UNCITRAL Model Law. However, certain scholars nevertheless argue that the rules on the inclusion of general terms and conditions in a contract are part of article II of the Convention's autonomous law[192]; this is, however, inaccurate given that the Convention does not specify any rules on contract conclusion[193]. As such, it can be discerned that the national law governing the conclusion of the arbitration agreement determines matters such as the requirement for an explicit reference to the agreement to arbitrate.

Another matter that deserves attention concerns the form requirements of electronically concluded arbitration agreements for reasons of recognition and validity. In contrast to its lack of provisions regarding contract conclusion, the New York Convention has explicit form requirements for the recognition of foreign arbitration agreements. Article II (1) of the Convention stipulates that "*Each contracting State shall recognize an agreement in writing (...)*" the terminology utilized in this article is problematic since the "in writing" requirement forms part of the autonomous law of the Convention the contracting States may not derogate from its provisions.

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[192] R. Hausmann, "Das internationale Privatrecht der Schuldverträge," in C. Reithmann and D. Martiny (eds.), Internationales Vertragsrecht, 8th ed. (Cologne: Otto Schmidt, 2015), paras. 8.267, 8.292.

[193] Schramm, Geisinger and Pinsolle, "Art. III:1," in J. Kronke, P. Nacimiento, A. Otto and J. Port (eds.), Commentary on the UN Convention on the International Sale of Goods (CISG), 2nd ed. (Oxford: Oxford University Press, 2018), at 89.

Whereas a traditional arbitration agreement is in writing, in the case of an e-arbitration agreement, the parties may simply make their consent apparent via a click.

In addition to being proof of consent[194], the "in writing" requirement set forth by the New York Convention assures that the arbitration panel has the authority to resolve the issue under the terms of the agreement. The written agreement is equally important in the enforcement stage since the party seeking enforcement is required to provide the courts with the written agreement as well as the arbitral award[195]

The preliminary conclusion based solely on the wording of the Convention is that the New York Convention has not included e-arbitration agreements as a valid form of concluding an arbitration agreement[196]. Scholars have argued in this regard that, since the Convention mentions fax and telegram, their meaning could and should be extended to cover electronic means of contract conclusion[197]. This approach that advocates for a broad interpretation of Article II of the Convention to include arbitration agreements concluded through means other than an exchange of letters or telegrams were also proposed in the ICCA's Guide to the Interpretation of the 1958 New York Convention[198]. The ICCA's Guide to Interpretation argues that "The wording of article II (2) was intended to cover the means of communication that existed in 1958" and that "It can be reasonably construed as covering equivalent modern means of communication. The criterion is that there should be a written record of the arbitration agreement. All means of communication that fulfill this criterion should then be deemed as complying with Article II(2), which includes faxes and e-mails[199]".

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[194] Julian D. M. Lew, Loukas A. Mistelis and Stefan M. Kröll, Comparative International Commercial Arbitration (Kluwer Law International, Dordrecht, 2003), 7-7.

[195] H. Yu, 'Written arbitration agreements – what written arbitration agreements?', Civil Justice Quarterly 32(1) (2012), 68.

[196] Muhammad, Nasiruddeen, and Mokhinur Bakhramova. "The Formation of the E-Arbitration Agreement in the Digital World" Innovative Technologica: Methodical Research Journal 3, no. 09 (2022): 1-12.

[197] Hill, R. "Online Arbitration: Issues and Solutions." 15 ARB. Int'l (1999).

[198] International Council for Commercial Arbitration. ICCA's Guide to the Interpretation of the 1958 New York Convention: A Handbook for Judges, 50.

[199] Id at 167.

The "in writing" requirement is a subject of debate that mostly depends on the enforcing courts' interpretation of the article. However, given that the Conventions' prime goal is to ease arbitral awards recognition and enforcement in different jurisdictions with minimal obstacles[200], it can be inferred that the liberal interpretation of Article II, which includes electronically concluded arbitration agreements as valid, should be upheld. The adoption of this approach has already been observed in multiple courts[201] and by scholars such as Professor Giuditta Cordero Moss[202] , who argued that "The question whether an arbitration clause entered into electronically meets the requirement of the written form, which is set by the New York Convention on Recognition and Enforcement of Foreign Arbitral Awards, seems relatively easy to answer affirmatively, on the basis of an extensive interpretation of the New York Convention[203]".

Furthermore, the General Assembly has adopted resolution 61/33 to clarify and harmonize the interpretation of Article II of the Convention[204]. In this resolution, it was advised that a broad interpretation was desirable and that the mention of letters and telegrams in the Convention were examples rather than an exhaustive list. Unfortunately, the recommendation of the General Assembly is not binding upon the signatory states[205] since UNCITRAL is not an enacting body[206].

Moreover, in practice, in *Compagnie de Navigation et Transports SA v. MSC Mediterranean Shipping Company SA*, the Swiss Supreme Court interpreted Article II (2) of the New York Convention in liberal terms, judging that "exchange of letters or telegrams" includes any and all means of communications. The court went further and noted that the form requirement

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[200] A. van den Berg, Yearbook Commercial Arbitration 1996 – Volume XXI (Kluwer Law International, Dordrecht, 1996) at 685.

[201] Dardana Ltd v Yukos Oil Company [2002] EWCA Civ 584.

[202] Giuditta Cordero-Moss is a Professor at the Department for Private Law, University of Oslo, Norway, in charge of International Commercial Law, International Commercial Arbitration and Private International Law.

[203] G. Cordero Moss, "Risk of Conflict Between the New York Convention and Newer Arbitration-Friendly National Legislation?" Stockholm Arbitration Report 2 (2003), 1-17.

[204] Recommendation regarding the interpretation of article II(2) and article VII, paragraph 1, of the Convention on the Recognition and Enforcement of Foreign Arbitral Awards, done in New York, 10 June 1958, adopted by the United Nations Commission on International Trade Law on 7 July 2006 at its thirty-ninth session.

[206] A Guide to UNCITRAL Basic facts about the United Nations Commission on International Trade Law (Vienna, 2013), para 43.

of the New York Convention was met since it was equivalent to the form provided by Article 178(1) of the Swiss Code on Private International Law[207].

Another form requirement that the Convention stipulates in Article II is the requirement of parties' signatures apposed on the arbitration agreement. The rationale behind this provision is to achieve a higher degree of reliability, and a literal reading of the article would suggest that simple electronic signatures would not qualify as valid signatures under the Convention's regime. In the following subsection, we will examine the validity of e-signature on arbitration agreements.

ii-) *The Validity of E-Signatures on Arbitration Agreements*

The New York Convention stipulates in Article II that the arbitration agreement must be "signed by the parties". The idea being that a signature is a reliable method of establishing the connection between the parties and their consent to the arbitration. This goal of authentication aligns with the fact that facsimiles and copies of signatures are insufficient[208] for reliably establishing the connection between the agreement and the signatory parties.

In order to determine the validity of agreements leading to an ODR procedure, we must ask whether electronic signatures satisfy the New York Convention's "signature" requirement. The response is similar to what we established about the "in writing" requirement. At face value, an electronic signature that simply names the party should not be sufficient to qualify as a signature in the sense that the Convention requires. The Convention does not explicitly state what constitutes a valid signature and what does not; in fact, it does not even define what constitutes a signature. For this reason, it is helpful to look at different sources to interpret this article and establish whether its wording can be extended to include electronic signatures[209].

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[207] Compagnie de Navigation et Transports SA v. MSC Mediterranean Shipping Company SA, [1996] 1 Swiss Arb. Dec. 225 (Switz. Trib. Fed. Jan. 16, 1995).

[208] Czernich, D., New Yorker Schiedsübereinkommen – UN- Übereinkommen über die Anerkennung und Vollstreckung ausländischer Schiedssprüche – Kurzkommentar (Vienna: LexisNexis, 2008), art II para 29.

[209] Muhammad, Nasiruddeen, and Bakhramova. "The Formation of the E-arbitration Agreement in the Digital World." (2022) 3 Innovative Technologica: Methodical Research Journal 09, 1-12.

In this regard, one of the most useful, albeit insufficiently recognized tool in international commerce is the United Nations Commission on International Trade Law Convention on the Use of Electronic Communications in International Contracts, or as it is more commonly referred to as the ECC[210]. The ECC stipulates in its article 9, paragraph 3 that:

"Where the law requires that a communication or a contract should be signed by a party, or provides consequences for the absence of a signature, that requirement is met in relation to an electronic communication if: (a) A method is used to identify the party and to indicate that party's intention in respect of the information contained in the electronic communication; and (b) The method used is either: (i) As reliable as appropriate for the purpose for which the electronic communication was generated or communicated, in the light of all the circumstances, including any relevant agreement; or (ii) Proven in fact to have fulfilled the functions described in subparagraph (a) above, by itself or together with further evidence".

The ECC increases the reach of the principle of "technological neutrality" by allowing for the same type of evidence to be used to authenticate electronic signatures as is used for handwritten signatures[211]. Another key principle that governs the ECC is the principle of functional equivalence[212] which aims to equalize electronic counterparts of "signatures" and "writing" with their original definitions. For example, article 9 paragraph 3(a) of the ECC stipulates as follows;

"Where the law requires that a communication or a contract should be signed by a party, or provides consequences for the absence of a signature, that requirement is met in relation to an electronic communication if a method is used to identify the party and

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[210] United Nations Commission on International Trade Law Convention on the Use of Electronic Communications in International Contracts was established to provide a procedural framework for the global recognition of international contracts entered into by electronic methods.

[211] Martin, Charles H. "The UNCITRAL Electronic Contracts Convention: Will it Be Used or Avoided?" (2005) 17 Pace International Law Review, 1-21.

[212] Reed, Chris. "Online and Offline Equivalence: Aspiration and Achievement," (2010) 18 International Journal of Law and Information Technology, 338-356.

to indicate that party's intention in respect of the information contained in the electronic communication";

This article requires, for an electronic signature to be valid, the possibility to identify the signatory, whereas traditional methods do not require a legible signature *per se*[213]. As a result, the electronic version of "signature" distinguishes itself from the original notion in that it involves a function that the original does not.

Although ECC is one of the key instruments today, in 1996, UNCITRAL had already presented the UNCITRAL Model Law on Electronic Commerce (MLEC) with a similar philosophical undertone as the ECC. The MLEC introduced in article 7 the "*principle of recognition*", whereby any electronic signature could be recognized. The legal effect of such a signature would be determined by the degree to which its dependability could be demonstrated.

Additionally, the European Union has introduced through its legislative mechanisms the Electronic Signatures Directive 1999/93/EC[214] , which has the core goal of creating a distinct framework for the recognition and the achievement of confidence in new technologies. The Directive establishes two regimes for the recognition of electronic signatures. The first one follows the same principles established by article 7 of the MLEC, and the second regime defines under which conditions can an electronic signature be systematically recognized. As such, the Directive establishes different categories of signatures. A distinction is made between an electronic signature[215] which is defined as "data in electronic form which are attached to or logically associated with other electronic data and which serve as a method of authentication", and an advanced electronic signature[216] is defined as "an electronic signature which meets the following requirements: (a) it is uniquely linked to the signatory; (b) it is capable of identifying the signatory; (c) it is created using means that the signatory can maintain under his sole control, and (d) it is

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[213] Towle, Holly K. "E-Signatures - Basics of the US Structure." Houston Law Review 38 (2001): 921-986.

[214] Council Directive 1999/93/EC of the European Parliament and of the Council of 13 December 1999 on a Community Framework for Electronic Signatures, OJ 2000 No. L 13, 19 January 2000, pp. 12–20.

[215] Article 2(1), Directive 1999/93/EC

[216] Article 2(2), Directive 1999/93/EC

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linked to the date to which it relates in such a manner that any subsequent change of the data is detectable."

The Directive also defines the concepts of "certificate[217]", "qualified certificate[218]", "signature creation device[219]", and "secure signature creation device[220]". When applied in their respective context, the Directive entails that an advanced electronic signature based on a qualified certificate created by a secure signature-creation device has equal legal standing with handwritten signatures. It is equally admissible in a legal proceeding without the need for any additional steps[221]. However, this does not mean that an electronic signature would be denied legal effect and admissibility solely on the ground that it does not present the qualities established by the Directive (*e.g.,* electronic form, based on a qualified certificate, created by a secure signature-creation device). This is in line with article 7 of the MLEC[222], which maintains two different recognition regimes whereby there exists a regime with conditions for automatic recognition and another regime that allows for recognition without conditions.

Following this tendency of establishing functional equivalency between e-signatures and e-documents to traditional paper ones, numerous States have equally enacted laws on electronic commerce where the same principles were retained. For example, the United States of America enacted the Uniform Electronic Transaction Act (UETA) in 1999[223] for e-commerce and the Electronic Signature in Global and National Commerce Act in 2000[224]. Equally, the Netherlands integrated provisions from the Electronic Signatures Directive in 2003 under *Wet Elektronische Handtekeningen* or Electronic Signatures Act.

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[217] Article 2(9), Directive 1999/93/EC

[218] Article 2(10), Directive 1999/93/EC

[219] Article 2(5), Directive 1999/93/EC

[220] Article 2(6), Directive 1999/93/EC

[221] Article 5(1), Directive 1999/93/EC

[222] The revised 2001 UNCITRAL Model Law on Electronic Signatures

[223] http://www.njleg.state.ng.us/2000/Bills/Plo1/116_.PDF

[224] https://www.fdic.gov/regulations/compliance/manual/pdf/x-3.1.pdf

Equally, the United States of America has enacted the "Electronic Signatures in Global and National Commerce Act", which gives a signature or record sent through cyberspace the same legal validity as a written document[225]. Similarly, Canada has enacted the PIPEDA[226], which, along with other measures, declares that an electronic signature satisfies the criteria for a signature in one of the listed provisions of federal law. The PIPEDA leaves more gaps in the legality of electronic signatures than are present at the provincial level since it is designed to only apply to particular clauses of selected federal acts. Nevertheless, a few additional federal legislations have independently included wording allowing electronic documents and signatures (e.g., the Canada Business Corporations Act has its own provisions setting out terms for the use of electronic documents).

PIPEDA provides that an electronic signature can be used to fulfill any signature requirement that is listed in specified provisions of federal laws. Other legislative acts in this regard include the Secure Electronic Signature Regulations, which provides the requirements for secure electronic signatures, the UECA or the Uniform Electronic Commerce Act of Canada, which is a model legislation that enables the provinces and territories (except for Quebec) to use as a model for their own e-signature legislation.

In Quebec the "*Act to Establish a Legal Framework for Information Technology*" applies. It stipulates in its article 39 that:

> "The link between a person and a document, whatever the medium used, may be established by means of the person's signature. A person's signature may be affixed to the document by means of any process that meets the requirements of article 2827 of the Civil Code.
>
> A person's signature affixed to a technology-based document may be set up against that person if the integrity of the document is ensured and the link between the

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[225] http://www.njleg.state.ng.us/2000/Bills/Plo1/116_.PDF

[226] Personal Information Protection and Electronic Documents Act (S.C. 2000, c. 5)

signature and the document was established at the time of signing and has since been maintained[227]".

As depicted via the examples of MLEC, ECC, Electronic Signature Directive, UETA, Electronic Signature in Global and National Commerce Act, the *Wet Elektronische Handtekeningen,* PIPEDA, the UECA, and the *Loi Concernant le Cadre Juridique des Technologies de l'information*, the tendency of both national, international and supranational legislative bodies is to eliminate the obstacles that hinder the expansion of electronic commerce. With this inclination in mind, it is not unreasonable to assume that the New York Convention pursues similar goals in relation to the obstacles that hinder the proliferation of international arbitration in the digital world.

As such, the "in writing" and "signature" requirements set forth by the New York Convention should not be considered as criteria that affect the validity of an arbitration agreement but should instead be read through a liberal lens to include contemporary technologies within its limits by applying the principles of functional equivalency and technological neutrality. We will discuss whether this conclusion can be applied in the context of blockchain arbitration in the upcoming sections.

In any case, should the national courts where the arbitration agreement is being judged to be valid or not decide on a strict interpretation of the New York Convention's provisions, the New York Convention itself allows for the alleviation of its form requirements through the application of a "more favorable law". Article VII(1) stipulates that:

> "The provisions of the present Convention shall not affect the validity of multilateral or bilateral agreements concerning the recognition and enforcement of arbitral awards entered into by the Contracting States nor deprive any interested party of any right he may have to avail himself of an arbitral award in the manner and to the extent allowed by the law or the treaties of the country where such award is sought to be relied upon".

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[227] C-1.1 - Loi concernant le cadre juridique des technologies de l'information

Although a literal reading of this article might lead us to conclude that the provision's scope is strictly limited to the recognition and enforcement of foreign arbitral awards, the French *Cour de Cassation* has, through an examination of No.2 of UNCITRAL's 2006 Recommendation, drawn an analogy and decided that article VII (1) of the New York Convention equally applies to arbitration agreements[228].

The analogy drawn between the arbitration agreement and the arbitration award for the application of the most favorable law principle is sensible in the sense that its utilization serves the overarching goal of the Convention, which is removing obstacles that may negatively affect international arbitration. The approach adopted by the French supreme court[229] is thereby logical and appropriate. If such an analogy is drawn, the form requirements imposed upon by Article II of the New York Convention may be mitigated should the courts of the State where enforcement is sought interpret the Convention strictly, and domestic law of the enforcement State or the law applicable by virtue of the enforcement State's conflict of law rules allows for less stringent criteria.

Now that we have discussed potential obstacles that may present themselves during the conclusion of the arbitration agreement via technological means and how to overcome them, we will now discuss how such obstacles may present themselves during the recognition and enforcement stage of an arbitral award and how to overcome such obstacles.

To summarize, the New York Convention requires parties to sign arbitration agreements but does not explicitly define a valid signature. To assess electronic signatures' validity, various international commerce tools and legislative bodies, such as the ECC, MLEC, and Electronic Signature Directive, support the principles of "technological neutrality" and "functional equivalency," aiming to equalize electronic counterparts of "signatures" and "writing" with their traditional definitions. This trend advocates for a broader interpretation of the Convention's requirements, which should encompass contemporary technologies like blockchain.

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[228] Cour de Cassation, XXXII Y.B. Com. Arb. 290, 292 et seq. (2007)

[229] Although it is not factually accurate to refer to the Court de Cassation as a supreme court, for purposes of simplification it is referred as a supreme court in numerous sources, including the present thesis.

However, national courts may apply a strict interpretation of the Convention's provisions. In such cases, the Convention allows for the application of a "more favorable law" to alleviate its form requirements. The French Cour de Cassation drew an analogy between the arbitration agreement and the arbitration award for the application of the most favorable law principle, serving the Convention's overarching goal of removing obstacles that may negatively affect international arbitration.

This analysis is relevant to the topic of blockchain arbitration because it emphasizes the need for a flexible interpretation of the New York Convention's requirements in the digital age. Blockchain technology introduces new methods of conducting the arbitration and offers numerous advantages like increased efficiency, security, transparency, and cost-effectiveness. However, it presents unique challenges in adapting traditional legal frameworks to accommodate these new dispute resolution methods.

Embracing the principles of technological neutrality and functional equivalency within the context of the New York Convention is crucial for addressing the challenges posed by blockchain arbitration. Adopting a flexible interpretation of the Convention's requirements can better accommodate blockchain technology's unique features. This includes recognizing electronic signatures and documents, adapting to the decentralized nature of blockchain networks, and accommodating the use of smart contracts as arbitration agreements. Ensuring that legal frameworks promote harmonization and uniformity in enforcing arbitration awards arising from blockchain disputes is essential, possibly involving the development of new international standards, guidelines, or model laws specifically addressing blockchain arbitration or, as we will examine in the upcoming sections, a complete bypass of the current frameworks in favor of a distinct arbitral legal order anchored in *lex cryptographia*.

D-) Recognition and Enforcement of Digital Arbitral Awards

When arbitration occurs online, either through traditional ODR mechanisms or through blockchain-based arbitration, several inherent and fundamental concerns come to life that could jeopardize the final award's enforceability under the rules of the New York Convention[230]. As

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[230] Schellekens, M.H.M. "Online Arbitration and E-Commerce." Electronic Communication Law Review 9 (2002): 113.

previously discussed, the first concern stems from the arbitration agreement itself[231] and whether the current legislative instruments and the conditions they impose for the validity of an arbitration agreement could coincide with novel technologies that are changing the arbitral landscape[232].

The second concern relates to the eventual award that forms perhaps the most fundamental aspect of an arbitral process[233]. As we have previously discussed, the New York Convention was adopted "at a time when the drafters could not have predicted that [both arbitration agreements and arbitral awards] could take other than a physical form[234]". As such, the courts have discretionary power in determining whether an arbitral award satisfies the formal conditions that the New York Convention imposes when it comes to the recognition and enforcement of an award.

In the years and decades that followed the enactment of the New York Convention, the framework of international arbitration consistently proved itself to be rather adaptable, and it recognized the majority of recent developments in the domain of long-distance information and communication technologies[235]. The consensus is that an arbitral award is functionally equivalent to a judgment rendered by a court of law[236], and the award rendered at the end of an arbitral process bestows the parties with an enforceable decision. However, an arbitral tribunal does not possess the power of coercion that state courts do. As such, the award must first be recognized by the court where enforcement is sought, and if the court does recognize it, it can give effect to the award and force parties (or third parties) to uphold the award's impositions.

In the case of domestic arbitral awards, the form requirements are determined by the *lex arbitri,* and although some laws are restrictive in the sense that they impose upon the parties the

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[231] Hong-lin Yu, Qi Wang, and Meng Yu. "Can Online Arbitration Exist within the Traditional Arbitration Framework?" Journal of International Arbitration 20, no. 5 (2003): 455-478.

[232] Alejandro López Ortiz, "Arbitration and IT" (2005) 21:3 Arbitration International 353.

[233] Paul D. Carrington, "Virtual Arbitration" (2000) 15 Ohio State Journal on Dispute Resolution 673.

[234] United Nations Conference on Trade and Development, Dispute Settlement: International Commercial Arbitration,Electronic Arbitration (2003) UNCTAD/EDM/Misc.232/Add.20, pp.3–55.

[235] E.g., European Convention on International Commercial Arbitration of 1961 recognized teleprinter and Inter-American Convention on International Commercial Arbitration of 1975 recognized the telex

[236] USLEGAL : Arbitral Award Law and Legal Definition

form requirements, such as the necessity of the arbitrators' signature on the award[237] other laws such as the English Arbitration Act[238] adopt a relatively liberal approach in regard to the form requirements for arbitral awards. The liberal approach entails that under these laws, digital awards raise no issues of form if the award complies with the relevant requirements set out by the parties[239]. Nevertheless, suppose the parties fail to provide for digital awards in their agreement. In that case, these arbitration laws are subject to the same interpretation issues as other laws, and regardless of whether the *lex arbitri* allows parties to determine the validity of e-arbitral awards, nearly all the arbitration laws demand that the award be in written form and signed by at least one person.

Whether digital awards meet the standards set forth is a whole different question. Certain jurisdictions answer that e-awards meet the requirements to be recognized and subsequently enforced. The response is either directly in the *lex arbitri's* arbitration statute or in the general form guidelines provided by the courts of the state where enforcement is sought. For example, the US Uniform Arbitration Act of 2000 necessitates that an award "must be signed or otherwise authenticated by any arbitrator[240]". The provisions' use of the terms otherwise authenticated is deliberate and addresses the E-SIGN Act, where it is stipulated that the signature requirement on an arbitral award can be satisfied via an electronic signature[241]. In a similar vein, the German legislature on delivery of the award to the parties was amended in 2005 to permit for electronic transmission of awards[242], the implication being that the award can be in digital form, such as an electronic document.

We can also find provisions to the same effect in the UNCITRAL Model Law. In fact, articles 6 and 7 facilitate the interchange of written form by data messages and signatures by

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[237] Article 1480(2) of the French Code of Civil Procedure.

[238] Section 52(1) of the English Arbitration Act 1996 ; also, Article 189(1) of the Swiss Private International Law Act.

[239] Ihab Amro, "Enforcement of Cross-Border Online Arbitral Awards" (2 November 2016).

[240] Section 19(a)(1) of the US Uniform Arbitration Act 2000.

[241] 15 U.S.C. § 7001, § 7006(5) of the E-SIGN Act 2000.

[242] Government bill, BT-Drucks. 15/4067, p. 36.

electronic signatures[243]. The law that determines whether electronic awards are recognizable and enforceable equally determines their form requirements. German law, for example, necessitates a qualified signature[244] , whereas, for US law, the simple apposition of the arbitrators' name on the award is enough for its form requirements[245].

