Intelligent arbitration of DAOs disputes

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Abstract

Smart arbitration in disputes involving Decentralized Autonomous Organizations (DAOs) utilizes blockchain technology and smart contracts to provide efficient solutions for resolving conflicts within the complex digital economy. DAOs, as decentralized entities operating on blockchain protocols, present a new model of governance and contracting that challenges traditional legal frameworks. Given their decentralized and jurisdictionally non-affiliated nature, these organizations encounter difficulties in determining jurisdiction in cases of dispute. However, smart arbitration, relying on automation and transparency provided by smart contracts, can facilitate the swift and effective enforcement of arbitral awards. It offers solutions that transcend the traditional boundaries of the judiciary, allowing arbitration procedures to be executed according to the codes programmed into smart contracts, thereby affording disputing parties access to fair resolutions without the need for traditional litigation. This approach opens new horizons for justice in the digital age and proposes innovative alternatives for addressing contemporary legal challenges.

Keywords: digital, decentralized organizations, blockchain, smart contracts, dispute.

التحكيم الذكي في منازعات DAOs

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الملخص:

التحكيم الذكي في منازعات المنظمات اللامركزية المستقلة DAOs يستخدم تكنولوجيا Block chain والعقود الذكية لتوفير حلول فعالة لتسوية النزاعات ضمن بيئة الاقتصاد الرقمي المعقد، إذ أن (Daos) ككيانات لامركزية تعمل على أساس بروتوكولات Block chain، تقدم نموذجًا جديدًا للحوكمة والتعاقد الذي يتحدى الأطر القانونية التقليدية، ونظرًا لطبيعتها المجهولة وعدم ارتباطها بأي ولاية قضائية محددة، تواجه هذه المنظمات صعوبات في تحديد الاختصاص في حالات النزاع، الا أن التحكيم الذكي القائم على الأتمتة والشفافية التي توفرها العقود الذكية، يمكن أن يسهل تنفيذ القرارات التحكيمية بشكل سريع وفعال، إذ يقدم حلولاً تتجاوز الحدود التقليدية للقضاء، حيث يمكن تنفيذ الإجراءات التحكيمية وفقًا للأكواد المبرمجة في العقود الذكية، مما يمنح طرفي النزاع إمكانية الوصول إلى حلول عادلة دون الحاجة للتقاضي التقليدي، هذا النهج يفتح آفاقًا جديدة للعدالة في العصر الرقمي ويقترح بدائل مبتكرة للتعامل مع التحديات القانونية المعاصرة.

الكلمات المفتاحية: الرقمي، منظمات مستقلة، بلوك تشين، عقود ذكية، منازعات

Introduction

Smart contracts have emerged as a revolution in how individuals enter into agreements, embodying digital agreements between parties. The decentralized and distributed characteristics of blockchain technology, coupled with the anonymous nature of cryptocurrency transactions, have created a new economy independent of nation-states, known as the "crypto economy." The use of this technology has led to complexities in the application of private international law rules, as transactions on public blockchains are usually not tied to the jurisdiction of a specific state.

Smart contracts enable the creation of digital entities that operate independently and are decentralized and are essential in the crypto economy, especially in Decentralized Finance (DeFi)[1]. The experience of the first Decentralized Autonomous Organization (DAO) revealed significant challenges in resolving disputes between parties with divergent interests, raising issues regarding the risks of disputes and legal ambiguity in blockchain transactions.

First, we will explore the concept of DAOs and their role in the crypto economy, focusing on whether they are considered legal entities and how their legal personality and litigation capacity can be determined in national courts. We will also discuss how to regulate the jurisdiction of disputes related to DAOs, including administrative disputes and those arising from contractual relationships with third parties.

Given the difficulties in identifying location and identity in the crypto economy, we will review the use of digital mechanisms for dispute resolution that have proven effective in e-commerce. These mechanisms, inspired by Online Dispute Resolution (ODRs) [2], solutions, have been developed to address the specific challenges of the crypto environment. We will also examine how these models can

assist in avoiding denial of justice by providing effective access to justice for DAOs and assessing the fairness of these decisions.