The situation is somewhat similar to a foreign electronic arbitral agreement except that the legal regime is that of the New York Convention rather than the law of the *lex arbitri.* As we have previously discussed, the form requirements imposed by the New York Convention can be alleviated with a liberal reading of the Conventions articles, and the approach adopted by courts in this regard supports an arbitration-friendly system where courts seek to remove obstacles that may lead to the setting aside of an award because of form-related issues. We have equally examined instruments such as the Electronic Communications Convention and determined that an analogy can be drawn between the stipulations contained in the ECC and the form requirements imposed by the New York Convention.

However, the situation differs regarding arbitral awards. The ECC does not apply to arbitral awards because of its narrow scope of application[246] , which is limited to "*electronic communications in connection with the formation or performance of a contract*" as per article 1(1) of the ECC and the New York Convention does not set out explicit requirements of form for arbitral awards. In order to understand whether a technological approach to an award could be a potential ground for denying its recognition and enforcement, we must first comprehend what the notion of "arbitral award" entails under the New York Convention.

Since it is not precisely defined by the autonomous law of the New York Convention, we must examine different viewpoints to reach a conclusion. Three different views can be discerned. The first view argues that the New York Convention adopts an *in abstracto* definition of an arbitral

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[243] UNCITRAL Model Law on International Commercial Arbitration,1985, With amendments as adopted in 2006.

[244] Section 126a (1) of the German Civil Code.

[245] National Conference of Commissioners on Uniform State Laws, Uniform Electronic Transactions Act (1999), section 2, comment 7.

[246] Note by the Secretariat, A/CN.9/WG.II/WP.132, para. 9.

award whereby the definition is autonomous. The second view estimates that the *lex arbitri* or the *lex fori* governs the boundaries of this notion, and the third view argues for a combination or cumulation of said axioms[247].

The third approach seems to be the one that is most in line with the overarching purpose of the Convention, which is to remove obstacles to the recognition and enforcement of foreign arbitral awards[248]. This perspective builds on New York Convention's article VII (1) 's recognition-friendly, minimum-standard paradigm. It coincides with the Convention's autonomous standard, particularly regarding form requirements.

As is the case today, national legislation on arbitral awards and the form requirements varied when the New York Convention was redacted. It would be illogical to presume that the Convention would reject entire clusters of arbitral awards that met all their applicable seats form requirements. If this were the case, none of the States that were pro-arbitration and pro-recognition and enforcement would have ratified the New York Convention to begin with, as it would mean a systematic rejection of arbitral awards rendered under its law from being recognized and enforced in other jurisdictions.

As discussed previously, the commentaries and interpretations of the New York Convention have demonstrated that the Convention is not rigid in its terms and is open to being interpreted to include novel technologies[249]. Additionally, the generally acknowledged standard for form requirements has broadened to include digital awards as well. To assume that the New York Convention would remain apathetic or outright reject these changes would contrast both the Convention's inherent ideology and the standards recognized by other international instruments such as UNCITRAL's Model Law.

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[247] New York Convention on the Recognition and Enforcement of Foreign Arbitral Awards of 10 June 1958: Article-by-Article Commentary (2nd Ed.) / R. Wolff ed., Beck, Hart and Nomos, 2nd edition, 2019.

[248] Herbert Kronke, Patricia Nacimiento, and Dirk Otto, Recognition and Enforcement of Foreign Arbitral Awards: A Global Commentary on the New York Convention (Kluwer Law International BV, 2010).

[249] M. Maleki and A. Shiravi, "The Attitude of New York Convention on Recognition and Enforcement of Electronic Online Arbitrations (the Comparative Study Electronic Commercial of Iran and the Law of Member States of Convention)" (2021) 7:2 Journal of Comparative Law 159-180.

An electronic arbitral awards recognition and enforcement may, apart from form requirements, be threatened by its delivery method to parties and its submission to court under article V (1) of the New York Convention.

Although the Convention itself is silent on the delivery of the award to parties, the delivery of the award to the parties is generally considered to be a fundamental aspect for the existence of the awards' binding effect on the parties[250]; it is the crown jewel of an arbitral process. As such, a non-delivery or the lack of a proper delivery under the rules of the *lex arbitri* can be a reason to deny recognition and enforcement of the award pursuant to article V(1)(e) of the New York Convention.

Submission of an arbitral award to the court is the last and concluding part of an arbitral process[251]. The New York Convention stipulates that "The duly authenticated original award or a duly certified copy thereof[252]" needs to be submitted to court for it to be recognized and subsequently enforced. The application of this article is nevertheless dependent on whether the party seeking recognition and enforcement can rely on a national law that offers a greater possibility of recognition, such as the Model Law[253] or its derivatives.

Again, we are confronted with the notion of "original", and again in the context of article IV(1)(a), this notion needs to be interpreted in accordance with the definition contained in the Electronic Communications Convention[254] or the definition contained in the EC-ML since arbitral awards fall outside of the Electronic Communications Convention's scope of application[255].

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[250] J. Hope, "Awards: Form, Content, Effect" (8 June 2021), online: Advokatfirman Vinge KB.

[251] Nigel Andrews, "Enforcement under the New York Convention (1958)" in Andrews on Civil Processes: Arbitration and Mediation (Toronto: Thomson Reuters, 2013) at 377-394.

[252] Article IV(1)(a) NYC.

[253] Article 35(2)(1) ICA-ML 2006.

[254] Article 9(4) ECC.

[255] M.S.A. Wahab, "Online Arbitration: Tradition Conceptions and Innovative Trends" in Albert Jan van den Berg (ed.), International Arbitration: The Coming of a New Age?, ICCA Congress Series, vol. XVII (Alphen aan den Rijn: Kluwer Law International, 2013) 654, 660.

"Authentication" is not part of the New York Convention's autonomous law, and as such, it is governed by the *lex arbitri* or the *lex fori*[256] therefore, an inspection of the national laws is required to determine the form of an electronic arbitral awards submission to court[257].

Authentication and certification of electronic arbitral awards may facilitate their recognition and enforcement in those jurisdictions where a strict interpretation of the New York Convention is adopted. For example, the e-Apostille Pilot Program, which is traditionally used to authenticate international notarized documents, can be a platform that eases the cross-border recognition of international electronic awards[258]. This platform came into existence in 2006 and has the goal of issuing and certifying apostilles, and in theory, it can be used as a method of authenticating electronic arbitral awards.

As we reach the final part of this chapter on the validity of electronic arbitration agreements and the recognition and enforcement of electronic arbitral awards, it is safe to conclude that digital arbitration agreements and digital arbitral awards appear appealing for international arbitration because they offer to substitute antiquated hard copy communication of information with fast and straightforward alternatives. It would, however, be unwise to believe that this digitalization is without its drawbacks. Rapidity, simplicity, and convenience may be beneficial; however, these positive aspects must be balanced against the risk that these electronic instruments will not be legally recognized, thereby failing to achieve their goals.

As discussed, both in the case of an electronic arbitration agreement and in the case of an electronic arbitral award, the provisions of the New York Convention necessitate a reading that is in conjunction with the provisions of national laws and international instruments aimed at harmonizing international commerce. This is further evidenced by the fact that the New York Convention often invokes the *lex arbitri* in its own autonomous law and from the fact that the commentaries made on the Convention often invoke international instruments such as the Model

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[256] Katharina Plavec, "The Law Applicable to the Interpretation of Arbitration Agreements Revisited" (2020) 4 University of Vienna Law Review 82-127.

[257] Horn, "Public Policy" (note 58) at 112 (in favour of an extensive functional (autonomous?) understanding of authentication under Article IV(1)(a) NYC).

[258] See www.uihj.com/en/e-apostille-first-regional-seminar-in-helsinki-finland-1019842.html

Law on Electronic Commerce, the Electronic Communications Convention and the UNCITRAL Model Law on International Commercial Arbitration.

Unfortunately, relative to these instruments that aid in reflecting upon the New York Convention's provisions, the acceptance rate of the New York Convention itself is far superior; consequently, a strict interpretation of its provisions by the courts is nevertheless possible. The analysis contained in this thesis estimates that the risk for denial of recognition and enforcement is higher for electronic arbitral awards relative to electronic arbitration agreements.

However, a hybrid solution that finalizes an electronic arbitration process with a physical arbitral award might be achievable. In any case, an arbitral tribunal is incentivized to render an award that is recognizable and enforceable. As such, a tribunal would refrain from rendering an electronic award if the court where parties will seek recognition and enforcement interprets the New York Convention strictly.

Considering these aspects, the optimal solution would be to enact a treaty-based standard for the recognition and enforcement of electronic arbitral awards. The redaction of such a harmonizing international instrument would likely fall on arbitral institutions or the UNCITRAL. This Convention, in order to be effective, would need to provide for the requirements for electronic signatures and details governing the recognition and enforcement of electronic awards.

To summarize, the focal point of this section is to discuss whether the current legislative framework, including the New York Convention, can accommodate the emerging technologies that are transforming arbitration, the adaptability of the international arbitration framework, and how it has recognized developments in long-distance information and communication technologies. We equally examined how the lack of explicit requirements for electronic arbitral awards creates uncertainty and potential risks for non-recognition and non-enforcement. The need for a treaty-based standard for the recognition and enforcement of electronic arbitral awards is suggested, with a focus on providing requirements for electronic signatures and governing the recognition and enforcement process.

In conclusion, the section emphasizes that while digital arbitration agreements and digital arbitral awards offer advantages such as speed and simplicity, they must be balanced against the

risk of not being legally recognized. It suggests a hybrid solution that combines electronic arbitration processes with physical arbitral awards and calls for the development of an international instrument to harmonize the recognition and enforcement of electronic arbitral awards.

The discussion about ODR and the current legislative frameworks' capacity to adapt to blockchain arbitration is necessary to understand blockchain arbitration and its future because it highlights the interplay between emerging technologies and existing legal structures. As blockchain technology transforms arbitration by providing decentralized, transparent, and secure mechanisms, it raises crucial questions about the enforceability and recognition of digital agreements and awards. By analyzing the adaptability of international arbitration frameworks, such as the New York Convention, and identifying potential gaps and risks, we can better comprehend the challenges and opportunities blockchain arbitration presents. Furthermore, this discussion can guide the development of harmonized international standards and the adoption of best practices that ensure the legal recognition and enforceability of blockchain-based arbitration outcomes, ultimately fostering the growth and widespread acceptance of this innovative approach to dispute resolution.

As we conclude the second title of our thesis and move on to our third title where we will discuss blockchain-based arbitration and the future of the arbitral landscape as justice becomes decentralized, a recapitulation of the main ideas and themes of the present title is required. Under this title, we have examined the implications of Online Dispute Resolution (ODR) and blockchain technologies for the future of international arbitration. We explored how ODR, initially designed for resolving virtual market conflicts, has expanded to real-world disputes due to technological advancements and the Covid-19 pandemic. The thesis also looks into the challenges faced by technology-driven ODR systems, such as establishing trust and expertise while addressing security concerns. Despite these challenges, ODR systems have shown success in resolving disputes more efficiently and cost-effectively by leveraging digital signatures and the expertise of neutrals.

The thesis then delves into the adaptability of the international arbitration framework, with a focus on the New York Convention, to accommodate the emerging technologies transforming arbitration. It discusses the lack of explicit requirements for electronic arbitral

awards and how this creates uncertainty and potential risks for non-recognition and non-enforcement. The thesis proposes a treaty-based standard for the recognition and enforcement of electronic arbitral awards, suggesting a hybrid solution that combines electronic arbitration processes with physical arbitral awards.

By analyzing the interplay between emerging technologies like blockchain and existing legal structures, the thesis highlights the challenges and opportunities blockchain arbitration presents. It emphasizes the need for harmonized international standards and best practices to ensure the legal recognition and enforceability of blockchain-based arbitration outcomes. In conclusion, the thesis underscores the importance of understanding the relationship between ODR, current legislative frameworks, and blockchain arbitration to foster the growth and widespread acceptance of innovative approaches to dispute resolution.

As the thesis transitions into the next chapter, titled "Blockchain Technologies & International Arbitration," it will further investigate the role of blockchain technology in transforming arbitration. This chapter will analyze how blockchain technology can offer decentralized, transparent, and secure mechanisms for dispute resolution, as well as how it may interact with the existing legal frameworks, such as the New York Convention, to ensure the enforceability and recognition of digital agreements and awards.

TITLE III: Blockchain Technologies & International Arbitration

"All advances in technologies, such as the internet, are followed by periods of instability and resistance from the institutions and individuals who feel threatened by the advances. However, in addition to affording opportunities to divide and destroy, such advances also unleash opportunities for improving communication and knowledge. At this moment, the virtual world of the internet is at a crossroads[259]".

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[259] Robert C. Bordone, "Electronic Online Dispute Resolution: A systems Approach-Potential, Problems, and a Proposal" (1998) 3 Harv. Negotiation L. Rev. 175 at 189.

Although Professor Bordone expressed these words about the internet over twenty years ago, they are still quite relevant when it comes to blockchain technologies. Blockchain technologies promise to disrupt the traditional landscape and offer new opportunities for an innumerable number of industries[260] such as business, education, health, information and communication, finance, and, most notably, for the purposes of the present thesis, the legal field, specifically, international arbitration.

Before we move on to blockchain technologies use in arbitration, we have to answer the following questions: What is blockchain? How does it function? What does it promise to achieve? Furthermore, what is the compatibility of arbitration with blockchain technologies?

To answer these questions, we will commence by introducing the overarching technology behind blockchain, distributed ledger technology, and Blockchain technologies' technical aspects **(A)**. Afterward, we will discuss the inherent synergy of arbitration and blockchain **(B)**, eventually leading us to scrutinize the future of international arbitration in our last title.

A-) Distributed Ledger Technology and the Blockchain

In order to understand the utility of blockchain in dispute resolution and particularly in arbitration, it is essential to grasp how the technology functions and what it achieves. As such, in this title, we will delve into the technical aspects of distributed ledger and blockchain technologies.

DLT (Distributed Ledger Technology) is one of the most significant advancements in the world of information technologies, with the potential to revolutionize the economy, society, and industry's organization and cooperation[261]. One of the most prominent use cases of DLTs are cryptocurrencies and the first cryptographic currency was presented in a white paper[262] in 2008 titled "Bitcoin: A Peer-to-Peer Electronic Cash System" which was written by a person (or

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[260] Gianluca Salviotti, Leonardo Maria De Rossi, and Nico Abbatemarco, "A structured framework to assess the business application landscape of blockchain technologies" in Proceedings of the 51st Hawaii International Conference on System Sciences (2018).

[261] Maull, R., Godsiff, P., Mulligan, C., Brown, A., & Kewell, B. (2017). The future of money and further applications of the blockchain. Journal of Financial Services Marketing, 26(5), 481-489.

[262] A white paper is a report or guide that informs readers concisely about a complex issue and presents the issuing body's philosophy on the matter. It is meant to help readers understand an issue, solve a problem or make a decision.

persons) under the pseudonym Satoshi Nakamoto[263]. Today, cryptocurrencies, non-fungible tokens (NFTs), and other major blockchain-based systems make DLT a highly discussed and "hyped" topic in research, academia, and application[264]. However, a distinction must be made between blockchain and DLT. It is common among professionals to distinguish between DLT and blockchain by stating that "all blockchains are DLT, but not all DLT are blockchains". The reason is that while blockchain is a form of distributed ledger technology, it is not the only form of DLT there is. DLT is essentially a database used for the storage, distribution, and exchange of data between users over private or public distributed computer networks[265] that can be created and spread over multiple locations; hence the designation "distributed". Each of these distributed databases may be managed by several individuals, making tampering with the data extremely complex to achieve and even more challenging to conceal[266].

On the other hand, with blockchains, we are still in the presence of a database; the critical difference is that the data contained in a blockchain is registered in a series of blocks. Each respective block contains a finite amount of data. As one block's data storage capacity is depleted, another block is created and linked to the previous block, hence the name "blockchain".
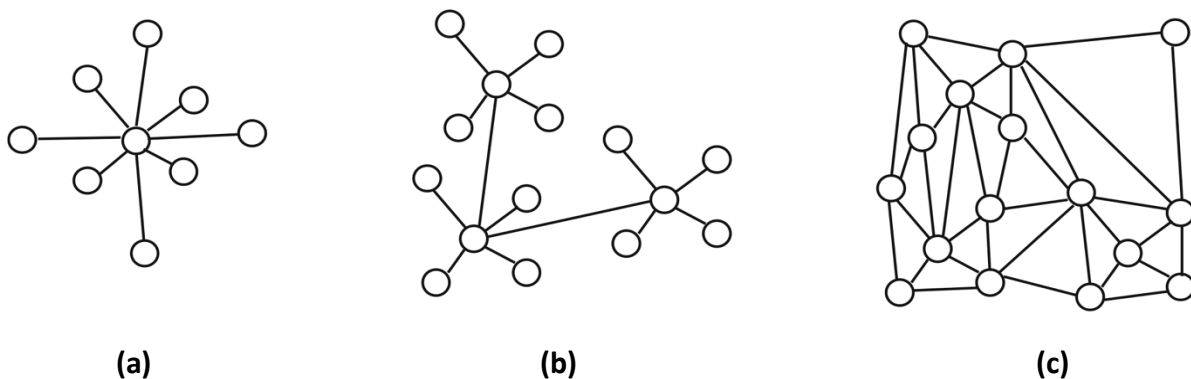
| (a) | (b) | (c) |

[263] S. Nakamoto, Bitcoin: A peer-to-peer electronic cash system (2008), [Online]. Available: https://bitcoin.org/bitcoin.pdf

[264] Zutshi, Aneesh, Antonio Grilo, and Tahereh Nodehi. "The value proposition of blockchain technologies and its impact on Digital Platforms." (2021) 155 Computers & Industrial Engineering 107187.

[265] Chakrabarty, K., Nassif, S., & Farshad, F. "8.1 Introduction to Distributed Ledger Technology and IoT 8.1.1 What is Distributed Ledger?" In Intelligent internet of things: From device to fog and cloud. Springer, 2020.

[266] Natarajan, Harish; Krause, Solvej; Gradstein, Helen. "Distributed Ledger Technology and Blockchain." FinTech Note;No. 1. World Bank, Washington, DC, 2017. https://openknowledge.worldbank.org/handle/10986/29053 License: CC BY 3.0 IGO.

The figures above are helpful in visualizing different systems; figure (a) is a centralized system, figure (b) is a decentralized system, and figure (c) is a distributed system. Blockchain can be thought of as a method of implementing a distributed ledger and is considered to be a decentralized system[267].

Now that we made the distinction between DLT and Blockchain technology, we can delve into the technical aspects of blockchain where we will examine the inner workings of the technology, which will lead us to consider its application for ODR and, more precisely, blockchain-based arbitration.

i-) Blockchain: Technical Aspects

New technologies are notorious when it comes to pressuring the status quo of legal systems and society[268]. Perhaps one of the most significant of these technologies since the advent of the internet is blockchain technology which is considered to be one of the most disruptive technologies in decades[269] on par with generative artificial intelligence models such as ChatGPT[270]. Blockchain was hailed by tech enthusiasts as being a "crucial tool for protecting and serving humanity[271]" and as a technology "at the same level as the World Wide Web in terms of importance[272]". The technology promises to function as a "new and relatively perfected system for value objectification[273]" and change the existing patterns of behavior and revolutionize the usage,

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[267] Blockchain Technology and Its Applications in FinTech: Second International Conference, ISDDC 2018, Vancouver, BC, Canada, November 28–30, 2018.

[268] Leppan Craig. "Who Is Blockchain Going to Affect the Most." Tech Crunch, 2015.

[269] Newman, Daniel. "What is Blockchain? The Most Disruptive Tech in Decades." Computerworld, 2018, p.2.

[270] ChatGPT is an advanced AI language model developed by OpenAI, based on the GPT-4 architecture, designed to generate human-like text responses in natural language conversations. It leverages cutting-edge machine learning techniques to understand and generate contextually relevant and coherent responses, making it a powerful tool for various applications, including content generation, problem-solving, and conversational assistance.

[271] Tapscott, D. and A. Tapscott. Blockchain Revolution. Penguin Business, 2016 and updated 2019, p. 52.

[272] Mougaya, William. The Business Blockchain: Promise, Practice and Application of the Next Internet Technology. Wiley, 2016, pp. xix, xxi.

[273] De Charentenay, Simon. "Blockchain et Droit: Code is deeply Law." Blockchain France, 2017. https://blockchainfrance.net/2017/09/19/blockchain-et-droit/.

transmission, and conservation of data. The creators of blockchain envisioned a future where users would be free from the monopolistic powers of centralized institutions such as states, financial intermediaries, and banks[274].

There are, of course, those who estimate that the "blockchain hype" is a bubble and that the technology is not as revolutionary as promoted[275]. The arguments against blockchain technologies generally revolve around the concepts of block tampering, privacy[276], power consumption, performance, and scalability issues. We will briefly address these arguments against blockchain in the upcoming sections as a preliminary understanding of the technology is required to comprehend the merits of the criticism of blockchain as a technology;

A portion of the legal community's tech-savvy members welcomed blockchain as a force accelerating the "structural shift of power from legal rules and regulation administered by government authorities to code-based rules and protocols governed by decentralized blockchain-based networks[277]" and the emergence of the fabled *Lex Cryptographia*[278] with the possibility to fundamentally mutate the "existing distribution of social and economic power[279]".

Essentially, blockchain is an accounting ledger that maintains an ever-expanding list of transactions amongst its users[280]. This solves the problem of double spending[281] without

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[274] Vergne, J.P. "Decentralized vs. Distributed Organization: Blockchain, Machine Learning and the Future of the Digital Platform." University College London, November 26, 2020.

[275] Elhalal, Anat. "'Everyone's Talking about Blockchain'." Digital Catapult Centre, 2015. www.digitalcatapultcentre.org.uk/everyones-talking-about-blockchain/.

[276] What is the impact of blockchains on privacy?' Jenni Tennison (2015) http://theodi.org/blog/impact-ofblockchains-on-privacy

[277] De Filippi, Primavera and Aaron Wright. Blockchain and the Law. Harvard University Press, 2018, p. 7.

[278] Wright, Aaron and Primavera De Filippi. "Decentralized Blockchain Technology and the Rise of Lex Cryptographia." 2015.

[279] Yeung, Karen. "Regulation by Blockchain: The Emerging Battle for Supremacy between the Code of Law and Code as Law." Modern Law Review, vol. 82, 2019, pp. 207-236, p. 208.

[280] D'Alliessi, Michele. "How Does the Blockchain Work?" 2016.

[281] Double-spending is a potential flaw in a digital cash scheme in which the same single digital token can be spent more than once. Unlike physical cash, a digital token consists of a digital file that can be duplicated or falsified. As with counterfeit money, such double-spending leads to inflation by creating a new amount of copied currency that did not previously exist. This devalues the currency relative to other monetary units or goods and diminishes user trust as well as the circulation and retention of the

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necessarily requiring a trusted third party; therefore, it is considered to be a trustless system[282]. Although Bitcoin is one of the first notable examples of blockchain's use, as of January 2021, there are over 7.800 different cryptocurrencies[283] and a wide range of use cases for blockchain technology, one of which is blockchain-based arbitration. The peer-to-peer nature of blockchain, with its use of cryptographic encryption and distributed data storage combined with decentralized consensus mechanisms, allows users to reach an agreement on a wide range of issues and record it in a verifiable and highly secure manner[284] that borders on being impossible to tamper with except for the case of a 51% attack[285].

To understand the underlying principles that make this system highly secure, we must first do a preliminary analysis of the concept of a "block". A block can be understood as a link in a chain or structure where data is permanently recorded.[286] The connection between these blocks is called a hash function which can be understood as a digital fingerprint that identifies and connects different blocks together[287]. The use of hash functions helps to explain the encryption of transactions and the process of block creation in the blockchain[288]. Any change in the original chain would create a new hash; thereby, the hash function is a cryptographic tool that anonymizes

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currency. Fundamental cryptographic techniques to prevent double-spending, while preserving anonymity in a transaction, are blind signatures and, particularly in offline systems, secret splitting.

[282] De Filippi, Primavera, Morshed Mannan, and Wessel Reijers. "Blockchain as a Confidence Machine: The Problem of Trust & Challenges of Governance." Technology in Society, vol. 62, 2020, p. 101319.

[283] Prasanna, G. "Cryptocurrency – The Next Big Thing." Recent Trends in Management and Commerce, vol. 3, no. 1, 2022.

[284] Wright, Aaron, and Primavera De Filippi. "Decentralized Blockchain Technology and the Rise of Lex Cryptographia." 2015, p. 5.

[285] A 51% attack on a blockchain refers to a malicious scenario in which an individual or group of miners gain control of more than 50% of a blockchain network's hashing power, enabling them to manipulate and compromise the system. With this level of control, the attackers can double-spend coins, prevent new transactions from being confirmed, and halt the mining of valid blocks. This undermines the decentralized and trustless nature of blockchain technology, making it susceptible to fraud and posing a significant threat to the security and stability of the affected cryptocurrency network.

[286] Antonopoulos, Andreas M. Mastering Bitcoin, 2015, p. 23.

[287] Di Pierro, M. "What Is the Blockchain?". Computing in Science & Engineering, vol. 19, no. 5, 2017, pp. 92-95.

[288] The Business Lawyer. Vol. 73, No. 1, 2017-2018, pp. 109-152. https://www.jstor.org/stable/e26419187

the information in a blockchain transaction[289]. Any block that is added to the chain passes through a validation called a consensus protocol and subsequently acquires a hash the mined block incorporates the hash of the previous block, which incorporates the hash of the previous block, thus making it possible to go back to the original block which is called a genesis block[290].

Although an interesting subject to examine, the underlying mathematical principles of a hash function are beyond the scope of the present thesis, and as such, it can be summarized as a cryptographic mathematical function that transforms a variable number of characters into a string with a fixed number of characters[291].

The security of blockchain transactions is only one aspect of the benefits offered by the technology; in fact, the "blockchain bundle[292]", which refers to the main advantages of blockchain, is composed of five elements: consensus, validity, uniqueness, immutability, and authenticity[293]. The decentralized network will inevitably lead to mistrust among users. In order to ensure trustworthiness, network systems will negotiate through the relevant protocols to reach an agreement, thus ensuring consistency. This is the so-called consensus mechanism[294]. It allows for a system in which the parties can be sure that the facts of the transaction are both visible and identical to all parties. When a consensus is reached between the parties, the nodes on the network validate the transaction and add it to the blockchain. The people who own the computers on the network are incentivized to verify these transactions with rewards (usually in the form of cryptocurrencies), this process is known as "proof of Work" in the Bitcoin blockchain, but other

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[289] Agencia española de protección de datos (AEPD), and the European Data Protection Supervisor (EDPS). Introduction to the Hash Function as a Personal Data Pseudonymization Technique, 2019.

[290] Wright, A., & De Filippi, P. (2015). Decentralized Blockchain Technology and The Rise of Lex Cryptographia, 5.

[291] Georgios Dimitropoulos, (2020), The Law of Blockchain 95 Wash L Rev 1117.

[292] Brown, R. G. (2016). Introducing R3 Corda: A Distributed Ledger Designed for Financial Services. R3 Blog. Retrieved from https://www.r3.com/wp-content/uploads/2016/04/Corda-Whitepaper-April2016.pdf

[293] Marks, Jesse. "Distributed Ledger Technologies and Corruption the Killer App." Columbia Science and Technology Law Review 20, no. 1 (2018): 42.

[294] Zhang, C., Wu, C., & Wang, X. (2020). Overview of blockchain consensus mechanism. In Proceedings of the 2020 2nd International Conference on Big Data Engineering (pp. 7-12).

consensus mechanisms exist, such as "proof of stake" which was introduced on the Ethereum 2.0 blockchain[295].

Proof of work is a system that requires the processing power of a computer; the "miners" generate a proof of work in a process with little chance of success, so trial and error is required for a valid proof of work to be generated. This system also makes the blockchain "immutable". Transaction records are kept in multiple locations and are validated by a consensus mechanism making the data essentially unalterable[296]. This system of implementing anonymous user transactions on a decentralized database with a consensus-based validation mechanism eliminates intermediaries and replaces trust in them with trust in the digital decentralized cryptographic system; thus, a "trustless trust" is obtained through peer-to-peer interaction[297].

Although an understanding of blockchain technologies' technical aspects is useful, an abundant[298] and laborious[299] amount of literature already exists. As such, extensive contemplations about fundamental blockchain concepts such as immutability, decentralization, hashing, and mining are both exhausting and outside of the scope of the present thesis[300].

However, before we move on to examine another application of blockchain technologies that deserve our attention, we will explore some of the arguments made against blockchain technologies.

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[295] Nguyen, C.T., Hoang, D.T., Nguyen, D.N., Niyato, D., Nguyen, H.T., and Dutkiewicz, E. (2019). Proof-of-Stake Consensus Mechanisms for Future Blockchain Networks: Fundamentals, Applications and Opportunities. IEEE Access, 7, 85.727-85.745.

[296] Duranti, Luciana and Rogers, Corinne. "Trust in Digital Records: An Increasingly Cloudy Legal Area." Computer Law and Security Review, vol. 28, no. 5, 2012, pp. 521-525.

[297] Werbach, K. (2018). Trust But Verify: Why the Blockchain Needs the Law. Berkeley Tech. L.J. 489.

[298] Fulmer, Nathan. "Exploring the Legal Issues of Blockchain Applications." Akron Law Review 52 (2018): 161-171.

[299] Wulf A. Kaal & Craig Calcaterra, "Crypto Transaction Dispute Resolution," 73 Bus. L. 109 (2017) 144-125.

[300] What is Blockchain?, LISK ACADEMY https://lisk.com/learn/undefined/what-is-a-blockchain

As previously mentioned, blockchain is perceived as being a revolutionary tool that will liberate individuals by eliminating the need for intermediaries, be it banks, states, or other systems of governance. Nevertheless, there are arguments that are directed at the technology, which negatively affects its widespread adoption. The main arguments we will examine revolve around the issues of block tampering, privacy, power consumption, and scalability.

a- Block tampering

According to the original paper by bitcoin's creator, Satoshi Nakamoto, "As long as a majority of CPU power is controlled by nodes that are not cooperating to attack the network, they will generate the longest chain and outpace attackers[301]." As we will examine in detail in the upcoming sections, blockchain is advertised as an unalterable database of information; however, this is not factually accurate. The nodes are devices that take part in a blockchain network (typically a computer). They manage the software that powers the blockchain protocol, enabling it to assist in transaction validation and network security. Blockchain nodes exchange information with one another. The greater the number of nodes in the network, the more decentralized it becomes[302] , and if the majority of the nodes reach a consensus, they are able to modify the blocks in a blockchain, thereby tampering with the data and consequently leading to legitimate security concerns.

b- Privacy

According to the Technology Director of the Open Data Institute, the irreversibility and transparency of blockchains make them unsuitable for personal data[303]." Irreversibility in the context of blockchain means the inability to remove data from the blocks retroactively; this can lead to issues such as the violation of the right to be forgotten and the impossibility to amend data

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[301] S. Nakamoto, Bitcoin: A peer-to-peer electronic cash system (2008), [Online]. Available: https://bitcoin.org/bitcoin.pdf

[302] What Is a Blockchain Node? By Lyle Daly – Jun 9, 2022, https://www.fool.com/investing/stock-market/market-sectors/financials/blockchain-stocks/blockchain-node/

[303] Id at 277

that is outdated. On the other hand, transparency, while being a great asset of blockchain technologies, can equally cause problems regarding privacy. It is not particularly difficult to imagine such a scenario. For example, if a blockchain were found to contain the names and addresses of at-risk children, the majority of nodes would have to reach a consensus in order to remove the data. Alternatively, a court could attempt to order the shutdown of all nodes in the network. Even if we disregard jurisdictional issues, as nodes can be (and most likely would be) located in various legal jurisdictions, such a decision would entail deleting both the order's target and the remainder of the data stored in the blockchain. There is a real risk that, pragmatically, erroneous or threatening data simply must continue to exist in order to prevent major disruptions to the provision of good data for other applications because the use of blockchains that people envision frequently involves the same blockchain holding many different types of data and supporting many different kinds of applications.

c- **Power consumption**

Regardless of the number of miners on the network, blockchains only allow blocks to be added to the chain at regular intervals. On the Bitcoin blockchain, roughly every 10 minutes, and on the Ethereum blockchain, approximately every 15 seconds. The causes are numerous, but the outcome is straightforward: The PoW challenges must be made more complicated when more mining capacity joins the network. In this sense, solving them still requires the same amount of time; it just requires more energy[304]. This energy consumption problem may seem insignificant, but given the current state of the climate crisis and the global consensus about the need to reduce energy consumption, the power consumption argument appears to be an important one[305].

d- **Scalability**

The three important issues affecting scalability in blockchain include limitations, transaction fees, and response time. The limitations are the main problem with blockchain

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[304] Meijer, E. (2022). Blockchain and our planet: why such high energy use?. Retrieved from https://pre-sustainability.com/articles/blockchain-and-our-planet-why-such-high-energy-use/

[305] Sedlmeir, J., Buhl, H. U., Fridgen, G., & Keller, R. (2020). The energy consumption of blockchain technology: beyond myth. Business & Information Systems Engineering: The International Journal of Wirtschaftsinformatik, 62(6), 599-608.

scalability. Each node updates the ledger with information about a new transaction whenever one is processed. As a result, the system as a whole can collapse due to the growing transaction history. In order to maintain high levels of trust, blockchain networks must also preserve all data accurately. Additionally, blockchain encounters problems with hardware constraints. It is challenging to set up and maintain the hardware needed for running nodes as the blockchain network grows.

The second crucial element that poses serious scaling problems for blockchain is the exorbitant transaction costs. Due to the increased demand for additional processing power for mining, the growing popularity of blockchain networks has resulted in more complexity in the procedures for validating transactions. Consequently, in order to validate a transaction, users are forced to pay fees that increase as time goes on.

All transactions on the blockchain network need validation. Generally, given the number of transactions in the queue, transactions must wait for long periods of time for validation. For example, the Bitcoin network implies that creating a new block takes nearly 10 minutes. During peak hours, the wait time for transaction validation increases. As one of the notable factors contributing to the blockchain scalability problem, response time is directly related to high transaction fees. As a result of these factors, the increasing number of transactions and users is unquestionably problematic for blockchain networks and their scalability.

Now that we have seen the main arguments directed against blockchain technologies, another application of blockchain deserves our attention before we can move on to examine the question, "why should the ODR community care about blockchain technologies?". This application is known as "Smart Contracts".

iii-) Smart Contracts

As previously explained, blockchain is a technology that grants users the ability to build applications on it. Even though all blockchains strive to make transactions safer, trusted, and pseudonymized, the intricacy and scope of transactions differ significantly between different

blockchains. For example, the Bitcoin blockchain, which was the first of its kind, is uniquely tailored to accommodate the trade of cryptocurrencies[306] . Although it is possible to accomplish more complex transactions, bitcoin remains a blockchain that deals exclusively with the transference of digital currencies[307]. To this end, other blockchains were developed with the goal of offering a "richer functionality[308]" through the utilization of smart contracts[309]. Although smart contracts became popular with the creation of the Ethereum blockchain, the notion itself traces its roots to the writings of Nick Szabo, who, in 1994, asserted that contracts could be converted into computer code to ensure automatic enforcement[310].

Today the term smart contract is used somewhat ambiguously[311] , and as such, it requires a more explicit definition. A smart contract, in the context of blockchain, is fundamentally a "self-executing digital transaction using decentralized cryptographic mechanisms for enforcement[312]". To put it another way, it is a means of transferring assets based on a series of "if-then" logic statements that cannot be stopped after they have been executed[313]. The usage of the term "contract" remains a discussion point amongst legal scholars; indeed, many experts believe that not all forms of this self-executing code can be considered to be fully-fledged, legally valid contracts[314]. Even though there are certain barriers against the recognition of these codes as valid contracts that are inherent to the blockchain technology itself, it is the opinion of blockchain and smart contract enthusiasts that in the upcoming years and decades, as crypto-economics and commerce over the blockchain become "mainstream", certain smart contracts will inevitably be

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[306] Will Price, Clustering Ethereum Addresses, Towards Data Sci. (Dec. 6, 2018). From https://towardsdatascience.com/clustering-ethereum-addresses-18aeca61919d

[307] Bitcoin Mag. (Oct. 13, 2017). Yes, Bitcoin Can Do Smart Contracts and Particl Demonstrates How, https://www.nasdaq.com/articles/yes-bitcoin-can-do-smart-contracts-and-particl-demonstrates-how-2017-10-13

[308] Wright, A. & De Filippi, P. (2015). Decentralized Blockchain Technology and the Rise of Lex Cryptographia.

[309] Cohney, S., Hoffman, D., Sklaroff, J., & Wishnick, D. (2019). Coin-Operated Capitalism. 119 Colum. L. Rev. 591.

[310] Szabo, N. (1995). Smart Contracts Glossary.

[311] Grimmelmann, J. (2019). All Smart Contracts Are Ambiguous. 2 J.L. Innovation 1, 2.

[312] Werbach, K., & Cornell, N. (2017). Contracts Ex Machina. 67 Duke L.J. 313,327.

[313] Sklaroff, J. M. (2017). Comment, Smart Contracts and the Cost of Inflexibility. 166 U. Pa. L. Rev. 263, 267.

[314] Raskin, M. (2017). The Law and Legality of Smart Contracts. Georgetown Law Technology Review, 1(2), 305-341.

recognized as valid legal contracts throughout various jurisdictions that are opposed to granting legal validity to these contracts today. Nevertheless, this self-executing code is frequently linked to a natural language, a semantic e-document that resembles a conventional contract. Parties read this verbal component and sign it via their anonymous blockchain addresses[315].

Apart from the standard commercial transactional use, smart contracts have many distinct use cases; for example, users can develop websites, exchange cryptocurrencies in return for a crypto monetary compensation, purchase physical commodities, place sports bets, transfer the ownership of assets through the sale of non-fungible tokens (or NFT's as it is more commonly known)[316]. Perhaps the most crucial use case for the purposes of the present thesis is that smart contracts can be constructed as arbitration agreements that automatically direct parties to a blockchain arbitration platform should a dispute arise between them; this process is automated via technology, thereby enhancing the rapidity and ease of the operation of the arbitral proceeding significantly. In fact, a smart arbitration contract could even be construed as a separate contract from the contract governing the relationship of the parties. This way, parties can incorporate the smart arbitration agreement into their traditional written contract via reference, further facilitating the process.

As previously explained, the execution of a smart contract is irrevocable once it has commenced; users do not have the ability to stop the code's conditions from being triggered and the assets from transferring as a result. This aspect of smart contracts is in accordance with the general characteristics of rigidity and immutability of blockchain technology. Simply put, smart contracts eliminate any ex-ante mechanism for changing the outcome by design. The transfer of digital assets is permanently recorded on the blockchain after the transaction is completed. The elimination of the ex-ante mechanism is precisely where blockchain-based dispute resolution comes into play; since it is expensive and difficult for parties to attempt to code for every permutation[317] , parties can instead opt for pre-coding an ex-post check for quality assurance. This

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[315] Wright, A. (2018, October 18). OpenCourt: Legally Enforceable Blockchain-Based Arbitration. [Video file]. Retrieved from YouTube.

[316] Marr, B. (2018, May 14). 30+ Real Examples of Blockchain Technology in Practice. Forbes.

[317] Sklaroff, J. M. (2017). Comment, Smart Contracts and the Cost of Inflexibility. 166 U. Pa. L. Rev. 263, 267.

pre-code serves as a basis for an on-chain dispute resolution. As perhaps the most outspoken advocates for on-chain arbitration, Professors Wulf A. Kaal and Craig Calcaterra argue that this creates "an open-source platform ecosystem of smart-contracting dispute resolution that allows users to opt-in to conflict resolution mechanisms[318]".

To summarize, distributed ledger technology (DLT) and blockchain have the potential to revolutionize industries and society by providing a decentralized, secure, and tamper-proof system for storing and exchanging data. However, there are several arguments against the adoption of blockchain technology, including block tampering, privacy, power consumption, and scalability issues.

Blockchain-based arbitration is a promising use case of blockchain technology. It provides a decentralized, secure, and tamper-proof system for resolving disputes. Smart contracts, which are essentially self-executing digital transactions using decentralized cryptographic mechanisms for enforcement, are an important application of blockchain technology. They can be used for exchanging cryptocurrencies, purchasing physical commodities, and transferring ownership of assets. Smart contracts can also be used as an arbitration agreement that automatically directs parties to a blockchain arbitration platform in case of a dispute.

However, once a smart contract has commenced, it is irrevocable, and its conditions cannot be stopped, which makes on-chain dispute resolution necessary. As blockchain technology continues to evolve and gain widespread adoption, it is vital to address the arguments against it and find solutions to the challenges it faces. Overall, blockchain technology has the potential to significantly transform industries and society by providing a secure and decentralized system for storing and exchanging data. Now that we have briefly introduced blockchain technologies and smart contracts, it is prudent to discuss the inherent synergy of arbitration with Blockchain technologies and the advent of blockchain-based ODR.

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[318] Kaal, W. A., & Calcaterra, C. (2017). Crypto Transaction Dispute Resolution. 73 Bus. Law. 109, 114-25.

B-) The Inherent Synergy of Arbitration and Blockchain

As previously stated, blockchain is a hot topic in the legal world nowadays. The link between the two domains is discussed by legal practitioners and technology enthusiasts, particularly in terms of international commercial arbitration[319]. Although certain scholars are of the opinion that blockchain is not a suitable platform for arbitral proceedings because of reasons such as blockchain being "slow and expensive to store massive volumes of data[320]", as the technology evolves, we perceive clear demonstrations of the synergy between blockchain and arbitration[321]. Even though this synergy is exemplified in a multitude of areas, it is prudent to examine it in the context of cybersecurity, confidentiality, and efficiency.

a-   Cyber security

Although international arbitration is not uniquely vulnerable to data breaches, they are nevertheless being targeted by cyber-attacks that damage the arbitral process. One such attack occurred in 2015 when the website of the Permanent Court of Arbitration in The Hague (PCA) was hacked while a maritime border arbitration between China and the Philippines was in the process. Even when faced with the reality of these attacks, arbitral institutions seem insistent on "relying upon relatively insecure storage and communication systems[322]". Similarly, in Libananco v. the Republic of Turkey[323], Turkey admitted that they have intercepted Libananco's communications with their counsel and third parties. Furthermore, in an unpublished order in Caratube International Oil Co. LLP and Devincci Salah Hourani v. the Republic of Kazakhstan[324],

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[319] Badway, E. E., & Howell, K. L. (2020). Arbitrating in the Cyber World of Cryptocurrency and Blockchain Regimes. 74(4) Disp Resol J 77–88.

[320] Chugh, A. (2018). Why We Don't Need Blockchain to Manage Cases in International Arbitration. Kluwer Arbitration.

[321] Shehata, I. (2018). Three Potential Benefits of Blockchain for Arbitration. 31 YAR 32.

[322] Claire Morel de Westgaver, 'Cybersecurity In International Arbitration – A Necessity And An Opportunity For Arbitral Institutions', Kluwer Arbitration Blog (6 October 2017), online: http://arbitrationblog.kluwerarbitration.com/2017/10/06/cyber-security/

[323] ICSID ARB/06/8

[324] ICSID ARB/13/1

certain documents obtained from the public disclosure of documents hacked from Kazakhstan's government computer network were admitted into evidence by the tribunal[325].

Unfortunately, states are not the only entities that are targeted by such attacks; law firms are equally at the crosshairs of malicious actors[326]. Evidence of this is a study made by the cybersecurity consulting firm LogicForce where it was found that all of the 200 law firms that were surveyed were victims of hacking attempts[327]. As demonstrated in the cases mentioned above, hacking sensitive data may result in the acceptance of illegally obtained or privileged evidence, undermining the integrity and legitimacy of the arbitral process[328]. Furthermore, because the arbitral participants typically reside in different jurisdictions, they will be subject to different data privacy regimes[329]. According to Deloitte, "while still nascent, there is promising innovation in blockchain towards helping enterprises tackle immutable Cyber Risk challenges such as digital identities and maintaining data integrity[330]". As they have no single point of failure due to their decentralized nature, blockchains are operationally quite resilient when it comes to cyber-attacks.

b-   Confidentiality

According to a survey conducted by Queen Mary University, participants in an arbitral process highly value their confidentiality[331]; in this sense, blockchain seems to be the optimal solution to provide a higher level of confidentiality for the participants in the process due to its use

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[325] Alison Ross, "Tribunal Rules on Admissibility of Hacked Kazakh Emails," GAR (22 September 2015), online: https://globalarbitrationreview.com/tribunal-rules-admissibility-hacked-kazakh-emails

[326] Nate Raymond, "U.S. Accuses Chinese Citizens of Hacking Law Firms, Insider Trading" (28 December 2016), online: Reuters https://www.reuters.com/article/us-cyber-insidertrading-idUSKBN14G1D5

[327] "Law Firm Cyber Security Scorecard," LogicForce, online: https://www.logicforce.com/e-book/law-firm-cyber-security-scorecard/

[328] Stephanie Cohen and Mark Morril, A Call To Cyberarms: The International Arbitrator's Duty To Avoid Digital Intrusion, 40 Fordham Int'l L.J. 981, 988 (2017).

[329] "Cybersecurity and Arbitration: Protecting Your Documents and Ensuring Confidentiality," NYSBA Inside (2016).

[330]Deloitte, "Blockchain & Cybersecurity: Friend or Foe?," online: https://www2.deloitte.com/content/dam/Deloitte/ie/Documents/Technology/IE_C_BlockchainandCyberPOV_0417.pdf

[331] "The 2018 International Arbitration Survey: The Evolution of International Arbitration," Queen Mary University of London, online: http://www.arbitration.qmul.ac.uk/research/2018/

of cryptography, thereby reducing the risk of leaking sensitive data, either to the opposing party or to the public.

c- __Efficiency__

According to Judge Holtzmann, "We must not allow arbitration to be as slow as the sloth or as cumbersome and therefore as obsolete as the dinosaur[332]. The accuracy of this quote is reflected in the findings of the aforementioned study conducted by Queen Mary University, as it shows that participants named the cost of arbitration as its worst feature and designated its lack of speed as its fourth worst feature[333]. Even though it is generally less costly and more efficient than court litigation, disputants of the information age expect (and require) even faster processes and lower costs.

Moreover, national courts seem to be inadequate in both resolving disputes arising out of or in connection with blockchain and the execution of an arbitral award rendered in cryptographic format due to its particular characteristics, as is the case with disputes arising on the internet and affect users from all over the world, the question of whether national jurisdiction should hear the matter is no longer an issue with online dispute resolution and with blockchain dispute resolution[334].

A primer in this regard could be the private adjudication system that has been devised by the users of the bitcoin system. This system operates primarily with two digital keys (public and private), as parties should be able to access their cryptocurrencies without dispute. In the event of a dispute, the parties can call a private arbitrator, who will have a third access key to the network and be able to examine the facts through the blocks and track the dispute's source to determine the outcome of the case[335]. Blockchain can utilize a "multi-signature address" system as a form of

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[332] Howard M. Holtzmann, "Streamlining Arbitral Proceedings: Some Techniques of the Iran-United States Claims Tribunal," 11(1) Arb. Int'l 39 (1995).

[333] *Id* at 329

[334] Joel R Reidenberg et al., "Internet Jurisdiction: A Survey of Legal Scholarship Published in English and United States Case Law" (Center on Law and Information Policy, Fordham Law School 2013) at 30.

[335] Pietro Ortolani, "Self-Enforcing Online Dispute Resolution: Lessons from Bitcoin," (2016) 36 OJLS 60.

transnational arbitration, which is exceptionally self-sufficient and outside of the influence of States[336], thereby creating "a new forum for the expression of private autonomy[337]".

Although we will examine in detail such examples in the upcoming sections, the instance of bitcoin alone provides sufficient evidence, with its multi-signature address, that a dispute resolution process which is able to enforce its own outcomes is possible and that blockchain can be seen as one of the most practical and advanced types of online arbitration due to its technical and decentralized characteristics[338].