Significance of the Issue: The reality reveals significant challenges in providing reliable judicial protection when issues relate to the use of blockchain technology. The uncertainty regarding the jurisdiction of state courts over disputes involving Decentralized Autonomous Organizations (DAOs) poses a significant problem; often, courts lack jurisdiction because the links to the blockchain environment are insufficient. Parties to a smart contract can include a choice of forum clause in the code to agree to submit any future disputes to a specific state court, providing a forum for those disputes involving disassociated DAOs or entities within the chain not subject to a substantive jurisdiction. However, this solution is theoretical in nature, as no state officially recognizes the legal scope of disassociated DAOs and entities within the chain using pseudonyms. As a result, even with a state nexus, courts with jurisdiction may fail to effectively provide justice, preventing the aggrieved party from seeking compensation.

This situation underscores the need to explore alternatives to formal justice in resolving disputes involving DAOs, leading us to inquire into the most suitable mechanism for settling this type of dispute, one that benefits from blockchain technology and smart contracts. With assets such as cryptocurrencies, DAO governance tokens, or non-fungible tokens (NFTs) [3], stored in digital wallets, new dispute-resolution mechanisms can be developed to enforce decisions on these assets.

Research Plan: We will divide this research into two main sections, preceded by an introduction and followed by a conclusion.

Section One: Definition of DAOs Disputes and Procedures for Smart Arbitration in Them

Subsection One: Definition of DAOs Disputes

Subsection Two: Procedures for Smart Arbitration in DAOs Disputes

Section Two: Implementation and Evaluation of Smart Arbitration Decisions in DAOs Disputes

Subsection One: Extent of Implementation of Smart Arbitration Decisions in DAOs Disputes

Subsection Two: Evaluation of Smart Arbitration in DAOs Disputes

Section One
Definition of DAOs Disputes and Procedures for Smart Arbitration in Them

In the current epoch of digital transformation, we have witnessed the emergence of pioneering technologies poised to reshape our interactions with the world. Prominent among these innovations is blockchain technology, serving as the cornerstone for novel advancements in contractual frameworks and institutional dynamics. Decentralized Autonomous Organizations (DAOs) epitomize this progress, presenting a paradigm shift in governance and asset administration characterized by decentralization and transparency. Within this discourse, we shall elucidate the concept of DAOs and their distinctive contributions to the digital economy. Our focus will encompass their establishment, administration, and the legal hurdles they confront. Furthermore, we will delve into the mechanisms underpinning smart arbitration within these entities, highlighting their capacity to offer efficacious resolutions transcending conventional realms of justice and litigation. Consequently, our examination shall be structured into two main sections: the initial segment shall entail an exploration of DAOs, followed by an exposition of the procedures governing smart arbitration in disputes within DAOs.

Subsection One
Definition of DAOs Disputes

DAOs, which stands for Decentralized Autonomous Organizations, are entities that rely on blockchain technology to facilitate collective action without the need for traditional centralized authority. DAOs leverage smart contracts to execute programmed rules and make decisions based on member voting, aiming to

enhance transparency and democracy in resource management and decision-making[4].

Where are they located? Decentralized Autonomous Organizations (DAOs) are not geographically bound as they rely on blockchain technology, operating online and accessible from anywhere in the world. Members of DAOs can come from various countries and collaborate online, with the organization and its decisions managed through the blockchain. This allows for decentralized operation and global distribution without the need for a central headquarters.

Decentralized Autonomous Organizations (DAOs) exhibit diverse functions and objectives contingent upon the distinctive nature and mission of each entity. Broadly speaking, DAOs serve a multitude of functions, among which the most pivotal encompass:[5]

1- **Democratic Governance:** DAOs provide a governance system that allows all members to vote on important decisions, such as how to spend funds and guide policies.

2- **Asset Management**: Some DAOs manage financial or digital assets, with members making collective decisions on investments and budgets.