From our point of view, the most flagrant obstacles that pose obstacles to the adoption of blockchain arbitration for disputes occurring "on-chain" seem to be the lack of technical know-how in the legal community about the technology[339]. For disputes occurring offline, the utilization of blockchain arbitration remains a point of discussion, which we will now elaborate on.

i-) The Arbitral Framework and Its Accommodation of Blockchain Technologies

The current arbitral framework does not systematically exclude the utilization of new technologies in arbitration. The significant autonomy offered to parties and arbitrators regarding the agreement to arbitrate, and the conduct of the proceedings is demonstrated in numerous documents such as the UNCITRAL Model Law, which stipulates in its article 19(1) that "*subject to the provisions of this Law, the parties are free to agree on the procedure to be followed by the arbitral proceedings[340]*" the Model Law equally states that "*Failing such agreement, the arbitral tribunal may, subject to the provisions of this Law, conduct the arbitration in such a manner as it considers appropriate*" and also has "*the power to determine the admissibility, relevance,*

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[336] Larry A DiMatteo and Cristina Poncibo, "Quandary of Smart Contracts and Remedies: The Role of Contract Law and Self-Help Remedies" (2018) 26 European Review of Private Law 805.

[337] *Id* at 332

[338] Emmanuel Gaillard, 'Transcending National Legal Orders for International Arbitration', (2013), ICCA.

[339] Graham Ross, "Challenges and Opportunities in ODR," (Mediate, 2003).

[340] United Nations Commission on International Trade Law (UNCITRAL), Model Law on International Commercial Arbitration, 1985, with amendments as adopted in 2006, art. 19(1), G.A. Res. 61/33, U.N. Doc. A/RES/61/33 (4 December 2006).

materiality, and weight of any evidence". Similar provisions are encountered in numerous arbitration rules such as the Singapore International Arbitration Center rules (SIAC), which stipulates in its article 19.1 that "*the tribunal shall conduct the arbitration in such manner as it considers appropriate, after consulting with the parties, to ensure the fair, expeditious, economical and final resolution of the dispute*[341]".

Similar rules are seen under the International Chamber of Commerce Rules, the London Court of International Arbitration Rules, and the Hong Kong International Arbitration Rules[342]. It can be concluded from the stipulation contained in the aforementioned instruments that there are minimal restrictions regarding the conduct of the arbitral proceedings and the procedure to be followed by the arbitral tribunal. International arbitration, be it on-chain or off-chain, matches the characteristics of blockchain technology; in fact, three key features make international arbitration the most appropriate dispute resolution mechanism to deal with disputes arising out of this new decentralized territory. These features are namely: neutrality, cross-border enforceability, and the flexibility to tailor specific arbitration rules[343], correspondingly the underlying principles of blockchain and smart contract technologies are decentralization, lack of intermediaries, and automation, which guarantee security, perpetuity, immutability and availability of a peer-to-peer network[344].

Correlatively, a study published in 2015 by the Queen Mary University of London identified the three most particular characteristics of international arbitration as decentralization (64%), flexibility (38%), and the ease of enforceability of awards (65%)[345]. As a result, the benefits

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[341] Arbitration Rules of the Singapore International Arbitration Centre, 2016, r. 19.1.

[342] London Court of International Arbitration Rules, 2014, arts. 14(4)(ii) and 22(1)(vi); Rules of Arbitration of the Hong Kong International Arbitration Centre, 2013, art. 22.2; Rules of Arbitration of the International Chamber of Commerce Rules, 2012, art. 25(1)

[343] Simon Maynard & Elizabeth Chan, "Decrypting Cryptocurrencies: Why Borderless Currencies May Benefit from Borderless Dispute Resolution," Kluwer Arb. Blog (2 Nov 2017). From
https://arbitrationblog.kluwerarbitration.com/2017/11/02/decrypting-cryptocurrencies-borderless-currencies-may-benefit-borderless-dispute-resolution/

[344] Gauthier Vannieuwenhuyse, "Arbitration and New Technologies: Mutual Benefits," 35 J. INT'L. ARB. (2018) 119.

[345] 2015 International Arbitration Survey: Improvements and Innovations in International Arbitration, Queen Mary University of London (2015).

of arbitration in blockchain disputes, which are themselves decentralized, cannot be overlooked. The intrinsic flexibility of international arbitration, as well as the ease with which it can be enforced, can be accentuated by the decentralization offered by blockchain technologies. A pro-blockchain section of the arbitration community suggests that "on-chain arbitration" is only possible for disputes that occur on the blockchain[346]; we beg to differ. Even though disputes arising on chain are relatively difficult and costly to resolve by methods of traditional arbitration, disputes involving real-world assets are possible to resolve via blockchain-based arbitration platforms, and their recognition and enforcement is not radically different from any other arbitration concluded via ODR platforms in existence. However, this claim must be nuanced as "each new advance in the technology of communication disturbs a status quo[347]", and so does blockchain. It brings certain novel challenges with it that the arbitral community must overcome if blockchain arbitration is to become widely popular and mainstream.

ii-) Unchartered Lands of Decentralized Arbitration and the Obstacles that Arise

As we have previously examined while discussing ODR and the obstacles posed by the New York Convention, the first issue we encountered was related to the validity of the electronic arbitration agreements and the validity of electronic signatures. The question becomes substantially more intricate when discussing arbitration agreements concluded on the blockchain via smart contracts and arbitration awards rendered through the blockchain. To highlight the distinction between e-arbitration agreements and e-awards, we will refer to blockchain arbitration agreements as cryptographic arbitration agreements and blockchain awards as cryptographic awards[348]. The distinction between referring to arbitral awards rendered on the blockchain as "cryptographic awards" and arbitration agreements concluded on the blockchain as "cryptographic arbitration agreements" rather than "electronic agreements" or "electronic awards" is necessary for several reasons. Firstly, it underscores the unique features and advantages that blockchain technology brings to arbitration. By using the term "cryptographic," we emphasize the secure,

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[346] "Why is Blockchain-Based Arbitration the Only Future for Dispute Resolution?," Medium (5 Oct 2017).

[347] Jonathan WALLACE and Mark MANGAN, "Sex, Laws and Cyberspace.", (1996).

[348] Maxime Chevalier, "From Smart Contract Litigation to Blockchain Arbitration, a New Decentralized Approach Leading Towards the Blockchain Arbitral Order," Journal of International Dispute Settlement, vol. 12, no. 4 (Dec 2021) 558–584.

transparent, and decentralized nature of blockchain-based arbitration, which is enabled by cryptography. This is in contrast to traditional electronic agreements or awards, which may still rely on centralized storage or management systems and may not necessarily benefit from the same level of security and transparency.

Moreover, the terminology helps to clearly delineate the specific characteristics of blockchain arbitration from other electronic forms of dispute resolution. By referring to these as cryptographic awards and agreements, we acknowledge the inherent immutability and tamper-proof nature of the records that are enabled by the consensus mechanisms of blockchain technology. This sets them apart from traditional electronic records, which may be vulnerable to alterations or unauthorized access. By recognizing this distinction in terminology, we are better able to communicate the unique aspects and benefits of blockchain arbitration, as well as the potential implications for the future of dispute resolution and legal practice in a rapidly evolving digital landscape.

The legitimacy of a cryptographic arbitration agreement concluded on the blockchain in the form of a smart contract via the use of multi-signature crypto wallets remains unclear due to the formal restrictions set by the international arbitration framework[349]. The New York Convention stipulates in its Article II (1) that, in order to be valid, an arbitration agreement must be "in writing[350]", and Article II (2) stipulates that the term "in writing" shall include an arbitration agreement signed by the parties or contained in an exchange of letters of telegrams, as we have previously discussed, this includes, according to the UNCITRAL Recommendations, electronic means of communication as well[351]. Equally, the Model law stipulates in article 7(3) that the written form of the arbitration agreement is met by any electronic communication, which can be a data message sent, received, or stored by any electronic, magnetic, optical, or similar means. Due to this provision, it can be concluded that, despite their cryptographic nature, blockchain arbitration

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[349] A. Gurkov, "Blockchain in Arbitration Development: Multi-Signature Wallet Showcase," (2017) 4 IJODR 63, 65.

[350] Arbitration agreements—the in writing requirement - LexisNexis. https://www.lexisnexis.co.uk/legal/guidance/arbitration-agreements-the-in-writing-requirement

[351] Howard M Holtzmann et al., A Guide to the 2006 Amendments to the UNCITRAL Model Law on International Commercial Arbitration: Legislative History and Commentary (Wolters Kluwer, 2015) 617-18.

agreements are nevertheless validly constituted agreements[352]. This conclusion as to the validity of cryptographic arbitration agreements must be nuanced as it is nonetheless a contract. As such, its validity will mostly depend on the national law that governs the cryptographic agreement as per articles II (3), V(1)(a), and IV(1)(b) of the New York Convention[353].

The arguments that question the validity of cryptographic agreements are similar to those made for smart contracts. Under national legislations, the validity of such contracts remains a topic of discussion since certain states may designate cryptographic agreements as contrary to their national public policy rules, thereby rendering the validity of such agreements under the New York Convention obsolete. Equally, the validity of the consent given to a cryptographic agreement can be brought into question. Inquiries such as the extent to which we can say that a party actually consented to an arbitration clause that was encrypted within a smart contract may raise complications regarding the threshold requirements for consent imposed by the New York Convention for text-based agreements[354]. However, we believe that although these arguments regarding the validity of cryptographic agreements hold merit, they will be overcome as blockchain technologies and their application domains proliferate. The usage of such agreements will become normalized within both the legal and the commercial communities. It will be recognized that cryptographic arbitration agreements are not fundamentally different from arbitration agreements concluded online. This understanding will inevitably lead to the recognition of such agreements in a broader context.

Another crucial aspect that deserves our attention is the validity and enforceability of cryptographic arbitral awards. While discussing the enforceability of awards rendered in an electronic form, we concluded that these awards should not be in violation of the New York Convention's provisions when said provisions are read in conjunction with the pro-enforcement policy adopted by the Convention. Article IV(1)(a) of the New York Convention stipulates that

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[352] Marike RP Paulsson, "The Blockchain ADR: Bringing International Arbitration to the New Age," Kluwer Arbitration Blog (9 Oct 2018).

[353] Ihab Amro, "Enforcement of Cross-Border Online Arbitral Awards and Online Arbitration Agreements in National Courts," (2016) 5(2) Slovenska Arbitrázna Praska 17.

[354] Peter L. Michaelson and Sandra A. Jeskie, 'Arbitrating Disputes Involving Blockchains, Smart Contracts, and Smart Legal Contracts' (2020) 74 Disp Resol J 129.

the party seeking enforcement must produce the duly authenticated original award. Moreover, the coded award may need to comply with specific requirements under various national arbitration legislation. For example, Article 31(1) of the Model Law necessitates that the award be in writing and contain the arbitrator's signature (s). This is common for many national jurisdictions where an award will be denied recognition and enforcement if it is not in writing or signed by the arbitrator(s)[355]. In light of this, the questions we must answer are the following: Does a cryptographic award satisfy the requirement to be "in writing"? Does a public-private key signature on the blockchain satisfy the requirement for the award to be signed by the arbitrator(s)? And finally, can the party which seeks to enforce a cryptographic award produce the "duly authenticated original award"?

As previously discussed, the electronic form of an arbitration agreement should not pose particular difficulty when it comes to its recognition and enforcement. Using the same reasoning and stating that a cryptographic award is merely a different form of "writing" where an award may (or may not, depending on the platform that offers arbitration on the blockchain) be rendered in a cryptographic code format,[356] we can conclude that the "in writing" requirement should be satisfied. The sole fact that the award is not rendered as ink on paper should not be a challenging obstacle to overcome when it has been demonstrated that arbitral awards rendered by ODR platforms are indeed valid.

The cryptographic form of the signatures on an award rendered on the blockchain may raise concerns[357] since those unfamiliar with blockchain technologies may find it complex to equate a token-secured key anchored to the cryptographic award with a traditional signature. However, these concerns are redundant as the cryptographic award that is insusceptible to alteration is intrinsically linked with the signatures of the arbitrators. Moreover, the pro-enforcement policy of the New York Convention leads us to believe that the validity of e-

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[355] e.g. English Arbitration Act 1996, s 52(3); French Code of Civil Procedure, articles 1506, 1481, and 1513; German Code of Civil Procedure, s 1054(1) sentence 1; Swiss Private International Law Act, article 189(2);

[356] Peter L. Michaelson and Sandra A. Jeskie, 'Blockchain and Smart Agreement Disputes Call for Arbitration's Strengths, Alternatives to the High Cost of Litigation' (2021) 39(6) Alternatives 91.

[357] Erik Schaefer, 'Chapter 8: E-Signature of Arbitral Awards' in Maxi Scherer et al. (eds), International Arbitration and the COVID-19 Revolution (Kluwer Law International 2020).

signatures under the Convention should also allow for cryptographic signatures contained on an award rendered on the blockchain as it is a proper signature in the sense that it identifies the signatory and is unique to a specific person.

Although there remains uncertainty regarding the stance of national courts regarding cryptographic awards, an award rendered on the blockchain is fundamentally analogous to an award rendered through any other digital means, as such the obstacles that a cryptographic award may face regarding the "in writing" requirement or the "signature" requirement should not be a factor for a denial of its recognition and enforcement. The duly authenticated award requirement[358] imposed by the New York Convention is, in our view, the least problematic of the obstacles that cryptographic awards may face. The blockchain being an immutable ledger, the originality of the award would be uncontested. If the ledger is public, it is accessible by all, and if it is private, access can be granted to those who wish to authenticate the originality of the award[359]. Moreover, as previously mentioned, numerous national arbitration laws such as those of the Netherlands[360], Switzerland[361] , and England[362] do not systematically bar the admissibility of awards rendered under an electronic format, thereby there should not be a significant issue regarding the compatibility of cryptographic awards and the stipulations contained in article IV(1)(a) of the New York Convention[363].

Moreover, the Covid-19 pandemic experience may hasten this new trend, which embraces the electronic, virtual, and digital practice of law within the context of international arbitration[364]. As we have discussed, cryptographic arbitration agreements concluded on the blockchain in the form of a smart contract through the use of multi-signature crypto wallets and cryptographic

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[358] Jasna Arsic, 'International Commercial Arbitration on the Internet-Has the Future Come Too Early?' (1997) 14 J Int Arb 219.

[359] Elias Strehle, 'Public Versus Private Blockchains' (BRL Working Paper Series No. 14, 30 September 2020).

[360] Dutch Code of Civil Procedure, art 1072(b)(3).

[361] Swiss Federal statute on Private International Law, art 189(1).

[362] English Arbitration Act 1996, art 52(1).

[363] Ihab Amro et al., 'Online Arbitration in Theory and in Practice: A Comparative Study in Common Law and Civil Law Countries' (Kluwer Arbitration Blog, 10 April 2019).

[364] David Geoffrey and Allan Bateson, 'Virtual Arbitrations: The Impact of COVID-19' (2020) 9 Indian J Arbitr L 169.

arbitral awards can be considered in compliance with the arbitral framework in place. In our view, the most problematic aspect that may block a cryptographic awards recognition and enforcement under the New York Convention is the convention's territorial approach which is in stark contrast to the decentralized nature of blockchain.

iii-) The Territorial Nature of the New York Convention and the Decentralized Nature of Blockchain: A significant challenge?

As our title suggests, the principal obstacle that may affect the recognition and enforcement of cryptographic awards under the New York Convention stems from the inherent attribute that defines blockchain technologies: Decentralization[365]. This is particularly problematic since, especially in international arbitration, the New York Convention rules with a territorial approach. Article I (1) of the New York Convention states that "This Convention shall apply to the recognition and enforcement of arbitral awards made in the territory of a State other than the State where the recognition and enforcement of such awards are sought and arising out of differences between persons, whether physical or legal (…)". Taken at face value, this provision eliminates the chance of a cryptographic awards recognition and enforcement since this award is not rendered by a State[366].

The principal issue with blockchain arbitration relates to the seat of the arbitration; there is no way to fix the seat of an arbitration proceeding conducted using a blockchain system because there is no clear-cut standard that can be used to determine whether a seat is determined or not[367], it is not possible to determine the awards "nationality" therefore it is technically not possible to determine whether the award was made in the territory of another contracting state.

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[365] Vyas, C.A. and Lunagaria, D., 'Security Concerns and Issues for Bitcoin' (2014) International Journal of Computer Applications, 10.

[366] Riikka Koulu, 'Blockchains and Online Dispute Resolution: Smart Contracts as an Alternative to Enforcement' (2016) 13(1) A Journal of Law, Technology & Society 40.

[367] Alexander J. Belohlávek, 'Importance of the Seat of Arbitration in International Arbitration: Delocalization and Denationalization of Arbitration as an Outdated Myth' (2013) 31 ASA Bulletin, Issue 2, 262-292.

In the upcoming sections of the present thesis, we will examine the most prominent blockchain arbitration platforms; however, we can state that these platforms do not refer to a particular seat of arbitration, neither directly nor through the rules of an arbitration institution[368]. Considering that determining the seat of arbitration for an online blockchain arbitration might be a significant barrier, a solution would be for blockchain arbitration systems to allow parties to select a seat in advance[369]. However, this solution might be easier said than done since most parties will refer to a blockchain arbitration platform as an oracle[370] or escrow[371] at best and will not engage in any discussion about the seat of arbitration at all.

To counteract this problem, it has been suggested that arbitrators themselves should choose the seat, but in any case, when an arbitral process takes place on a network, the traditional territorial approach becomes non-sensical[372]. Again, in a futile attempt, it has been suggested for those procedures that take place in the cyber world that, the arbitrators could utilize the place where the e-arbitration provider is based or the place of the platform, or even the place where the servers are located[373] which is known under the name *Lex Loci Server*[374]. These solutions are barely acceptable for traditional ODR and truly unreasonable for blockchain arbitration as the network is entirely decentralized. As such, in the case of blockchain arbitration, the award that is rendered is "stateless" and, therefore, not attached to a particular jurisdiction. The lack of connection to a national seat of arbitration means that the award is anchored in the blockchain itself and is not made in any particular state[375].

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[368] Clément Lesaege, Federico Ast and William George, 'Kleros'; Luis Cuende and Jorge Izquierdo, Aragon Network; 'Jur'.

[369] Michael Buchwald, 'Smart Contract Dispute Resolution: The Inescapable Flaws of Blockchain-Based Arbitration' (2020) 168 U PA L Rev 1369 at 1399.

[370] "Oracle" enables the blockchain or smart contract to interact with external data, namely, the world outside the blockchain platform.

[371] Before making a transaction, tokens are transferred to a third-party smart contract called the escrow. The escrow holds the deposited tokens until the payment conditions are satisfied.

[372] Gabrielle Kaufmann-Kohler, 'Le Lieu De L'arbitrage à L'aune De La Mondialisation - Réflexions à Propos De Deux Formes Récentes D'arbitrage' [1998] Revue de l'Arbitrage 532.

[373] Cemre Kadioglu and Sadaff Habib, 'Virtual Hearings to the Rescue: Let's Pause for the Seat?' (Kluwer Arbitration Blog, 27 October 2020).

[374] Jasna Arsic, 'International Commercial Arbitration on the Internet-Has the Future Come Too Early?' (1997) 14 J Int Arb 219.

[375] Ritika Bansal, 'Enforceability of Awards from Blockchain Arbitrations in India' (Kluwer Arbitration Blog, 20 August 2019). From https://arbitrationblog.kluwerarbitration.com/2019/08/21/enforceability-of-awards-from-blockchain-arbitrations-in-india/

A proposal in this regard has been made by Professor Lafi Daradkeh[376]. His study revolves around the discussion on how attempts can be made by both the blockchain and arbitration communities to influence international legislature to introduce legal means of enforcing cryptographic awards[377]. According to this argument, the best theories in support of the recognition and enforcement of a cryptographic award under the New York Convention is that of floating arbitration or delocalization theory.

According to the delocalization theory, arbitration is dependent on party autonomy, as such, arbitration is exclusively a creature of agreement. The presumption is as follows: (a) International commercial arbitration is subject to sufficient self-regulation, and (b) the sole control mechanism should apply when the award is being recognized and enforced[378]. Therefore, by employing blockchain technology to conduct arbitration using a decentralized solution, parties' autonomy is subject to self-regulation, whether it be rules that parties have adopted, or rules adopted by the arbitrators[379]. In this regard, Article I (1) of the New York Convention clearly refers to any award made in a contracting State's territory. Thus, it does not seem likely to apply the New York Convention to cryptographic awards. However, the second part of the article states that "It shall also apply to arbitral awards not considered as domestic awards in the State where their recognition and enforcement are sought". According to this provision, we can conclude that the crucial factor is whether or not the State is a signatory to the Convention with respect to the dispute, not where an award was rendered.

This argument leads us to a possible analogy that can be drawn between investment arbitration awards and cryptographic awards. The Washington Convention of 1965[380] in its section

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[376] Professor of International Trade Law and Ex-Dean Univesity President's Adviser and Director of Legal Affairs Yarmouk University, Jordan

[377] Lafi Daradkeh, Recognition and Emforcement of Blockchain Arbitradl Awward Under New York Convention of 1958: The Need for New Interpretation to Motivate Blockchain Investments

[378] Dejan Janićijević, Delocalization in International Commercial Arbitration, Law and Politics Vol. 3, no.1, 2005, pp. 63 - 71

[379] Lafi Daradkeh, "Recognition and Enforcement of Blockchain Arbitral Award Under New York Convention of 1958: The Need for New Interpretation to Motivate Blockchain Investments."

[380] Convention on the Settlement of Investment Disputes between States and Nationals of Other States, 1965.

54, stipulates that the contracting states should recognize and enforce arbitral awards made by the International Centre for Settlement of Investment Disputes (ICSID). There is no need to fix the nationality of an award in order to determine whether it was made in a contractual State or not in order to enforce it in accordance with the Washington Convention because an award is made under the "jurisdiction" of the ICSID and not on the territory of a contracting State. Unfortunately, an international treaty such as the Washington Convention or an arbitration center such as ICSID does not exist for blockchain arbitration. As such, although from a theoretical perspective these arguments may hold merit, they are unrealistic solutions and either require far-fetched analogies to be drawn or necessitate a revision of the New York Convention to include decentralized awards, thereby parting from the territorial approach that the convention adopts.

An award rendered through a blockchain arbitration platform is, therefore, a-national and the supporters of the delocalization theory of the arbitration argue for the application of principles specifically tailored to the blockchain. The advocates of a decentralized arbitral legal order conclude that a derivative form of *Lex Mercatoria* should be the procedural law of this new territory[381], namely *Lex Cryptographia*[382]. The idea of a stateless award's enforceability under the New York Convention is a subject of debate[383]; although some scholars support the idea of a cryptographic awards enforceability[384], another portion is against the idea because of the territorial approach that the New York Convention adopts[385]. As a result, when a blockchain award is rendered on the blockchain itself rather than in a state, the main argument is that there should be no need to enforce the award under the New York Convention.

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[381] Eric A. Caprioli, "Arbitrage Et Médiation Dans Le Commerce Électronique (L'expérience Du «CyberTribunal»)." Revue de l'Arbitrage (Vol 1999, Issue 2), 1999, pp. 236-37.

[382] Maxime Chevalier, "From Smart Contract Litigation to Blockchain Arbitration, a New Decentralized Approach Leading Towards the Blockchain Arbitral Order." Journal of International Dispute Settlement, Volume 12, Issue 4, December 2021, pp. 558-584.

[383] Georgios Petrochilos, "Chapter 8: International and A-National Awards in New York Convention." Procedural Law in International Arbitration. Oxford University Press, 2010.

[384] Dolores Bentolila, Arbitrators as Lawmakers. International Arbitration Law Library Series 43, Kluwer Law International, 2017, pp. 19-22.

[385] Roy Goode, "The Role of the Lex Loci Arbitri in International Commercial Arbitration." AI, vol. 17, 2001, pp. 19-23.

To summarize, in this section, we argued that Blockchain technology has the potential to enhance international commercial arbitration by addressing issues such as cybersecurity, confidentiality, and efficiency. Its decentralized nature and use of cryptography provide resilience against cyber-attacks and ensure sensitive data privacy. Furthermore, blockchain-based dispute resolution, as demonstrated by the Bitcoin network's private adjudication system, can offer a more efficient and self-sufficient form of transnational arbitration. The flexibility inherent in the arbitral framework and documents such as the UNCITRAL Model Law aligns well with blockchain principles, making international arbitration a suitable mechanism for resolving disputes arising from this technology.

However, challenges remain for blockchain arbitration to become widely accepted, including the validity and enforceability of cryptographic arbitration agreements and awards. The pro-enforcement policy of the New York Convention suggests that cryptographic signatures should be acceptable, and the "in writing" requirement should be satisfied by awards rendered on the blockchain. Despite this, the New York Convention's territorial approach may conflict with the decentralized nature of blockchain. As a result, the delocalization theory has been proposed to argue that arbitration is subject to self-regulation and party autonomy; therefore, a distinct legal order of arbitration anchored in the blockchain is not only possible but also desirable.

Advocates of a decentralized arbitral legal order suggest developing principles specifically tailored for the blockchain, such as *Lex Cryptographia*. The enforceability of stateless awards under the New York Convention remains debated, with some scholars supporting the idea and others opposing it due to the Convention's territorial approach. As blockchain awards are rendered on the blockchain itself rather than in a state, as per the indications contained in our research, we argue that there should be no need to enforce the award under the New York Convention. This argument highlights the need for exploring self-contained legal systems anchored in the blockchain and the potential future of international arbitration as a separate legal order.

Having demonstrated the compatibilities and the incompatibilities of blockchain-based arbitration with the New York Convention, it is now time to move on to discuss the possibility of

self-contained legal systems anchored in the blockchain and, by extension, the future of International Arbitration.

TITLE IV: The Future of International Arbitration

In this final title of our thesis, we will delve further into the development of blockchain arbitration and try to explain from both a philosophical and technical point of view why blockchain arbitration could be the future of international arbitration and how blockchain arbitration leads the arbitral community in recognizing the transnationality that arbitration is meant to embody[386]. We will equally argue how this transnational comprehension of arbitration endows legitimacy to a self-contained system of arbitration, thus leading to a blockchain arbitral legal order that distinguishes itself as being a legal order that does not require state supervision or power.

In order to arrive at this conclusion, we will discuss the intrinsic proclivity of blockchain technologies' natural predisposition to promote judicialization **(A)**, followed by an examination of the ecosystem of blockchain arbitral platforms, in which the concepts of crypto-economics, game theory, decentralized justice, and oracle-based dispute resolution systems will be discussed **(B)**. This examination will lead us to our final chapter, whereby we will discuss the blockchain arbitral legal order and its implications **(C)**.

A-) Blockchain Technologies' Natural Predisposition to Promote Judicialization

Blockchain and the technologies accessory to it brought forth an unprecedented degree of contractual automation, the culmination of these technologies led to the inception of private and self-enforcing systems of arbitration. It is theorized that these systems have the potential to circumvent the recognition and enforcement procedures that have traditionally allowed states to exert a level of control over arbitral rulings.

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[386] Thomas Schultz, Transnational Legality: Stateless Law and International Arbitration. Oxford University Press, 2014.

The idea is that as self-enforcing systems of arbitration proliferate, the need for national courts and their coercive power may become marginalized[387]. Traditional arbitration has relied on national courts and their coercive power to ensure recognition and enforcement of arbitral rulings. However, with blockchain technology, arbitration can now be automated, private, and self-enforcing, which could fundamentally alter the role of courts in this process.

Blockchain arbitration enables parties to create smart contracts that automatically execute contractual terms and resolve disputes without the need for court intervention[388]. By utilizing decentralized and transparent ledgers, blockchain arbitration ensures that the involved parties can trust the process without relying on the traditional court system. This circumvents the need for recognition and enforcement procedures that have historically allowed states to exert control over arbitral rulings. As self-enforcing systems of arbitration proliferate, the dependence on national courts and their coercive power may diminish[389].

The rise of blockchain arbitration has the potential to disrupt the traditional role of courts in dispute resolution. By offering a more efficient and self-enforcing alternative to traditional arbitration, blockchain technology can marginalize the need for national courts and their coercive power. This shift not only reduces the reliance on court systems but also empowers individuals and organizations to resolve disputes in a decentralized, secure, and efficient manner[390], ultimately transforming the landscape of dispute resolution.

The principal argument in support of this stems from the structural tendency of blockchain technologies toward creating internal adjudication systems. By designing its judicial structures, blockchain technologies challenge the traditional, state-centric notions of jurisdiction and enforcement, encouraging both the users and practitioners to re-conceptualize justice in the context

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[387] Pietro Ortolani, "The Impact of Blockchain Technologies and Smart Contracts on Dispute Resolution: Arbitration and Court Litigation at the Crossroads." Unif. L. Rev., 2019, pp. 430-448.

[388] Werbach, Kevin, and Cornell, Nicolas. "Contracts Ex Machina." Duke Law Journal, 2017.

[389] Raskin, Max. "The Law and Legality of Smart Contracts." Georgetown Law Technology Review, 2017.

[390] Kaufmann, C., Rühle, J. and Widmer, L. "Blockchain and Smart Contracts: Disrupting Traditional Contractual Relations and Private International Law?" ASA Bulletin, 2018.

of technology-induced self-sufficiency. In fact, this self-sufficiency can be considered as a step toward a post-geographic global society[391], where the inadequacies of states are replaced with technological methods of coercion[392] , and national jurisdictions are replaced by the concept of autonomous jurisdiction based upon consent. In this sense, blockchain technologies and their utilization in arbitration is not revolutionary but can instead be seen as a return to the pre-Westphalian understanding of justice[393], where the concepts of jurisdiction and sovereignty were not linked, and jurisdiction was seen as a professional service that was granted upon the practitioner through the parties' consent[394].

According to Professor Pietro Ortolani, it is precisely for this reason that arbitral systems utilizing blockchain technology have an inherent tendency towards judicialization; by renouncing the authority of the State and its courts, they spontaneously "trigger the need for the parties to set up their own courts[395]".

The need for self-enforcement is an example of "Legal Darwinism[396]"; what is meant by this term is that if blockchain arbitration is to be effective, blockchain arbitration must be binding and result in an award that is self-executory. Although its scope is not limited to such disputes, as is the case with traditional ODR, blockchain-based online dispute resolution will principally deal with cases related to low-value electronic (or cryptographic) transactions, and as such, the need for self-enforcement is twofold; First and foremost, the acceptance of courts to recognize and enforce a cryptographic award is, as discussed, dubious at best and secondly even if the recognition and enforcement of an award rendered through a blockchain arbitration process would be acceptable, the associated expenses and the complicatedness of such an enforcement proceeding

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[391] Alexandre Kedar, The Expanding Spaces of Law - A Timely Legal Geography. Stanford University Press, 2014, p. 30.

[392] Aaron Wright and Primavera De Filippi, "Decentralized Blockchain Technology and the Rise of Lex Cryptographia." 2015.

[393] Emmanuel Gaillard, "Transcending National Legal Orders for International Arbitration." International Arbitration: The Coming of a New Age?, edited by Albert Jan van den Berg, ICCA Congress Series No. 17, Kluwer, Deventer, 2013, pp. 371.

[394] Berthold Goldman, "Frontie`res du droit et lex mercatoria." Archives de Philosophie du Droit, vol. 8, 1964, pp. 177.

[395] Pietro Ortolani, "The Impact of Blockchain Technologies and Smart Contracts on Dispute Resolution: Arbitration and Court Litigation at the Crossroads." Unif. L. Rev., 2019, pp. 430-448.

[396] Pietro Ortolani, "Self-Enforcing Online Dispute Resolution: Lessons from Bitcoin." Oxford Journal of Legal Studies, vol. 36, no. 3, 2016, pp. 595-629.

would be excessive when compared with the amount in dispute. In fact, this was confirmed by the UNCITRAL working group III in its 22nd session, where it was considered that a need existed to address mechanisms that were simpler than the enforcement mechanism provided by the 1958 New York Convention, given that the treaty-based recognition and enforcement system is not adequate for low value, high volume transactions[397].

The New York Convention, which primarily focuses on the recognition and enforcement of foreign arbitral awards, has been widely accepted as the cornerstone of international arbitration enforcement. However, its treaty-based system can be cumbersome and time-consuming, making it less suitable for disputes involving smaller amounts and high transaction volumes.

One of the reasons behind this concern is the cost of enforcing awards under the New York Convention. As the process often requires the involvement of national courts and legal professionals, it can be expensive and resource-intensive, particularly for low-value disputes[398]. Additionally, the Convention's territorial approach, which relies on the contracting states' recognition and enforcement, can create obstacles in the increasingly globalized and digital world of commerce[399]. This has led to a growing interest in exploring alternative mechanisms better suited for resolving low-value, high-volume disputes, such as those arising from cross-border e-commerce transactions.

One such mechanism is the online dispute resolution (ODR) system, which aims to provide a more efficient, cost-effective, and accessible means of resolving disputes, especially for low-value transactions. The UNCITRAL adopted the Technical Notes on Online Dispute Resolution in 2016 to provide guidance on designing and implementing ODR systems[400]. Additionally, the European Union has implemented the ODR platform to help consumers and traders resolve cross-border disputes arising from online transactions[401].

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[397] G Kaufmann-Kohler & T Schultz, Online Dispute Resolution: Challenges for Contemporary Justice (Kluwer 2004) 70.

[398] Born, Gary B. International Arbitration: Law and Practice. Kluwer Law International BV, 2021.

[399] Oxford Handbook of International Arbitration, ed. Thomas Schultz and Federico Ortino, 2018.

[400] UNCITRAL Technical Notes on Online Dispute Resolution, 2016.
[401] Implementation Report on the European Framework for Alternative Dispute Resolution (ADR) and Online Dispute Resolution (ODR), 2019.

Furthermore, as discussed earlier, blockchain technology and smart contracts have the potential to revolutionize dispute resolution by automating contractual performance and enforcement. The self-enforcing nature of smart contracts can significantly reduce the need for court intervention, making them particularly suitable for low-value, high-volume transactions[402]. As these technologies continue to develop and gain wider acceptance, they could provide a viable alternative to the traditional enforcement mechanisms under the New York Convention, better addressing the needs of low-value, high-volume disputes in the digital age.

In this "survival of the fittest" perspective, self-enforcement will allow blockchain arbitration to prevail and expand. Since self-enforcement is an inherent characteristic of such systems, it is considerably easier to implement mechanisms for the auto-enforcement of cryptographic awards. This mechanism is not foreign to blockchain systems; in fact, the bitcoin blockchain has been designed to accommodate for a private adjudication mechanism. The enforcement of agreements to arbitrate and the recognition and enforcement of decisions are not dependent on any form of collaboration with domestic legal systems but rather result from the way the bitcoin protocol functions. In this sense, it could be argued that bitcoin's adjudication process works in a grey area where the enforcement of agreements or awards do not rely on an international convention but rather relies on an internal structure.

By rejecting the pertinence of state authority and collaboration, transnational arbitration seems to be the most relevant representation that is analogous to the bitcoin system[403], which utilizes the multi-signature address and can be thought of as a sophisticated escrow mechanism. The concept of a multi-signature address can be understood as a chest with two keyholes, and unless both keys are used simultaneously, the chest does not open. Two parties that enter a transaction can use this chest to store cryptographic assets such as an amount of cryptocurrency or NFTs. When the transaction's obligations are fulfilled, parties can use their respective keys to release the funds to their destination. If, however, a dispute arises and one party refuses to use their

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[402] Kevin Werbach & Nicolas Cornell, Contracts Ex Machina, 67 DUKE L.J. 313,327, 2017

[403] Ralf Michaels, 'Dreaming law without a state: scholarship on autonomous international arbitration as utopian literature' (2013) 1(1) London Review of International Law 35.

key, the assets are locked in the chest until a private adjudicator or an arbitrator reviews the merits of the case and render a decision regarding the transaction.

This is a very rudimentary form of arbitration[404] , and although the process can be refined and fine-tuned to reflect a better arbitral process, which we will discuss in the upcoming sections, the most basic form of blockchain arbitration can be the usage of multi-signature addresses whereby a third key is provided to the arbitrator which they can use, in conjunction with the other key that the party with the prevailing cause possesses to open the chest and release the funds. The difference between an escrow mechanism and a multi-signature address is that the third party which is entrusted to resolve the dispute does not have access to the funds at any point. As such, this process allows private parties to set up a dispute resolution process that can enforce their own decisions without relying on state courts to recognize and enforce such a decision.

It is somewhat remarkable that this method of arbitration has been largely unrecognized by the arbitration community until recently. Arbitration based on multi-signature addresses seems to be a distinctive form of transnational arbitration that operates without the intervention of state law and with an exceptionally high degree of self-sufficiency[405]. In fact, this method might be considered as the "most practical instantiation of the theory of delocalized arbitration[406]", which we have previously discussed as a method to bypass the provisions of the New York Convention.

To understand how arbitration based on blockchain technologies renders seeking recognition and enforcement under the New York Convention superfluous, it is necessary to look at its effects on the concepts of recognition and enforcement. As we have previously discussed, under the New York Convention, for an award to produce effects, it must be recognized. Article V of the New York Convention (or the law governing recognition in the case of domestic arbitral awards) makes it possible for the tribunals of the State where recognition is sought to refuse recognition in the existence of a narrow but relevant set of conditions such as a violation of the

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[404] Pietro Ortolani, 'The impact of blockchain technologies and smart contracts on dispute resolution: arbitration and court litigation at the crossroads' (2019) Unif. L. Rev. 430-448.

[405] Pietro Ortolani, 'The Three Challenges of Stateless Justice' (2016) 7(3) Journal of International Dispute Settlement 596.

[406] Jan Paulsson, The Idea of Arbitration (Oxford University Press, Oxford 2013) 10-13.

public policy or procedural circumstances such as a violation of the right to be heard[407]. As such, it can be ascertained that states hold a central position in regard to awards rendered by arbitral tribunals. Consequently, recognition can be seen as a filter for arbitral awards, giving courts the power to restrict a judgment rendered by arbitrators from producing any real impact.

On the other hand, with blockchain arbitration based on multi-signature addresses, this filter is avoided entirely. Even if the decision is denied recognition by state courts, the adjudication still produces practical effects without any intermediation by public authorities. In this sense, this process is a structure of self-enforcing arbitration in which the delivery of an arbitral ruling and its practical application are not only inextricably linked but also overlap entirely. A parallel can be drawn with ICANN arbitration which we have previously discussed; the key difference between the blockchain system and the ICANN system is that although ICANN allows for self-enforcement as well, it is not seen as a form of arbitration that precludes *de novo* court litigation[408]. On the other hand, blockchain arbitration's self-executory nature and the immutable structure of a blockchain provide the users with a practical solution to the problem of re-litigation of disputes that have already been decided upon by an arbitrator or an arbitral tribunal. Since the decision is self-executory, the winning party of the dispute does not need to rely on the public authority to utilize its coercive powers to give effect to the decision.

This automatic enforcement must, however, be nuanced. In the case of low-value, high-volume transactional disputes that blockchain arbitration generally deals with, it is usually not quite challenging to strike a balance between the need to enforce the creditor's right and the protection of the interests of the debtor. However, in the case of complex disputes whereby the timing of asset forfeiture may be crucial for the economic survival and the protection of the debtor[409]. This balance is usually achieved when a national court enforces an award, but in the case of a blockchain arbitration decision, this logic does not apply. Without the involvement of State

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[407] Bernard Hanotiau, 'Arbitrability, Due Process, and Public Policy Under Article V of the New York Convention Belgian and French Perspectives', (2008) 25 Journal of International Arbitration 721-741.

[408] Thomas Schultz, 'Private Legal Systems: What Cyberspace Might Teach Legal Theorists' (2007) 10 Yale Journal of Law and Technology 151.

[409] Carel van Lynden, Enforcement of Judgments, Awards and Deeds in Commercial Matters (Thomson Reuters, Toronto 2013).

courts, or more significantly, without any consideration of whether certain interests of the debtor should be safeguarded, the disputed assets are instantly transferred to the party that prevails via the technology. As stated, this problem is not particularly troubling for disputes arising out of transactions made with cryptographic assets, as these are generally not extremely high in value and complexity. Such considerations may, however, become more pertinent as the usage of blockchain arbitration becomes more mainstream.

To summarize, in this section, we discussed how blockchain technology and the concept of self-enforcing arbitration can potentially transform the traditional arbitration process. By automating contractual enforcement and dispute resolution through blockchain arbitration, the need for national courts and their coercive power may become marginalized. This shift in dispute resolution could lead to a post-geographic global society where jurisdiction and enforcement are based on consent rather than state-centric notions.

The section further elaborates on the concept of self-enforcement in blockchain arbitration. Utilizing multi-signature addresses, private parties can set up dispute resolution processes that enforce their own decisions without relying on state courts for recognition and enforcement. This method, which has been largely unrecognized until recently, could be considered the "most practical instantiation of the theory of delocalized arbitration" as it bypasses the provisions of the New York Convention.

Lastly, the section raises concerns about the balance between the need to enforce a creditor's rights and the protection of the debtor's interests in complex disputes. While blockchain arbitration works well for low-value, high-volume transactions, the automatic enforcement of decisions may not consider the debtor's interests in more complex cases. As blockchain arbitration becomes more mainstream, these considerations will become increasingly important to address. It is now time to move on to a more in-depth examination of some of the most prominent blockchain arbitral platforms in use today and their mechanisms of function.

B-) Smart Arbitration Platforms and Their Mechanisms of Function

When the technology first rose to prominence, blockchain enthusiasts hailed an ecosystem of commercial activity free of disputes since transactions are irreversible and benefit from automated execution. This dream has, as expected, failed to deliver since even though the technology and its applications are promising, disputes are bound to occur.

In response to such disputes, a new generation of ODR applications rose from the blockchain ecosystem[410]. A theoretical explanation is insufficient to comprehend the practical use and mechanisms of these systems; as such, in this section, we will examine the most notable blockchain arbitration, both active and non-operational.

i-) Kleros

"*Whoever controls the courts controls the state*". The Kleros Protocol's whitepaper[411] commences with this quote from the Greek philosopher Aristotle, making their ultimate goal of decentralized justice known to the reader from the first second[412]. As a point of depart the protocol argues that although smart contracts are "smart" enough to execute if/then statements, they are inadequate in rendering subjective judgments that include elements from the real world (as opposed to assets held on a blockchain) and that existing ADR and ODR platforms cannot address the needs of a decentralized global economy since they are slow, expensive and unreliable to accommodate disputes that arise from the blockchain environment.

The Kleros Project finds its roots in the open-source dispute resolution protocol that came into existence in 2017. This protocol utilizes blockchain technologies and crowdsourcing to resolve disputes, giving the community decision-making powers regarding disputes. The Kleros Protocol's arbitration system operates as a decision protocol for a multipurpose "court system"

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[410]Jenny Vatrenko, 'The Lay of the Land in Blockchain Dispute Resolution and Governance Designs', Hackernoon Blockchain Governance (16 January 2019).

[411] A white paper, also written as "whitepaper", is an informational document usually issued by a company or not-for-profit organization to promote or highlight the features of a solution, product, or service that it offers or plans to offer.

[412] Clément Lesaege, Federico Ast, and William George Kleros, 'Short Paper v1.0.7' (September 2019).

that can solve a wide range of disputes[413] . The Kleros "court system" can be seen in the following example:
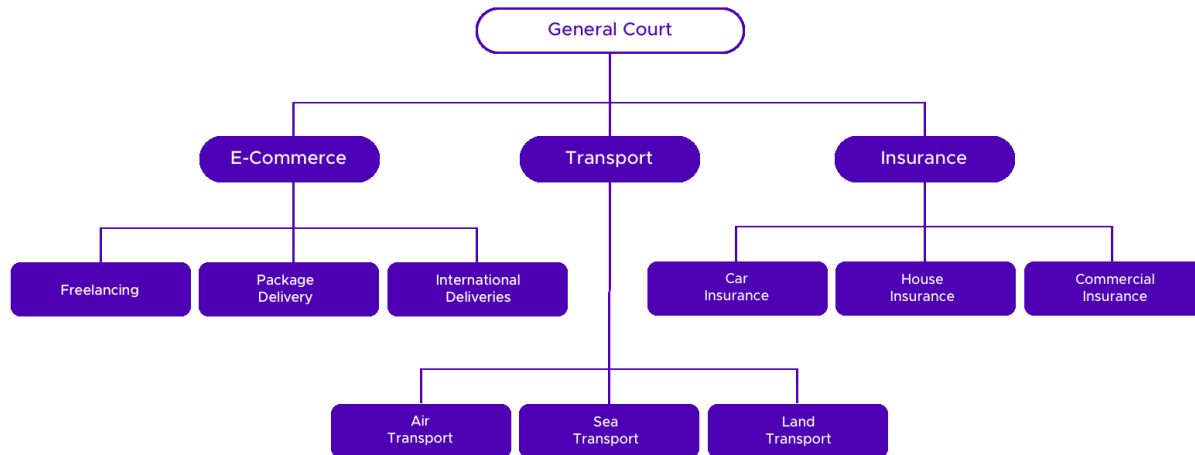
Once a conflict emerges during the performance of a smart contract, the Kleros process is initiated, suspending fund transfers under the smart contract until the dispute is resolved[414]. In the case of a smart contract dispute, the parties can include in their smart agreement a clause that stipulates the utilization of Kleros and some of the features of the dispute resolution process, such as the Kleros sub-court to be chosen and the number of jurors that will decide on the merits of the case.

The community members, also called jurors, are economically incentivized to participate in the process by rewards in the native currency of the protocol called "Pinakion", which operates on the Ethereum blockchain. Although, irrelevant to the Kleros Protocol's mechanisms of function, we believe the name chosen for the cryptocurrency is significative in the sense that Pinakion is also the name of the Athenian token that functioned as a way to attract people of the Ancient Greek city-state to important trials. On the Kleros platform, its purpose is comparable, and instead of

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[413] The Blockchain Dispute Resolution Layer, KLEROS, https://kleros.io/

[414] Federico Ast, 'Kleros, A Protocol for a Decentralized Justice System', MEDIUM (11 September 2017).

relying on the honesty of a few individuals, the protocol utilizes game-theory[415] and crypto-economic incentives to obtain reliable results[416] through jury voting[417]. In order to decide on the case equitably, the jury is incentivized to vote together in a majority through a derivative of the "Schelling Point" called a SchellingCoin, which was proposed by the founder of the Ethereum blockchain Vitalik Buterin[418].

Developed by game theorist Thomas Schelling, the Focal Point theory tries to answer the question "How can people coordinate their behavior in the absence of communication?[419]". Schelling responds by describing focal points as being "each person's expectation of what the other expects him to expect to be expected to do[420]". The SchellingCoin utilizes this concept to align honesty with economic incentives, for example in order to answer the question "has it rained in Montreal on the morning of May 12th, 1999?", each SchellingCoin holder would vote either yes or no by secret ballot, and after the voting process is concluded, the result is revealed.

The majority of owners are rewarded with 10% of their coins, and the minority lose 10% of their coins. By utilizing this idea, SchellingCoin encourages those who do not know or trust one another to be honest. It is anticipated that agents will select the correct response because they anticipate that others will select the correct response as well[421].

Schelling Point theory is employed to maintain anonymity and trust within the system, encouraging users to vote coherently with others for desirable outcomes. Jurors self-select

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[415] Game theory is the study of mathematical models of strategic interactions among rational agents. It has applications in all fields of social science, as well as in logic, systems science and computer science.

[416] Clément Lesaege, Federico Ast, and William George Kleros, 'Short Paper v1.0.7' (September 2019).

[417] Clement Lesaege & Federico Ast, 'Teaching with Technology White Paper 1' (2018).

[418] Buterin, V., 'Schellingcoin: A minimal-trust universal data feed' (2014).

[419] Maurer, WM, & DuPont, QI, 'Ledgers and Law in the Blockchain'.

[420] Schelling, TC, The Strategy of Conflict (Oxford University Press, 1960).

[421] Metzger, J., 'The current landscape of blockchain-based, crowdsourced arbitration' (2019) 19 Macquarie Law Journal 81-101.

themselves for disputes using the Pinakion (PNK) token, and once chosen, they examine evidence and cast their votes independently to prevent influencing each other's decisions[422].

Despite these measures to ensure impartiality and independence in the dispute resolution process, concerns remain about the protocol's transparency and potential financial bias among jurors. Jurors in the Kleros protocol, like traditional arbitrators, earn fees for deciding disputes. However, those who vote against the majority lose their invested tokens. This raises questions about financial bias and the possibility of award debtors challenging the impartiality of jurors.

The critical concern is whether the Schelling Point theory is an adequate basis for assuming that a group of anonymous individuals will achieve a fair and procedurally just outcome. While game theory-based crypto economics might protect against arbitrary decisions, the integrity of a system allowing jurors to self-select themselves remains open to scrutiny.

Kleros protocol allows for automating every step of the arbitration process, such as selecting jurors, securing evidence, and communicating the decision to parties. For the arbitration process to commence, the necessary monies for the juror's pay must be deposited, and the party that wishes to initiate the process needs to communicate all the evidence that supports their claim. This evidence is secured through public key encryption. The jury selection is "randomized" within the selected courts' jury pool. To be selected as a juror, the juror candidate must stake their tokens[423]. The greater the number of tokens a juror stakes, the more likely it is that they will be selected as a juror.

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[422] After candidates have self-selected into specific courts and staked their tokens, the final selection of jurors is done randomly. The probability of being drawn as a juror is proportional to the amount of staked tokens. Theoretically, a candidate may be drawn more than once for a specific dispute (but in practice it is unlikely). The amount of times a user is drawn for a dispute (called its weight) determines the number of votes he will get in the dispute and the amount of tokens he will win or lose during the token redistribution.

[423] Staking cryptocurrencies is a process that involves committing your crypto assets to support a blockchain network and confirm transactions.

This method of juror selection is intentional and serves two main goals: protection against sybil attacks[424,425,426] and the incentivization of honest voting. If the juror selection were randomized entirely, a hostile party could create a large number of addresses to be drawn a large number of times in each case; consequently, the hostile party would have control of the system since they would be drawn more often than other jurors. Additionally, this method incentivizes the jurors to vote honestly through the incentive system; incompetent jurors who fail to agree with the majority are required to pay a part of their staked tokens to the majority, which constitutes a part of the compensation of the arbitrators. Although execution is automatic, the losing party has a right to appeal the decision as many times as they wish, however in order to avoid "spamming" the system, Kleros protocol will double the number of jurors (plus one so that the number of jurors is always odd numbers) and consequently appeal fees would increase exponentially.

Although it is principally designed for crypto-commerce and smart contracts, there have been instances whereby an arbitral decision reached via the Kleros court has been recognized and enforced in national courts. One remarkable and unprecedented example in this regard is the decentralized arbitration clause in a leasing contract in Mexico. The decision can be qualified as a hybrid and has the benefit of demonstrating that blockchain arbitration platforms can be utilized in conjunction with traditional arbitration methods and result in an enforceable award under the New York Convention[427]. In this case, the two parties agreed to include an arbitration clause in a real estate leasing agreement subject to Mexican law on September 1st, 2020. This was a typical arbitration agreement where the parties chose the arbitrator and established the rules per the New York Convention[428].

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[424] A Sybil attack is a type of attack on a computer network service in which an attacker subverts the service's reputation system by creating a large number of pseudonymous identities and uses them to gain a disproportionately large influence.

[425] Douceur, JR, 'The sybil attack', in Revised Papers from the First International Workshop on Peer-to-Peer Systems (London, UK, UK, 2002), IPTPS '01, Springer-Verlag, pp. 251-260.

[426] Newsome, J., Elaine, S., Dawn, S., Adrian, P., 'The sybil attack in sensor networks: analysis & defenses', in Third International Symposium on Information Processing in Sensor Networks (2004), pp. 259-268.

[427] Chevalier, Maxime 'Arbitration Tech Toolbox: Is a Mexican Court Decision the First Stone to Bridging the Blockchain Arbitral Order with National Legal Orders?', March 4, 2022.

[428] How to Enforce blockchain Dispute Resolution in Court? The Kleros Case in Mexico, January 2022, https://blog.kleros.io/how-to-enforce-blockchain-dispute-resolution-in-court-the-kleros-case-in-mexico/

The interesting aspect of this arbitration clause was that it instructed the arbitrator to render the award on the Kleros protocol. This meant that an arbitrator that was chosen by the parties would utilize decentralized protocols to settle the dispute. When the dispute occurred, the parties initiated the arbitral proceedings, and the arbitrator appointed by them drafted the procedural order and communicated it to Kleros. A decision was rendered on the platform by three jurors chosen according to the mechanisms of Kleros[429]. The landlord was decided to be the winning party, and the landlord requested enforcement of the arbitral award before Mexican courts. The latter issued a decision on May 28th, 2021, granting enforcement of the award.

The Kleros protocol and its potential to be used in conjunction with traditional methods of arbitration for enforcement under the New York Convention is promising, and we will reiterate and nuance its importance in the upcoming sections of the present thesis. For now, it is useful to examine another interesting blockchain arbitral platform: *Juris*.

ii-) Juris

Juris is another pioneering platform in the blockchain arbitration world; it operates where the parties include the Juris code in their smart contract, and it identifies three key goals for itself;

1. To make smart contracts on any blockchain safe, robust, human, legally enforceable, and open source.

2. To make access to civil justice and legal help as widely and publicly accessible as The Internet.

3. To bring effective, peaceful, fair, and balanced dispute resolution to the billions underserved and overcharged by established legal infrastructure[430].

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[429] Mauricio Virues Carrera, "Accommodating Kleros as a Decentralized Dispute Resolution Tool for Civil Justice Systems: Theoretical Model and Case of Application" (2021).

[430] Juris whitepaper, available at https://drive.google.com/file/d/1318klGEYL4g02VudL-C-BCnvpKujTnbF/view

When a dispute emerges, the parties can suspend the contract and use the Juris dashboard to access the system. A multi-step conflict resolution procedure is recommended to the parties, beginning with "SELF Mediation", which is a consensual process whereby parties are encouraged to resolve the dispute without interference. If the parties cannot reach a decision, the next step is initiated, which is called a SNAP judgment (Simple Neutral Arbitrator Pool)[431], which refers to a procedure wherein parties receive a decision from neutral jurors who vote pseudonymously on the case.

The jury panel also offers a brief opinion about the case[432]. Following the decision of the jurors, the parties may revert to the SELF stage and achieve a consensual agreement[433]. Throughout this stage, the parties are given a timeframe to provide the essential details about the case, after which the case brief is sent to jurors with JRS tokens for review[434]. Jurors must provide one of three justifications as well as a brief reasoning, as part of their vote[435]. All verdicts are kept secret until the filing date. After that, the information is made available to the public, and SNAP jurors participate in a discussion while being actively engaged by legal professionals who ask questions and provide pertinent details and arguments[436].

After this phase, the jury votes once more after providing their reasons and justifications. After the vote, each consensus group of legal experts creates a "final opinion" after being assigned to one. The parties now have access to these perspectives, and they can rely on them when they return to the consensual tools[437]. The last step of the Juris protocol is the binding Preemptory Agreement for Neutral Expert Litigation (PANEL). This step ensures the adjudication of complex disputes that require the examination of the most skilled jurors, which are called High Jurists, and

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[431] Metzger, J. (2019), "The current landscape of blockchain-based, crowdsourced arbitration." Macquarie Law Journal, 19, 81–101.

[432] Juris whitepaper, available at https://drive.google.com/file/d/1318klGEYL4g02VudL-C-BCnvpKujTnbF/view

[433] *Id*. At 310

[434] *Id*. At 310

[435] *Id*. At 310

[436] *Id*. At 310

[437] *Id*. At 310

disputes wherein the parties[438] desire to reach a legally enforceable award that is in accordance with the New York Convention[439]. Although this process is more expensive than the Simple Neutral Arbitrator Pool process, it has the particular advantage of providing the disputants with an award that is binding and enforceable under the New York Convention.

The jury will have access to all materials from the SNAP phase at this point, and the decision-makers may ask for additional information before making their verdict. After the decision has been taken, the parties' smart contract will be closed, and the award will be automatically enforced. The decision must be made within thirty days[440].

The Juris platform enlists three levels of jurors: high jurists, good-standing jurists, and novice jurists[441]. In this hierarchy, high jurists are professional arbitrators that have experience on the Juris platform, their duty is to resolve the most complex cases, and their reward is commensurate with the complexity of the dispute; the second rank belongs to the good-standing jurists who are jurors that participate in the process, contribute to the platform and have voting rights in SNAP cases[442].

The hierarchy is not strict, and a good-standing juror may ascend to the level of a high jurist by accumulating high rankings; this is achieved through the reputational system of Juris that assesses how well jurors make decisions. Finally, Juris enlists novice jurists that are novel users that have the possibility to participate in the discussions, but they cannot decide cases in contrast to high jurists and good-standing jurists[443].

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[438] *Id*. At 310

[439] *Id*. At 310

[440] *Id*. At 310

[441] *Id*. At 310

[442] *Id*. At 310

[443] *Id*. At 310

Juris utilizes tokenized juror voting but equally grants the parties the possibility to reach an agreement via consensual party-to-party discussion. Thus, Juris is a blockchain dispute resolution platform that has a tiered resolution system, with the final step being a legally enforceable and binding arbitral award[444]. Now we will move on to discuss Mattereum, which is another blockchain dispute resolution platform that closely resembles traditional arbitration as it allows for smart contracts to cover physical assets in the real world by getting "real world assets on-chain"[445].

It is important to note that at the present time, Juris is no longer in operation. It is an indication of the fragility of these novel blockchain dispute resolution platforms.

iii-) Mattereum

With an initial focus on the legally transferable ownership of rights and tangible assets on a blockchain, Mattereum offers a framework for the development of smart contracts that can address a variety of legal concerns[446]. In order to achieve its goals, the Mattereum protocol utilizes the "Smart Property Register," which is a decentralized legal database and an automated Ricardian contract[447] that enables one to stake assets, safeguard property rights, and transfer ownership. This "automated custodian" tool has been developed and established as s real-world asset's legal owner and registrar. Mattereum can be thought of in terms of a hybrid blockchain dispute resolution platform because it equally incorporates a dispute resolution process premised on off-chain arbitration that relies on independent external arbitrators[448].

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[444] *Id*. At 310

[445] Vinay Gupta et al., "Smart Contracts. Real Property." 2-3 (Mattereum, Working Paper)

[446] Mattereum, Summary White Paper (October 2018)

[447] A Ricardian contract is "a digital contract that defines the terms and conditions of interaction, between two or more peers, that is cryptographically signed and verified. Importantly it is both human and machine-readable and digitally signed".

[448] *Id*. At 328

If the parties cannot agree, an arbitrator will be assigned to them. Alternatively, the parties may select an arbitrator from those offered to them[449]. The fee for the audit of Mattereum contracts, which is done to find defects, areas of ambiguity, and other potential issues, includes the costs of the arbitration. In this regard, Mattereum actively engages in ex-ante dispute avoidance activities in addition to providing ex-post dispute resolution services[450].

For a number of reasons, Mattereum's structure is distinct from that of many other platforms in the blockchain dispute resolution ecosystem. One such reason is that it makes an ambitious attempt to use blockchain for off-chain assets, thereby broadening the range of conflicts that could be resolved by blockchain dispute resolution. In this sense, it resembles how the distinction between offline and online has become irrelevant for ODR in other settings as we have previously discussed. Another reason to support the claim that Mattereum is structurally different from other blockchain arbitration platforms is that Mattereum chooses traditional arbitration over crowd-sourced jury voting. While making such a decision may have its benefits, it also raises concerns about the future ability to grow and manage large-scale disagreements.

To summarize, Mattereum's objectives are to place titles or ownership rights of real-world assets on the blockchain and to eliminate the complexities associated with requesting the execution of cryptographic arbitral awards. Now we will examine another blockchain dispute resolution platform that is based on the development of a decentralized voting system that utilizes tokenization and the wisdom of the crowds, the Jur.io platform[451].

iv-) Jur.io

Jur is a platform that aims to be the first network to create an efficient jurisdiction for the digital economy; in the developer's view, a new stage of digitization was ushered in by the development of blockchain technology, and as the world's assets are being converted into digital

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[449] *Id*. At 328

[450] *Id*. At 328

[451] It is worth mentioning that I had the opportunity to have hands-on experience with this particular platform during a workshop event about blockchain based arbitration in the Netherlands in 2019

assets, it is necessary to address the insufficiency and misalignment of offline traditional legal systems[452]. The Jur network is deemed to be autonomous, legally binding, and interoperable with traditional offline jurisdictions. What this interoperability entails is that Jur intends to leverage the existing legal framework of arbitration and *Lex Mercatoria* to achieve its goals[453].

Similarly, to the Kleros platform that we have previously discussed, the users of Jur utilize their cryptographic tokens to vote and are incentivized to cast their votes in accordance with their predictions about the outcome of the majority vote. Open voting and closed voting are the two types of voting used to settle disputes. Where no expertise is required, open voting is used. All token-holding users may assess the situation and cast their votes in such a vote. As an economic incentive, users who voted in accordance with the vote of the majority will receive the tokens of those who were in minority[454]. The incentive structure is designed so that rational voters would only cast ballots when they are at least 50% confident that they can correctly forecast the outcome[455], the presumption being that the users are encouraged by the incentive system to vote in order to reach a low cost and just dispute resolution[456].

In a similar vein with the Mexican case[457] that utilized the Kleros protocol in conjunction with a real-world arbitrator, Jur aims to leverage real world arbitration and the established legal instruments in enforcing their arbitral decisions. This hybrid approach envisions the collaboration of law firms in different jurisdictions that will actively work with Jur to enforce the arbitral awards reached through the Jur protocol[458].

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[452] Jur lightpaper, The Network State for the Digital Economy, April 2022

[453] Pietro Ortolani, "Self-Enforcing Online Dispute Resolution: Lessons from Bitcoin." Oxford Journal of Legal Studies, vol. 36, no. 3, 2016, pp. 595-629.

[454] *Id*. At 449

[455] *Id*. At 449

[456] *Id*. At 449

[457] How to Enforce blockchain Dispute Resolution in Court? The Kleros Case in Mexico, January 2022, https://blog.kleros.io/how-to-enforce-blockchain-dispute-resolution-in-court-the-kleros-case-in-mexico/

[458] *Id*. At 449

Although there remain several noteworthy blockchain arbitration platforms such as Sagewise, RHUbarb, Aragon court, and ECAF, the examples we provided thus far are sufficient in demonstrating the principal characteristics that these platforms share and also the characteristics that define and differentiate one from another. Fundamentally, we can classify these platforms into five groups according to their functions and structures[459].

The first category of platforms aims to resolve blockchain and smart contract disputes[460] an example in this regard is the Aragon court[461] which is a platform specifically tailored to this end. Kleros, as we have previously examined, equally has a sub-court to address blockchain disputes, and Sagewise[462] incorporates an arbitration protocol to resolve disputes over blockchain transactions whereby the platform uses smart contracts with an arbitration clause incorporated in it[463].

The second category of blockchain arbitration platforms attends to dispute resolution needs that occur outside of the blockchain. Here again, Kleros seems to be the most prominent example since, in addition to blockchain-based disputes, the Kleros protocol equally hosts a sub-court that deals with issues related to marketing, minor disputes, and video production[464]. Under this category, it is equally possible to cite Mattereum, which advertises itself as a legal, technical, and commercial infrastructure layer for the on-chain property transfer and control. This platform contains in its protocol a decentralized commercial arbitration center for disputes among the parties[465].

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[459] Cemre C. Kadioglu Kumtepe, "A Brief Introduction to Blockchain Dispute Resolution" (2021) 14:2 J Marshall LJ 138.

[460] Darcy Allen, Aaron Lane, and Marta Poblet, "The Governance of Blockchain Dispute Resolution" (2019) 25 Harvard Negotiation Law Review 75, 100.

[461] Aragon, "Whitepaper, Aragon Network A Decentralized Infrastructure for Value Exchange" (available at: https://cryptorating.eu/whitepapers/Aragon/Aragon%20Whitepaper.pdf)

[462] Sagewise, "Whitepaper, Hedera: A Public Hashgraph Network & Governing Council" (available at: https://hedera.com/hh_whitepaper_v2.1-20200815.pdf)

[463] *Id*. At 343

[464] Clément Lesaege, Federico Ast, and William George Kleros, "Short Paper v1.0.7", September 2019.

[465] Mattereum, "Working Paper: Smart Contacts: Real Property", https://mattereum.com/wp-content/uploads/2020/02/mattereumworkingpaper.pdf

The third category comprises of platforms that direct parties to resolve the dispute amicably between themselves as a first step. These platforms adopt different structural mechanisms to assist parties in reaching a mutually agreed solution to their dispute. Under this category, we can cite the platforms Sagewise and Juris, both of which are currently inoperative. Nevertheless, they provide good examples to show this type of Blockchain arbitration platforms. Whereas Sagewise offers the parties the option to negotiate as a first step[466] and, should they fail to reach a consensus, give the parties the option to seek out the expertise of a third-party human, on the Juris platform, the parties are instructed to "crowdsource an opinion" if they are unable to reach a settlement by themselves[467].

The fourth category of blockchain arbitration platforms are those that accomplish their goals by utilizing crowd intelligence and voting principles. In this regard, the Jur platform uses these voting and crowd intelligence techniques either on a closed group of voters with specific knowledge or on an open group without specific knowledge. Kleros, on the other hand, adopts a crowd-sourced decision-making process that incorporates game theory principles[468], the Kleros protocol does not necessitate the jurors to be experts, but the jurors are nevertheless free to choose a sub-court that corresponds to their expertise[469].

The fifth and final category of blockchain arbitration platforms that we can distinguish utilize a hybrid method to resolve disputes. Rather than opting to resolve disputes directly on the blockchain, this type of platforms gets assistance from traditional methods of dispute resolution. For example, Sagewise platform directs the disputant to an external ODR platform if the negotiation and "human facilitator" steps that the platform provides have failed[470]. Mattereum equally directs parties to external arbitrators so that the disputants can receive an award that is

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[466] Orna Rabinovich-Einy and Ethan Katsh, "Blockchain and the Inevitability of Disputes: The Role for Online Dispute Resolution" (2019).

[467] Adam J. Kerpelman, 'Introducing the Juris Protocol: Human-Powered Dispute Resolution for Blockchain Smart Contracts.' (Medium, 17 February 2018), https://medium.com/jurisproject/introducing-the-juris-protocol-human powered- dispute-resolution-for-blockchain-smart-contracts-bc574b50d8e1

[468] *Id*. At 348

[469] *Id*. At 348

[470] *Id*. At 350

recognizable and enforceable under the New York Convention[471]. Another example here could be the Juris platform which, before the platform was shut down, used the concept of "High Jurists" to resolve complex disputes and render awards that were recognized and enforced under the New York Convention[472].

To summarize, Kleros is an open-source blockchain dispute resolution protocol that uses game theory and crypto-economic incentives to encourage jurors to vote honestly, with the native cryptocurrency Pinakion as a reward. Kleros has been utilized in conjunction with traditional arbitration methods, as seen in a Mexican real estate leasing agreement, demonstrating its potential for enforceable awards under the New York Convention. Juris, on the other hand, was a pioneering blockchain arbitration platform with a multi-step conflict resolution process and a hierarchy of jurors. Despite its innovative approach, Juris is no longer in operation, highlighting the fragility of such novel platforms.

Mattereum is another blockchain dispute resolution platform that focuses on legally transferable ownership of rights and tangible assets on a blockchain, using a "Smart Property Register" and automated Ricardian contracts. Mattereum stands out due to its ambitious attempt to use blockchain for off-chain assets and its choice of traditional arbitration over crowd-sourced jury voting. Jur is a platform aiming to create an efficient jurisdiction for the digital economy, leveraging existing legal frameworks of arbitration and *Lex Mercatoria*. Jur employs cryptographic tokens for voting and uses a hybrid approach, collaborating with law firms to enforce arbitral awards.

Blockchain arbitration platforms can be classified into five groups based on their functions and structures: 1) platforms resolving blockchain and smart contract disputes; 2) platforms addressing dispute resolution needs outside of the blockchain; 3) platforms directing parties to resolve disputes amicably; 4) platforms utilizing crowd intelligence and voting principles; 5) platforms incorporating hybrid methods to resolve disputes by combining blockchain solutions with traditional methods of dispute resolution. These diverse platforms demonstrate shared and distinct characteristics, offering a range of dispute-resolution options for various scenarios.

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[471] Vinay Gupta, "The First Mattereum Briefing," Medium, 15 December 2017, https://medium.com/humanizing-the-singularity/the-first-mattereum-briefing-11a67c75d840

[472] *Id*. At 296

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Having discussed the most notable blockchain arbitration platforms and having classified them into different categories considering their most prominent specifications, it is now time to pass on to the final chapter of our thesis, whereby we will first discuss some of the more practical issues that blockchain arbitration faces and then move on to why blockchain will autonomize arbitration to its greatest degree and why this goal that must be pursued to offer disputants a low cost, reliable and expedited arbitral avenue.

C-) The Blockchain Arbitral Legal Order: Liberation Through Decentralization

In this final section of our thesis, we will commence by outlining some of the more pronounced problems and limitations that plague blockchain arbitration. We will then move on to explain why these limitations should not hinder the development of this novel model of dispute resolution since, as was held by judge Renata Barroes Souto Maior Baiao of the Sao Paulo Court about encouraging the use of blockchain arbitration "And why not a new way of solving them before they turn into a lawsuit before the judiciary[473]".

In fact, we will argue that if we shift our perspectives regarding arbitration and its limits, it is possible to recognize blockchain arbitration as a tool that allows us to achieve the ultimate goal of arbitration, a completely autonomous legal order with its distinct principles, use cases, and mechanisms.

If approached from a transnational perspective, blockchain arbitration might prove to be the embodiment of a truly autonomous arbitral legal order that is detached from traditional concepts, such as state supervision that inhibits the expansion of arbitration into a legitimate and self-contained legal sphere. In order to arrive at this conclusion, we will first discuss the limitations of blockchain arbitration when seen through a traditional lens and then move on to the future of blockchain arbitral legal order and its autonomization through decentralized mechanisms.

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[473] Gino Matos, "Blockchain Is Already Used To Mediate Digital Conflicts" (2022).

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i-) Limitations and Advantages of Blockchain Dispute Resolution Systems

The fundamental apprehensions about blockchain arbitration and blockchain-based dispute resolution systems, in general, have philosophical undertones touching upon the traditional understanding of justice and the need for a centralized authority with the power to oversee private methods of dispute resolution[474]. It is the concern of many whether it is possible to achieve proper and legitimate dispute resolution without any oversight and involvement from a governing authority such as a State[475].

In fact, certain authors raise concerns in which they question the reliability of oracle-based blockchain dispute resolution platforms, the impartiality and expertise of decision-makers, and its impact on platforms that employ the economic incentive models[476]. Such critics equally question whether due process is protected while using these platforms and, if not, whether it is possible to attribute legal validity to any decision that was taken through blockchain arbitration[477].

The main vexations regarding oracle-based systems are that it does not adequately respond to the need for thorough examination of cases and thus violate, to a certain extent, the right to a fair hearing, cross-examination, and impartial judgment that traditional arbitration is capable of providing[478]. The counter-oracle arguments equally lead to questions about the impartiality of the arbitrators[479] themselves. In this regard, Palombo, Battaglini, and Cantisani argue that "the

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[474] Colin Rule and Larry Friedberg, "The Appropriate Role of Dispute Resolution in Building Trust Online," (2005) 13(2) Artificial Intelligence and Law 193.

[475] Marcella Atzori, "Blockchain Technology and Decentralized Governance: Is the State Still Necessary?" (2015) 6(1) Journal of Governance and Regulation 45.

[476] A. Palombo, R. Battaglini, and L. Cantisani, "A Blockchain-Based Smart Dispute Resolution Method," in The Cambridge Handbook of Lawyering in the Digital Age, ed. L. DiMatteo et al. (Cambridge Law Handbooks, 2021), pp. 122-139.

[477] *Id.* At 363

[478] W. E. D. Allen, A. M. Lane, and M. Poblet, "The Governance of Blockchain Dispute Resolution," Harvard Negotiation Law Rev. 25 (2019): 75–101.

[479] D. Devine, "Effects of Cognitive Ability, Task Knowledge, Information Sharing, and Conflict on Group Decision-Making Effectiveness," Small Group Research 30, no. 5 (1999): 608–634.

presence of economic incentives to vote with the majority delves into decision-making based on prediction and not entirely based on the merits of the dispute[480]".

As a hypothetical example in this regard, we could argue that a well-informed lawyer with expertise in cryptographic agreements might, in order to be amongst the majority and thereby economically profit from the dispute, decide in a manner that is in contradiction with the truth but in a manner that would affirm the ideas of the uninformed masses. This might lead to bias amongst the voters that, in order to profit economically, might sacrifice their impartiality. This aspect which might endanger the justness of the final decision is named "herding behavior," which can be defined as the alignment of the thoughts or behaviors of the decision-makers in a group through local interaction and without centralized coordination[481].

The jurors might reach a consensus not by a thorough deliberation process but by obeying or aligning themselves with the opinions of others, thus leading to flawed judgments. It is therefore argued that although consensus may be reached during jury deliberation, mistakes in the jurors' decision are exacerbated[482].

Another major concern regarding blockchain arbitration platforms involves respect of due process that directly affects the validity of the decision. The right to a fair hearing is the foundation upon which any decent dispute resolution system should be built upon; the exchange of arguments, the flow of evidence, and certain procedural safeguards to guarantee fundamental rights all form part of the right to a fair hearing.

In order to become widely adopted and used, these arguments must be addressed by the blockchain dispute resolution platforms. It is true that blockchain dispute resolution is at odds with our traditional understanding of judicial concepts and that the platforms do not adopt the same procedures and processes, thus leading to incohesion in the blockchain dispute resolution

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[480] *Id.* At 363

[481] R. Raafat et al, "Herding in Humans," Trends in Cognitive Sciences 13 (2009): 420–428.

[482] B. Luppi, "Jury Size and the Hung-Jury Paradox," Journal of Legal Studies 42 (2013): 399–422.

ecosystem. The fact that "jurists" do not necessarily have to be legal professionals and the lack of binding codes of conduct[483] adds to the skepticism that these platforms face.

The core properties that these platforms adopt, such as decentralization, anonymity, economic incentive models based on game theory, and the idea that a voluminous number of non-experts would reach a more accurate judgment than a small group of professionals[484] form the basis upon which counter blockchain arbitration arguments base themselves upon. Moreover, those who question the viability of blockchain arbitration equally argue that the lack of procedural safeguards, the lack of imperative action by the decision makers regarding fact-finding and evidence-taking, and the justness of the decision are all major sources of concern[485].

Nevertheless, it would be unfair to present blockchain-based dispute resolution as an undertaking that is consumed by problems. In fact, if properly designed and executed, blockchain dispute resolution offers numerous advantages compared to traditional ADR and ODR mechanisms[486].

First and foremost, in many countries, the backlog of court cases has reached astronomical numbers; for instance, according to the statistics for 2021, the Turkish courts are faced with 2,179,993 pending civil law cases and 22,204,240 cases pending bankruptcy and enforcement filings[487]. This situation is similar in the US[488] and Canada[489] as well, and although the authorities claim that 98% of the cases reach a settlement before trial, there are doubts as to the veracity of

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[483] Some platforms propose codes of conduct for the decision makers for their platforms but to date no universal code of conduct for "jurist's" is in place

[484] Clay Halton, "Wisdom of Crowds," Investopedia, 23 July 2019.

[485] Daniel Dimov, "Crowdsourced Online Dispute Resolution," Crowdsourced Online Dispute Resolution, Leiden University Center for Law and Digital Technologies, SIKS Dissertation Series No. 2017-17 (June 27, 2017).

[486] J. Buck, "Blockchain Oracles, Explained," Cointelegraph, October 18, 2017.

[487] Ulusal Yargi Agi Bilisim Sistemi [National Justice Network Informatics System], "Statistics," 15 February 2021.

[488] United States Courts, 'Judicial Caseload Indicators - Federal Judicial Caseload Statistics 2020'

[489] Courts statistics, https://www.statcan.gc.ca/en/subjects-start/crime_and_justice/courts

this claim[490]. Small to medium-sized conflicts typically end up in formal litigation. As a result, the litigants' resources are usually used excessively, resulting in stalemates in the procedures and an overflow of cases in the courts, which eventually reduces access to justice for both the litigating parties and the general public[491].

As a major solution to this backlog issue, small to medium-sized claims can be handled easily, rapidly, and cost-efficiently via self-enforcing blockchain arbitration mechanisms, and as such, the technology can be used to take the burden off courts and increase the efficiency of the judicial system[492].

Moreover, it is counterproductive from a merely utilitarian standpoint for the claimant to submit an application to a foreign court to settle minor cross-border claims and invest a substantial amount of time and money in laborious processes. Cross-border litigation and enforcement are very time and resource-intensive, and in the case of small claims, the expenses and delays involved are typically out of proportion to the ultimate outcome[493].

As a solution to this problem of proportionality, it can be argued that information is processed more quickly by blockchain dispute resolution than by an arbitrator. Thus, the opinion poll approach enables parties to voice their thoughts regarding a dispute without having to use legal jargon or divulge their identities[494]. In this sense crowd-sourcing decision making seems to be one of the most cost-efficient method of dispute resolution.

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[490] Theodore Eisenberg and Charlotte Lanvers, "What is the Settlement Rate and Why Should We Care?" (2009) 6(1) Journal of Empirical Studies 111.

[491] Mauricio Virues Carrera, Accomodating Kleros as a Decentralised Dispute Resolution Tool for Civil Justice Systems: Theoretical Model and Case of Application, 2022

[492] Aleksei Gudkov. Crowd Arbitration: Blockchain Dispute Resolution. P. 59–77

[493] Hörnle J. (2009) Cross-border internet dispute resolution. Cambridge: Cambridge University Press, p. 286.

[494] Martic D. Blind Arbitration Proposal for Anonymous Crowdsourced Online Arbitration. Sintelnet WG5 Workshop on Crowd Intelligence: Foundations, Methods and Practices. 2019. European Network for Social Intelligence, pp. 94–107.

Even if the prior arguments regarding the justness of the decision are taken into account, when one balances the options between letting go and accepting the loss they incurred, choosing traditional court or ADR mechanisms, or blockchain dispute resolution, one would opt for the latter. Even though it has certain obstacles, the overcome disputants opting for blockchain arbitration would at least possess a viable dispute resolution method that can be easily afforded.

Although arbitration is deemed to be relatively less costly compared to litigation, according to the Canadian Arbitration Association, the typical fee for an arbitrator range between 250$ and 800$ (plus applicable taxes[495]), and this fee makes up for a fraction of the total costs, therefore in the case of low to medium value disputes or micro claims neither traditional arbitration nor ODR seems to be an efficient method of dispute resolution.

It is generally the case that parties who have been aggrieved often choose to give up rather than pursue justice through inefficient means when they have minor claims or larger but modest claims. For these kinds of disputes, an oracle model based on crowd-sourced decision making has the possibility of granting access to justice.

Regarding the argument for the necessity of a centralized governing entity with the power to oversee private methods of dispute resolution and give legal effect judgments rendered through such mechanisms[496], legal anthropologist Simon Roberts[497] argues that based on the anthropological evidence, the attainment of order is possible without a central authority[498]. It is possible to draw an analogy between the decentralized and generally democratic process that the tribes studied by Simon Roberts employ and the decentralized dispute resolution methods that blockchain can offer.

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[495] Canadian Arbitration Association, https://canadianarbitrationassociation.ca/?page_id=19

[496] *Id*. at 362

[497] Richard Abel (2014) In memoriam – Simon Roberts (1941–2014), The Journal of Legal Pluralism and Unofficial Law, 46:3, 287-288

[498] Simon Roberts, Order and Dispute: An Introduction to Legal Anthropology (Penguin 1979).

An important point that connects the two situations is that in both cases, parties must be willing to resolve their disputes. Ortolani compares this system to the pre-Westphalian era, where jurisdiction was a private service provided by professionals and mainly based on disputing parties' consent, as previously discussed[499].

The arguments of Simon Roberts can be seen as a support for blockchain dispute resolution being a major player in the small claims scene as well since, in contrast to the complex commercial relationships in the modern global economy, disputes in tribal communities are comparatively easy and clear-cut which is an indication that blockchain dispute resolution is perfectly viable for resolving minor claims[500].

To summarize, blockchain-based dispute resolution systems have raised concerns regarding their ability to ensure impartiality, due process, and fair hearings, especially when compared to traditional arbitration. Critics argue that the use of oracles and economic incentives can lead to biased decision-making and herding behavior among jurors, ultimately affecting the validity of the decision. Furthermore, the lack of procedural safeguards and the absence of centralized oversight may undermine the overall integrity of these systems.

Despite these concerns, blockchain dispute resolution offers several advantages over traditional ADR and ODR mechanisms. It can alleviate the burden on courts by efficiently handling small to medium-sized claims, and it provides a cost-effective and accessible solution for cross-border disputes. By crowdsourcing decision-making, the process becomes faster and more efficient, making it a viable option for those seeking justice in minor claims or disputes.

The need for a centralized governing entity to oversee private dispute resolution methods is not a strict requirement, as anthropological evidence suggests that order can be achieved without a central authority. Blockchain dispute resolution, therefore, can still play a significant role in

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[499] Pietro Ortolani, "The Impact of Blockchain Technologies and Smart Contracts on Dispute Resolution: Arbitration and Court Litigation at the Crossroads" (2019) 24 Uniform Law Review 430, 432.

[500] Michael Buchwald, "Smart Contract Dispute Resolution: The Inescapable Flaws of Blockchain-Based Arbitration" (2020) 168 University of Pennsylvania Law Review 1369, 1422.

resolving small claims and providing access to justice, despite the limitations and concerns surrounding its implementation.

Now that we have discussed the reasons for the skepticism that blockchain dispute resolution faces and how these concerns may be overcome for its mainstream adoption, we will move on to an in-depth discussion about the arbitral legal order and how it is possible to achieve the goal of a genuinely decentralized transnational and self-sufficient legal order.

ii-) The Rise of a Blockchain Arbitral Legal Order

Up until the present, we have discussed the features, pros, and cons of blockchain arbitration, and as an *interim conclusion,* we have reached the understanding that due to the fundamental characteristics of blockchain arbitration, the current arbitral framework is, for the most part, ill-suited to accommodate a decentralized arbitration mechanism[501]. Although Blockchain adjudication and international arbitration have some common characteristics, such as the fact that they are both private, cross-border adjudication systems that function separately from state courts as distinct legal entities, it is not easy to encompass blockchain arbitration within any of the traditional narratives of international arbitration. It must therefore be seen as a pioneering and independent concept for resolving conflicts.

Although the incompatibilities between traditional arbitration and blockchain arbitration are not fatal, and a compliance regime can be instituted in the future via international organizations such as UNCITRAL, as it currently stands, the international framework is, for the most part, *malapropos* regarding the cryptographic form of the arbitration agreement[502], cryptographic awards and the lack of an arbitral seat and the enforcement mechanisms.

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[501] Derric Yeoh (Schellenberg Wittmer), "Is Online Dispute Resolution The Future of Alternative Dispute Resolution?" Kluwer Arbitration Blog, March 29, 2018.

[502] Maxime Chevalier, "From Smart Contract Litigation to Blockchain Arbitration, a New Decentralized Approach Leading Towards the Blockchain Arbitral Order," Journal of International Dispute Settlement, Volume 12, Issue 4, December 2021, Pages 558–584.

However, trying to adapt blockchain arbitration and the arbitral framework so that they can co-exist might not be the correct perspective to adopt. In fact, trying to assess under which conditions a cryptographic arbitral agreement might be binding before national courts or whether an award rendered on the blockchain can be enforced under national law may be futile. Rather than trying to reconcile the traditional with the novel, it is perhaps a better approach to acknowledge the existence of a separate blockchain arbitral legal order.

Given that blockchain arbitration can operate as an oracle that can trigger smart contracts, it is self-enforcing[503]. This sole fact grants blockchain arbitration autonomy and allows it to detach from traditional mechanisms of recognition and enforcement that require the oversight of a State. The only exception to this autonomy is that the blockchain economy is currently not totally detached from national legal orders because certain blockchain assets are nevertheless linked to the real world and thus to national legal orders[504]

In this temporary stage, before blockchain arbitration becomes a distinct legal creature, it can still be used in conjunction with national recognition and enforcement mechanisms to provide a hybrid transitionary solution. This hybrid model aims to utilize blockchain arbitration as a tool based on current legal frameworks without further statutory reforms. The principal advantage of this model is that it relies on widely accepted civil and commercial law notions[505].

An example in this regard is the Mexican case which we have previously discussed[506]; the crucial aspect of that case is that the arbitration agreement between the parties stated that after reviewing the parties' claims, the arbitrator would issue a procedural order and send it to a decentralized justice platform which would then provide a judgment using its blockchain arbitration protocol.

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[503] Amy J. Schmitz, Colin Rule, "Online Dispute Resolution for Smart Contracts," J. Disp. Resol. 103 (2019).

[504] Notheisen, B., Cholewa, J.B. & Shanmugam, A.P. Trading Real-World Assets on Blockchain. Bus Inf Syst Eng 59, 425–440 (2017).

[505] Mauricio Virues Carrera, Accomodating Kleros as a Decentralised Dispute Resolution Tool for Civil Justice Systems: Theoretical Model and Case of Application, 2022.

[506] *Id*. At 423

Given that the subject matter of the dispute was a real-world immovable property that only existed off-chain, the parties were obliged to connect their dispute to the Mexican legal order for enforcement reasons. The off-chain arbitrator issued an arbitral award that included the Blockchain Arbitral Award following the on-chain jury's verdict. By doing this, the off-chain arbitrator indirectly granted legal validity to the Blockchain arbitral award, which under the pre-existing rules of traditional arbitration might not have been seen as being enforceable in a court of law. In this sense, it could be argued that the enforcement of blockchain awards can be achieved through the use of traditional arbitration. In fact, Mauricio Virues Carrera argues in his report that this method can bridge the blockchain arbitral legal order and national legal orders[507].

The main factors connecting the blockchain arbitral order with national legal orders should be credited to the doctrine of *res judicata* and party autonomy[508]. As per article 19(1) of the Model Law[509], party autonomy allows for disputants to decide how the tribunal will conduct the arbitration as long as it complies with the relevant *lex arbitri*. Except for the public policy exception, there are no obstacles for parties to choose a boxing match or a game of rock paper scissors to resolve their disputes where the arbitrator acts as a referee. *Per analogiam,* nothing prevents parties from choosing to have a blockchain arbitration protocol reach a verdict regarding all or some aspects of their dispute, with an off-chain arbitrator then including the outcome in its arbitral award. This is demonstrated by the recent judgment from Mexican courts, which in the future can become a standard approach when dealing with blockchain arbitration cases that involve tangible assets[510].

Another legal method to properly incorporate the blockchain ruling into a conventional arbitral award is to invoke the *res judicata* doctrine. The *res judicata* doctrine dictates that

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[507] Mauricio Virues Carrera, Accomodating Kleros as a Decentralised Dispute Resolution Tool for Civil Justice Systems: Theoretical Model and Case of Application, 2022.

[508] Maxime Chevalier, "Arbitration Tech Toolbox: Is a Mexican Court Decision the First Stone to Bridging the Blockchain Arbitral Order with National Legal Orders?" Kluwer Arbitration Blog, March 4, 2022.

[509] UNCITRAL Model Law on International Commercial Arbitration (1985), with amendments as adopted in 2006.

[510] Pietro Ortolani, "The impact of blockchain technologies and smart contracts on dispute resolution: arbitration and court litigation at the crossroads" (2019) 24 Unif L Rev 430.

consistency must be sought where a similar dispute to the case at hand has been previously decided upon by a competent authority such as a national court or an arbitral tribunal[511]. In accordance with this doctrine, arbitrators are inclined to act in accordance with what has already been decided upon. To emphasize the importance of this doctrine, we might use the Hong Kong courts' judgment[512] where it was decided that an arbitral award that conflicted with an earlier judgment made by another arbitral tribunal and involving the same parties was manifestly invalid[513].

However, the tribunal that made the decision must be acknowledged as a valid authority by the tribunal before which the *res judicata* doctrine is invoked in order for the decision to have the authority of the *chose jugée*[514]. Ergo, if arbitrators adjust their perspective and recognize the existence of the blockchain arbitral order, there are no obstacles in admitting a cryptographic arbitral award under the *res judicata* doctrine. Such recognition would therefore grant a decision reached via blockchain arbitration an issue estoppel effect, which would, in turn, allow for its incorporation into an arbitral award to be enforced off-chain[515].

Even though this hybrid solution is useful for the time being, as we stand on the eve of the fourth industrial revolution whereby disruptive technologies such as blockchain and trends such as the Internet of Things are changing the way modern people live and work. It is stipulated that with the fourth industrial revolution, real-world goods and services will converge with the digital economy, thus transitioning our economy toward the Internet of Things[516]. As such, it is necessary to peak into the near future and imagine arbitration that is liberated from state intervention and influence.

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[511] German Derbushev, "Res Judicata and Arbitral Awards" (LLM Thesis, 29 March 2019).

[512] W v AW [2021] HKEC 2792; [2021] HKEC 2792.

[513] Philipp Hanusch, 'Hong Kong Court Finds That Award Which Is Inconsistent with Previous Award Concerning the Same Parties is Manifestly Invalid', Global Arbitration News Blog (November 24, 2021).

[514] Max Raskin, "The Law and Legality of Smart Contracts" (2017) 1:2 Georgetown L Tech Rev 305.

[515] *Id*. At 510

[516] Shua-Yan Chou, 'The Fourth Industrial Revolution: Digital Fusion with Internet of Things' (2018) 72(1) J Int Aff 107-120.

The theory of autonomous arbitration has been a debated topic for many years; certain authors claimed it is a mere fantasy that is impossible to achieve[517] , yet others have deemed this concept to be the ultimate goal of arbitration[518]. At the time, Professor Julian D.M. Lew[519] estimated that parties would have to necessarily rely on national courts for enforcement of arbitral awards; in fact, he stated that "inevitably there are tentacles that float down from the international arbitration domain to the national jurisdiction, to assure recognition of agreement to arbitrate, to give effect to awards of international tribunals and to obtain assistance for the international arbitration process when needed[520]".

Similarly, Prof Dr. Ralf Michaels[521] rejects the idea of autonomous arbitration simply because, according to him, "for arbitration to be totally autonomous, it must not rely on states at all, and must have its own enforcement mechanisms[522]". With the advent of the digital economy and blockchain technologies, autonomous arbitration is not only possible and achievable but also necessary. Today, international arbitration is governed by international treaties and national laws as such parties are forced to spend excessive amounts of resources if they seek legal remedies via arbitration, such as the cost of hiring experts like arbitration practitioners who are knowledgeable about both international and domestic laws.

The lack of affordable mechanisms for small to medium-sized claims means that an innumerable number of disputes pass without being resolved. To remedy this, the tentacles of state intervention must be slit, and an autonomous mechanism that permits parties to directly resolve

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[517] Ralf Michaels, 'Is Arbitration Autonomous' in C. L. Lim (ed), The Cambridge Companion to International Arbitration (Cambridge University Press, 2021) 115, 137.

[518] Julian D.M. Lew, QC, 'Achieving the Dream: Autonomous Arbitration' (2006) 22(2) Arbitration International 179-204.

[519] Julian D.M. Lew, QC is primarily a practicing lawyer and arbitrator. His research interest is international commercial arbitration and private international law. He has written extensively on many different aspects of international arbitration and trade law, and has authored and edited numerous books, and has written innumerable articles, on international arbitration.

[520] Sneha Vijayan, "Autonomous Arbitration in the Era of the Metaverse" (11 March 2022).

[521] Ralf Michaels has been a Director at the Institute since 2019. He is additionally Global Law Professor at the Queen Mary University of London and Professor of Law at the University of Hamburg.

[522] Ralf Michaels, "Is Arbitration Autonomous" in CL Lim, ed, The Cambridge Companion to International Arbitration (Cambridge University Press, 2021) 115 at 137.

disputes with minimal intervention must be formulated[523]. This remedy is achievable through the complete autonomization of arbitration; consequently, we claim that the future of access to justice lies with blockchain technologies.

The first step in comprehending the existence of a dispute resolution procedure independent from national legal norms is understanding the philosophy of arbitration. The proliferation of blockchain arbitration contributes to the trend of globalism[524] which also has implications for international arbitration. The blockchain arbitral order is legitimized by the fact that blockchain arbitration is moving toward a decentralized method of arbitration. The consensus amongst practitioners and academics has been the anchoring of the arbitral process in a national legal order[525] where the seat of arbitration gives legitimacy to the process[526].

This view eventually led to a multilocal vision of arbitration that bases the legitimacy of the arbitral process primarily on the prospective legal orders prepared to recognize the award rather than the legal seat of the arbitration[527]. Additionally, this view that recognizes the existence of the arbitral legal order has been adopted by some scholars[528] and jurisdictions[529]. This theory of autonomous arbitration suggests that international arbitration transcends national legal orders, and the award that is rendered does not owe its legitimacy to any national legal order[530].

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[523] Sneha Vijayan, Autonomous Arbitration in the Era of the Metaverse, March 11, 2022. From https://arbitrationblog.kluwerarbitration.com/2022/03/11/autonomous-arbitration-in-the-era-of-the-metaverse/

[524] Benyekhlef, Karim. Une possible histoire de la norme. Les normativités émergentes de la mondialisation. 2nd ed., Éditions Thémis, 2015.

[525] Mann, Frederick Alexander. "The UNCITRAL Model Law–Lex Facit Arbitrum." 1986, vol. 2, no. 3, Arb Int'l, pp. 241–251.

[526] Menon, Sundaresh. "Standards in Need of Bearers: Encouraging Reform from Within." Chartered Institute of Arbitrators: Singapore Centenary Conference, 2015.

[527] Paulsson, Jan. "Arbitration in Three Dimensions." 2011, vol. 60, Int Comp L Q, pp. 291–304.

[528] Gaillard, Emmanuel. "The Present–Commercial Arbitration as a Transnational System of Justice: International Arbitration as a Transnational System of Justice." Arbitration: The Next Fifty Years, edited by Albert Jan van den Berg, ICCA Congress Series No 16, 2012, pp. 66–73.

[529] Société Hilmarton Ltd c. Société Omnium de traitement et de valorisation (OTV), Cour de cassation (Cass) 1ere civ, 23 March 1994; Société PT Putrabali Adyamulia v Société Rena Holding et Société Moguntia Est Epice, Cour de cassation (Cass) 1ere civ, 29 June 2007.

[530] Mistelis, Loukas A. "Award as an Investment: The Value of an Arbitral Award or the Cost of Non-Enforcement." 2013, vol. 28, ICSID Rev, pp. 64–86.

The most logical argument against the idea of autonomous arbitration is that sooner or later, enforcement will be sought, and a national court will have to apply its own legal norms[531]. This argument is decimated by blockchain arbitration. As discussed previously, blockchain arbitration has built-in self-enforcement mechanisms, and as such, a cryptographic award does not require acceptance from national legal orders to produce effects[532]. Thus, having its legal seat on the blockchain, this form of arbitration can be seen as the most sophisticated expression of the theory of delocalized/autonomous arbitration[533], which may lead to its mainstream adoption[534]

Grounding the arbitral proceedings' legitimacy in the *lex mercatoria* to liberate it from the tentacles of state intervention by utilizing its self-enforcement capabilities and the decentralized crypto economy will enable blockchain arbitration to be recognized as the embodiment of transnational arbitration. Using *lex mercatoria* as an anchor to reinforce the legitimacy of blockchain arbitration is, however, a subject of debate. *Lex mercatoria* is frequently defined as an outcome of legal Darwinism for the society of merchants, which constructed autonomous transnational rules in response to the requirements of international trade[535] because they were dissatisfied with the limitations of state law[536].

Lex mercatoria has its ideological foundations in the archetype that national legal norms are lacking in terms of the needs of merchants. As a result, the inability of state laws to evolve to reflect the economic reality is what leads to the emergence of non-state norms such as Lex mercatoria[537]. Although the decentralized transnational theory of arbitration is not antagonistic to

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[531] J Metzger, "The current landscape of blockchain-based, crowdsourced arbitration" (2019) 19 Macquarie L J 81.

[532] Maxime Chevalier, From Smart Contract Litigation to Blockchain Arbitration, a New Decentralized Approach Leading Towards the Blockchain Arbitral Order, Journal of International Dispute Settlement, Volume 12, Issue 4, December 2021, Pages 558–584

[533] Pietro Ortolani, 'The Impact of Blockchain Technologies and Smart Contracts on Dispute Resolution: Arbitration and Court Litigation at the Crossroads' (2019) 24 Unif L Rev 430.

[534] Kadioglu, Cemre and Sadaff Habib. "Virtual Hearings to the Rescue: Let's Pause for the Seat?" Kluwer Arbitration Blog, 27 October 2020, https://arbitrationblog.kluwerarbitration.com/2020/10/27/virtual-hearings-to-the-rescue-lets-pause-for-the-seat/.

[535] Carbonneau, Thomas E. (ed). Lex Mercatoria and Arbitration: A Discussion of the New Law Merchant. Juris, 1998.

[536] E. Loquin, 'Où en est la lex mercatoria?' in Souveraineté étatique et marchés internationaux à la fin du 20ème siècle. A propos de 30 ans de recherches du CREDIMI. Mélanges en l'honneur de Philippe Kahn (Litec 2000) 23, 26.

[537] E. Gaillard, 'Transcending National Legal Orders for International Arbitration' in AJ van den Berg (ed), International Arbitration: The Coming of a New Age? (ICCA Congress Series No 17, Kluwer 2013) 371.

national legal systems, the inadequacies of the established norms of international arbitration are apparent when it comes to blockchain arbitration.

Certain authors have been inspired by the idea of a *lex mercatoria* for the decentralized legal landscape and coined the term *lex cryptographia* to refer to the legal norms that aspire to regulate blockchain ecosystems, including blockchain arbitration[538]. The blockchain arbitral legal order is therefore anchored in the *lex cryptographia,* which can be defined as a set of rules administered through self-executing smart contracts and DO's[539], and it can be seen as a natural progression of the *lex mercatoria*[540].

The growth of the crypto-economy with its new domains, such as NFTs, the Metaverse, and smart contracts, will give birth to practices that rely directly on *lex cryptographia*[541]. The doctrine of this collection of new legal norms is already present with concepts such as "the Rule of Code[542]" and "Code is Law[543]". This new law of blockchain will likely be determined mainly by practice. The consensus is that international arbitration and *lex mercatoria* work together in a "functional symbiosis" as the former dramatically influences the growth of the latter[544]. Similarly, it can be inferred that the shape of *lex cryptographia* with its new procedural rules will principally be derived from blockchain arbitration itself[545].

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[538] Aaron Wright and Primavera De Filippi, "Decentralized Blockchain Technology and the Rise of Lex Cryptographia", (2015).

[539] *Id*. At 538

[540] Thomas N Doty, 'Blockchain Will Reshape Representation of Creative Talent' (2019) 88 UMKC L Rev 351, 356.

[541] Max Raskin, 'The Law and Legality of Smart Contracts' (2017) 1 Georgetown L Technol Rev 305, 321; Werbach and Cornell (n 49) 319.

[542] *Id*. At 538

[543] Lawrence Lessig, Code and Other Laws of Cyberspace (Basic Books, Inc 1999) 6.

[544] Horia Ciurtin, 'A Quest for Deterritorialisation: The "New" Lex Mercatoria in International Arbitration', in Stavros Brekoulakis (ed), Arbitration: The International Journal of Arbitration, Mediation and Dispute Management, vol 85 no 2 (Chartered Institute of Arbitrators; Sweet & Maxwell 2019) 126–27.

[545] Maxime Chevalier, 'From Smart Contract Litigation to Blockchain Arbitration, a New Decentralized Approach Leading Towards the Blockchain Arbitral Order', Journal of International Dispute Settlement, Volume 12, Issue 4, December 2021, pp. 558–584.

In this regard, the Jur platform, which we have discussed previously, utilizes its "Arbitration Hubs" to develop the *lex cryptographia* of blockchain. In order to make the blockchain a more understandable and predictable legal system, the community creates its own standards for contract interpretation, compiles a list of best practices, and takes part in the production of a handbook of anonymized cases[546].

Jur is not the only platform that laid the first stones of *lex cryptographia*; in fact, CodeLegit, which is a technology compliance company, is creating a blockchain arbitration library that includes pre-made smart contracts which come with the "Code Legit Arbitration Certificate" after being audited and checked for compliance with ethical practices[547]. Moreover, platforms like OpenZeppelin[548] and GitHub[549] offer a depository for secure smart contract creation that meets previously established criteria.

Thus, it seems likely that in the near future, we will witness an expansion of the rules and regulations that will apply to arbitral procedures occurring on the blockchain. Through trial and error, the legal community will find solutions to the shortcomings that currently present themselves. *Lex cryptographia* will most likely develop a set of flexible rules adapted to the needs of blockchain users. As its predecessor *lex mercatoria* had developed despite the lack of enforcement by any sovereign power and a systematic opposition by the royal courts of the age, *lex cryptographia* will nevertheless continue to develop even if national courts show reluctance in accepting its validity[550]. It does not seem far-fetched to imagine a future where the principles of *lex mercatoria* will be adapted to blockchain law and constitute the building blocks of *lex cryptographia*. An example in this regard could be the "reasonable person test" which may

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[546] Jur Whitepaper. From https://jur.io

[547] Codelegit–Legal Libraries for Smart Contracts (Datarella) https://datarella.com/codelegit-legal-libraries-for-smart-contracts/.

[548] Build Secure Smart Contracts in Solidity (Open Zeppelin) https://openzeppelin.com/contracts/.

[549] Smart Contract (GitHub) https://github.com/smartcontractkit.

[550] Filippi and Wright (n 141) 45; Lawrence M Friedman, 'Erewhon: The Coming Global Legal Order' (2001) 37 Stan J Int Law 347, 356.

become, under the law of blockchain, the "reasonable coder test" when assessing the contractual clauses held in a cryptographic arbitration contract[551].

To summarize, blockchain arbitration and traditional international arbitration share certain characteristics, but the fundamental differences between them pose challenges to their coexistence within the current legal framework. Though a compliance regime can be developed in the future, the current international framework is largely ill-suited to accommodate blockchain arbitration's unique features, such as cryptographic agreements and awards, lack of an arbitral seat, and self-enforcement. Instead of trying to reconcile the two systems, it might be more fruitful to acknowledge the existence of a separate blockchain arbitral legal order.

In the meantime, a hybrid model can be employed to use blockchain arbitration within the existing legal framework without requiring statutory reforms. This model can take advantage of widely accepted civil and commercial law notions, and enforcement of blockchain awards can be achieved through traditional arbitration. By utilizing the doctrine of res judicata and party autonomy, this hybrid approach can serve as a bridge between the blockchain arbitral legal order and national legal orders. As the global economy transitions towards the Internet of Things, it becomes essential to consider an arbitration system that is free from state intervention and influence.

The future of access to justice may lie with blockchain technologies and the development of an autonomous arbitration system. As blockchain arbitration moves toward a decentralized method, it is legitimized by the growing trend of globalism and the use of lex mercatoria, which could evolve into lex cryptographia for the blockchain ecosystem. The growth of the crypto-economy will give rise to practices that rely directly on lex cryptographia, and through trial and error, the legal community will find solutions to the current shortcomings.

Before reaching the conclusion of our thesis, it is prudent to give an overview of this last title of our thesis. In this last title, we established that Blockchain technology and self-enforcing arbitration have the potential to transform traditional arbitration processes, automating contractual

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[551] Sarah Green, 'Smart Contracts, Interpretation, and Rectification' (2018) LMCLQ 234.

enforcement and dispute resolution. It was argued that by utilizing multi-signature addresses, private parties can establish dispute resolution processes without relying on state courts. However, concerns have been raised regarding the balance between enforcing creditor's rights and protecting debtor's interests in complex disputes. As blockchain arbitration becomes mainstream, addressing these concerns is crucial.

Various blockchain arbitration platforms have emerged, offering diverse dispute resolution options. The most prominent of these platforms is Kleros, which is an open-source protocol that uses game theory and crypto-economic incentives to encourage jurors to vote honestly. Mattereum focuses on legally transferable ownership of rights and tangible assets through a "Smart Property Register" and automated Ricardian contracts. Jur aims to create an efficient jurisdiction for the digital economy, leveraging existing legal frameworks and employing cryptographic tokens for voting. These platforms can be classified into five groups based on their functions and structures, demonstrating a range of options for various scenarios.

Critics of blockchain-based dispute resolution systems argue that they may struggle to ensure impartiality, due process, and fair hearings compared to traditional arbitration. However, blockchain dispute resolution offers several advantages, such as efficiently handling small to medium-sized claims, providing cost-effective solutions for cross-border disputes, and speeding up decision-making processes. Despite the limitations and concerns, blockchain dispute resolution can still play a significant role in resolving small claims and providing access to justice.

Currently, blockchain arbitration and traditional international arbitration share similarities but have fundamental differences that pose challenges to coexistence within the legal framework. A hybrid model can be employed to use blockchain arbitration within the existing legal framework without requiring statutory reforms. As the global economy transitions towards the Internet of Things, an arbitration system free from state intervention becomes essential. Blockchain technologies and autonomous arbitration systems may hold the key to the future of access to justice, legitimizing a decentralized method and evolving into lex cryptographia for the blockchain ecosystem.

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Conclusion

We began the present thesis with the goal of examining the interaction of technologies with alternative dispute resolution methods, namely international arbitration and the blockchain. Throughout our research and analysis, we had the opportunity to delve into the philosophy of arbitration by examining what the notion entails, how the rules and the agreement to arbitrate affect the procedure, and to what extent the jurisdictional authority of states influences arbitral autonomy.

As per the established doctrine of arbitration, the concept of autonomy plays a massive role in an arbitral process. The contemporary framework of arbitration and the international conventions that regulate international arbitration equally seem to indicate the importance of party autonomy in arbitration. As we examined these notions, legal instruments, and structures, it became apparent that an ideological divergence has occurred over the past decades, and arbitration is by no means an expectation to the sectors and industries affected by this shift in perception[552]. Our research led us to acknowledge that the Westphalian understanding of centralization and state sovereignty is losing prominence. The contrast between local and global, national and transnational, is becoming clearer by the day. The rise of individualism that defines our generation, as opposed to collectivism, forms the backbone of this perceptual shift. Consequently, the destination on the horizon seems to be a post-Westphalian society marked by self-regulation[553]. As a byproduct of its ideological foundations, such a society would overcome the barriers of physical distance, language, and territorial legislation.

Consequently, the integration of blockchain technology into the field of arbitration has the potential to dramatically reshape the dispute resolution landscape, revolutionizing traditional arbitration processes and offering a more efficient and accessible system for parties involved in disputes. This thesis has delved into the current state of arbitration, examining its benefits, drawbacks and exploring the implications of online dispute resolution and the transformative power of blockchain technology on arbitration. As we move towards a more interconnected and digital world, the impact of these

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[552] Blatter, J., & Schlenker, A. (2013). Between nationalism and globalism: Spaces and forms of democratic citizenship in and for a post-Westphalian world. Working Paper Series "Global Governance and Democracy," 6. University of Lucerne, Department of Political Science.

[553] Rodrik, D. (2011). The Globalization Paradox: Democracy and the Future of the World Economy. Norton, 200-201.

innovations on the future of arbitration is immense, making it essential for legal professionals, policymakers, and scholars to understand and adapt to these changes.

The traditional benefits of arbitration, such as neutrality, speed, finality, expertise, flexibility, and confidentiality, are being further enhanced by the incorporation of emerging technologies like blockchain. Blockchain technology offers a more efficient, resilient, and confidential approach to dispute resolution by leveraging its decentralized nature and cryptography. It can address key challenges in arbitration, such as cybersecurity, jurisdiction, and enforceability, and provide a more efficient form of transnational arbitration. As the digital economy grows and cross-border transactions become increasingly common, the need for effective and efficient international arbitration mechanisms becomes even more pressing. Blockchain technology, with its decentralized and trustless nature, has the potential to significantly streamline arbitration processes and reduce the costs and complexities associated with traditional dispute resolution methods.

Moreover, the adaptability of the international arbitration framework, particularly in light of disruptive technologies like blockchain, is crucial in ensuring its continued relevance and effectiveness. The thesis has explored the role of key legal instruments, such as the New York Convention, in accommodating emerging technologies and the challenges they present to traditional arbitration processes[554]. It has discussed the lack of explicit requirements for electronic arbitral awards and the uncertainty and potential risks this creates for non-recognition and non-enforcement of such awards.

Furthermore, the thesis has highlighted the importance of harmonizing international standards and best practices to ensure the legal recognition and enforceability of blockchain-based arbitration awards; emphasizing the need for a treaty-based standard for the recognition and enforcement of electronic arbitral awards that combine electronic arbitration processes with physical arbitral awards. By analyzing the interplay between emerging technologies like blockchain and existing legal structures, the thesis underscores the importance of understanding the relationship between these technologies, current legislative frameworks, and the future of arbitration.

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[554] Michaelson, P. L., & Jeskie, S. A. (2020). Arbitrating Disputes Involving Blockchains, Smart Contracts, and Smart Legal Contracts. Disp Resol J, 74, 129.

The thesis argued that Blockchain technology offers a more efficient, resilient, and confidential approach to dispute resolution by leveraging its decentralized nature and cryptography, thereby enhancing the aspects of arbitration that are attractive to disputants. As the world continues to become more interconnected and international transactions increase in frequency, the need for an efficient and secure dispute-resolution mechanism has never been more significant. Blockchain technology has the potential to revolutionize the arbitration process, offering a faster and more cost-effective solution while maintaining the key benefits of traditional arbitration[555].

This thesis has examined various blockchain arbitration platforms, including Kleros[556], Mattereum[557], and Jur[558], demonstrating the diversity of approaches and structures being employed in this emerging ecosystem. Each platform has its unique strengths and focuses. Kleros, for example, uses game theory and crypto-economic incentives to encourage honest voting by jurors, while Mattereum emphasizes the legal transferability of rights and tangible assets on a blockchain using a "Smart Property Register" and automated Ricardian contracts. Jur, conversely, aims to create an efficient jurisdiction for the digital economy by leveraging existing legal frameworks and employing cryptographic tokens for voting. These diverse platforms showcase the potential of blockchain technology in providing a range of dispute resolution options tailored to various scenarios and needs.

Incorporating blockchain technology into arbitration also presents its challenges, such as ensuring impartiality, due process, and fair hearings. The use of oracles, economic incentives, and crowd intelligence can give rise to concerns regarding biased decision-making and herding behavior among jurors[559]. However, the development and refinement of blockchain arbitration platforms can address these concerns and create robust systems that maintain the core principles of fairness and justice. By continuing to explore the potential of blockchain technology in dispute resolution and adapting existing legal frameworks to accommodate this new landscape, arbitration can evolve to meet the changing

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[555] Zekos, G. I. (2022). From ADR to ODR. In Advanced Artificial Intelligence and Robo-Justice (pp. 261-284). Springer, Cham.

[556] Patiño, G. C. (n.d.). Lex Cryptographia Guidelines for Ensuring Due Process in Transnational Blockchain-Based Arbitration: Study on the Kleros Model. Transnational Dispute Management (TDM). From https://www.transnational-dispute-management.com/journal-advance-publication-article.asp?key=1923

[557] Mattereum. (2018, October). Summary White Paper.

[558] Jur. (2022, April). The Network State for the Digital Economy.

[559] Buck, J. (2017, October 18). Blockchain Oracles, Explained. Cointelegraph.

needs of a globalized and digitized world, providing efficient and cost-effective solutions for cross-border disputes.

Despite the potential of blockchain arbitration, there are significant challenges that must be addressed. As we have discussed, one of the primary concerns is the validity and enforceability of cryptographic arbitration agreements and awards within the existing legal framework. Arbitration laws and conventions, such as the New York Convention, are primarily designed to accommodate traditional arbitration procedures, and the incorporation of emerging technologies like blockchain may create uncertainty and potential risks for non-recognition and non-enforcement of blockchain-based awards. The existing legal framework must be examined, and effort should be given to adapting the legislative framework to ensure that cryptographic signatures, smart contracts, and other blockchain innovations can be recognized and enforced by national courts and international conventions.

Another challenge that must be addressed is striking a balance between enforcing a creditor's rights and protecting a debtor's interests in complex disputes. As blockchain arbitration platforms become more prevalent, there is a risk of oversimplification or lack of nuance when dealing with intricate legal issues. This could potentially undermine the rights and interests of parties involved in disputes. To prevent this, it is crucial to establish guidelines and best practices for blockchain arbitration that encompass a wide range of potential disputes, ensuring that both creditors' and debtors' rights are protected. Additionally, the expertise and impartiality of arbitrators in blockchain-based arbitration must be assured to maintain fairness and due process in resolving disputes.

To address these challenges, the thesis suggests exploring a hybrid model that can bridge the gap between the existing legal framework and the emerging blockchain arbitral legal order[560]. This model would utilize widely accepted civil and commercial law notions and enforcement through traditional arbitration mechanisms. By integrating the advantages of blockchain technology with the reliability and enforceability of the traditional arbitration system, this hybrid model could provide a comprehensive and legally sound solution for dispute resolution in the digital age. By fostering cooperation and harmonization between the traditional arbitration system and emerging blockchain

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[560] Virues Carrera, M. (2022). Accommodating Kleros as a Decentralized Dispute Resolution Tool for Civil Justice Systems: Theoretical Model and Case of Application.

arbitration platforms, this model could pave the way for a more efficient, secure, and accessible dispute resolution landscape.

The future of access to justice may well be shaped by blockchain technologies and the development of autonomous arbitration systems[561]. As the global economy transitions towards the Internet of Things and an increasingly interconnected digital landscape, it is essential to consider an arbitration system that is free from state intervention and influence. In this new era, the traditional arbitration system, which often relies on state recognition and enforcement mechanisms, may need to adapt to accommodate the unique characteristics of decentralized and technology-driven dispute resolution processes. By embracing these technological advancements, the international arbitration community can contribute to the development of a more dynamic and versatile dispute resolution ecosystem, catering to the diverse and evolving needs of parties engaged in digital transactions.

The growth of the crypto-economy, along with the emerging lex cryptographia, provides a foundation for a new legal order that will evolve to address the current shortcomings of blockchain arbitration. This new legal order could consist of decentralized and self-regulating mechanisms, allowing for more streamlined and efficient dispute-resolution processes that operate beyond state borders[562]. It may also involve the development of specialized legal norms and principles that cater specifically to disputes arising from digital transactions and blockchain-based contracts. As *lex cryptographia* continues to develop, it is crucial for the international arbitration community to actively participate in shaping its principles and norms, ensuring that they align with the core values of fairness, impartiality, and due process.

In light of these developments, the international arbitration community must strive to embrace, adapt, and shape the future of dispute resolution, ensuring that access to justice remains accessible, efficient, and equitable for all parties involved. This may include the adoption of new technologies, the development of innovative dispute resolution processes, and the collaboration with legal experts and technologists to design a comprehensive framework for blockchain arbitration. By actively engaging in

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[561] Ortolani, P. (2019). The Impact of Blockchain Technologies and Smart Contracts on Dispute Resolution: Arbitration and Court Litigation at the Crossroads. Unif L Rev, 24, 430.

[562] Janićijević, D. (2005). Delocalization in International Commercial Arbitration. Law and Politics, 3(1), 63-71.

the development of this new frontier, the international arbitration community can help build a more just and inclusive global dispute resolution landscape that is prepared to meet the challenges and opportunities presented by the rapidly evolving digital economy.

It is also essential to recognize the challenges of implementing blockchain arbitration within the existing legal framework, such as the New York Convention. The Convention's territorial approach may conflict with the decentralized nature of blockchain, as it primarily relies on the recognition and enforcement of arbitral awards by state courts. Blockchain arbitration, on the other hand, operates beyond geographical boundaries and often without the need for state intervention. This inherent incompatibility has led us to consider the delocalization theory, which argues that arbitration should be subject to self-regulation and party autonomy, allowing for the emergence of dispute-resolution mechanisms that are not tethered to any specific jurisdiction[563].

The delocalization theory underscores the need to explore self-contained legal systems anchored in the blockchain. These legal systems could potentially exist outside of the purview of any particular nation-state, thereby avoiding the constraints imposed by the existing legal frameworks. Developing such self-contained legal systems may involve the creation of new rules and principles tailored specifically to the unique characteristics of blockchain arbitration. Furthermore, these new legal systems could incorporate the use of smart contracts and decentralized autonomous organizations (DAOs) to facilitate the execution of agreements and the resolution of disputes. By embracing the concept of delocalization, the international arbitration community can help pave the way for the development of alternative legal frameworks that cater to the evolving needs of parties engaged in digital transactions.

In light of the potential future of international arbitration as a separate legal order, it is crucial for stakeholders in the arbitration community to actively engage in the development and refinement of this emerging landscape. This may involve the collaboration of legal experts, technologists, and dispute resolution professionals in designing comprehensive and adaptable frameworks that can accommodate the unique challenges and opportunities presented by blockchain arbitration. By actively participating in the formation of new legal systems and embracing the potential for self-regulation and party

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[563] Michaels, R. (2013). Dreaming Law without a State: Scholarship on Autonomous International Arbitration as Utopian Literature. London Review of International Law, 1(1), 35.

autonomy, the international arbitration community can help shape the future of dispute resolution in a manner that is more aligned with the rapidly evolving digital economy.

As blockchain technology continues to evolve, it is crucial for legal professionals and policymakers to stay informed and adapt to the changes this technology brings. Ensuring compatibility between blockchain arbitration and existing legal structures will require harmonized international standards and best practices that take into account the unique characteristics and challenges of decentralized dispute resolution. This may involve revising existing arbitration laws, drafting new legislation, or creating model rules that can be adopted and adapted by various jurisdictions. Legal professionals must be prepared to embrace innovative approaches to dispute resolution and familiarize themselves with the technical aspects of blockchain technology to serve their clients better and contribute to the development of this emerging field.

One of the innovative approaches to blockchain arbitration involves the use of oracles and economic incentives. Oracles are trusted third parties that provide external information to smart contracts, enabling these contracts to resolve disputes based on real-world data. Financial incentives, such as token rewards and penalties, can encourage participants in the dispute resolution process to act honestly and diligently. However, these approaches also raise potential concerns related to bias, herding behavior, and the lack of procedural safeguards. Legal professionals must be prepared to address these concerns by developing appropriate checks and balances and ensuring that the principles of fairness, transparency, and due process are upheld in blockchain arbitration proceedings.

Finally, legal professionals must actively engage in interdisciplinary collaborations with technologists, academics, and policymakers to help shape the future of blockchain arbitration. By participating in the ongoing discourse and contributing their legal expertise, they can help to ensure that the development of blockchain arbitration is not hindered but rather guided by a comprehensive understanding of its implications for the broader legal landscape. This collaborative approach will be essential in addressing potential pitfalls, refining existing legal frameworks, and developing new standards that can accommodate the unique challenges and opportunities presented by blockchain technology. In doing so, legal professionals can play a crucial role in ensuring that blockchain arbitration remains an accessible, efficient, and equitable means of dispute resolution for all parties involved.

The potential of blockchain arbitration to revolutionize the field of dispute resolution is immense, but it also presents significant challenges. As the world becomes more interconnected through technology, the legal community must be prepared to adapt and shape the future of arbitration, ensuring that access to justice remains available, efficient, and equitable. To do so, legal professionals must actively engage in interdisciplinary collaborations, stay informed about technological developments, and work towards integrating blockchain arbitration within the existing legal frameworks.

Embracing and understanding the relationship between existing legislative frameworks, online dispute resolution, and blockchain arbitration is essential in fostering the growth and widespread acceptance of these innovative approaches to dispute resolution. This entails recognizing the potential advantages of blockchain arbitration, such as increased efficiency, reduced costs, and enhanced data security, while also addressing the challenges it presents, including concerns about the validity and enforceability of arbitration agreements and awards, the protection of procedural safeguards, and the harmonization of international standards. By working together, legal professionals, technologists, and policymakers can create an environment where blockchain arbitration can flourish and contribute to the broader evolution of dispute resolution.

Ultimately, the successful integration of blockchain arbitration into the global legal landscape will depend on the ability of stakeholders to adapt, innovate, and collaborate. Legal professionals must be willing to embrace change, acquire new skills, and contribute their expertise to the ongoing development of blockchain arbitration. Technologists must work closely with legal experts to ensure that innovations are compatible with existing legal structures and principles. And policymakers must be open to revising existing laws and drafting new legislation that reflects the changing needs of the global community.

This thesis has demonstrated the immense potential of blockchain technology in transforming the field of international arbitration and paving the way for a decentralized and efficient arbitral legal order. As the world becomes increasingly interconnected through digital innovations, it is essential for legal professionals, technologists, and policymakers to embrace the opportunities presented by

blockchain arbitration, addressing the challenges it poses and ensuring that access to justice remains available, efficient, and equitable for all parties involved.

The establishment of a blockchain arbitral legal order requires a collaborative approach, with stakeholders working together to harmonize international standards, adapt existing legal frameworks, and develop innovative solutions to overcome the inherent challenges of integrating blockchain arbitration within traditional systems. By successfully incorporating blockchain arbitration into the global legal landscape, we can usher in a new era of dispute resolution, one that is decentralized, secure, and more aligned with the needs of an increasingly digital and interconnected world. This shift towards a blockchain-based arbitration system will ultimately enhance access to justice and contribute to the evolution of arbitration as a whole, ensuring its continued relevance and effectiveness in resolving disputes across borders.

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- Article 189(1) of the Swiss Private International Law Act

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- Article 2(10), Directive 1999/93/EC

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- Article 2(6), Directive 1999/93/EC

- Article 2(9), Directive 1999/93/EC

- Article 35(2)(1) ICA-ML 2006

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- English Arbitration Act 1996, s 52(3)

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