3- **Project and Initiative Organization**: Many DAOs are used to organize and fund projects and initiatives that serve their community or broader organizational goals.

4- **Profit Distribution:** In some cases, DAOs distribute profits among their members based on contribution or investment.

5- **Collaboration and Innovation**: DAOs facilitate collaboration among individuals from different parts of the world, supporting innovation and idea exchange.

6- **Contract Automation**: Many DAOs use smart contracts to automatically execute decisions based on programmed rules and voting results, increasing efficiency and transparency.

In general, DAOs aim to reduce the need for traditional organizational structures and improve democracy and transparency in decision-making, leveraging blockchain technology to enhance security and reliability.

Since the inception of Bitcoin, blockchain technology enthusiasts have envisioned a new model for digital companies, where their management rules are distributed across the blockchain network to ensure security and resistance to hacking. Cryptocurrencies act as shares in these digital companies, serving as assets for the company. This concept led to the emergence of the "virtual company," a new model based on the security, speed, and accuracy of computer code, aiming to minimize human intervention to reduce errors and corruption.

However, the Bitcoin protocol did not support encoding such complex rules, leading to the development of a new type of blockchain. Entrepreneur and developer Vitalik Buterin participated in the development of the Ethereum blockchain in 2013, which allowed cryptocurrency transactions to be subjected to a set of rules through a mechanism called "smart contracts." Smart contracts were originally proposed by computer scientist and legal researcher Nick Szabo in 1994, defining them as "computerized transaction protocols that execute the terms of a contract." Smart contracts programmed on the Ethereum blockchain automate currency transfers and can also be programmed to gather information from an external source, called an "oracle." To initiate cryptocurrency transfers, some countries have decided to legally recognize certain smart contracts, while their legal scope remains disputed in other countries. According to Buterin, DAOs are a natural evolution of smart contracts, forming "long-term smart contracts" that contain assets and encode the internal regulations of an entire organization. The difference between DAOs and smart contracts is that DAOs have an internal governance system that regulates how their encrypted assets

are managed, while smart contracts are simple rules for asset transfers upon meeting specific conditions[6].

DAOs are defined as independent entities operating programmatically on a distributed system that allows a network of participants to manage resources transparently and according to defined rules. Participants can only be identified through their public key or wallet address, rarely associated with the "real" identity of individuals except in cases where services requiring customer identification are used. The primary barrier to joining DAOs is economic, meaning anyone from anywhere in the world can become a member if they can provide the necessary economic resources. For DAOs to function effectively, their architectural structure must be designed to accommodate this key feature, enabling interaction and control of resources in an organized and transparent manner according to the rules set by the independent program[7].

This structure grants DAOs the ability to operate automatically without continuous human intervention, reducing risks associated with human errors and potential corruption. With technological advancements, particularly with the advancement of artificial intelligence, it may become possible in the future for DAOs to manage themselves fully and independently without human intervention in their daily operations. These developments open new doors of possibilities in virtual companies and enhance the effectiveness of blockchain as a tool for governance and asset management securely and transparently.

The Second Issue: Challenges and Risks, Despite the promising benefits offered by Decentralized Autonomous Organizations (DAOs) and smart contract technology, they also face various challenges and risks:

1-**Security and Technical Challenges**: Although blockchain technology is considered secure, it is not immune to electronic attacks and technical vulnerabilities. DAOs may encounter

challenges in securing the network and preventing advanced attacks.

2-**Regulatory and Legal Issues**: Legislative bodies face challenges in developing a legal framework to regulate Decentralized Autonomous Organizations and positions on the legality of smart contracts and their control vary among countries and regulatory authorities worldwide.

3-**Control and Democracy**: While DAOs aim to enhance democracy, they may face challenges in achieving a balance between democratic governance and effective control, with potential issues in voting processes and decision-making.

4-**Internal Organization and Conflicts**: DAOs may encounter challenges in managing internal organization and resolving conflicts among members, especially in the absence of traditional organizational structures.

5-**Flexibility and Technological Evolution**: DAOs must be flexible and able to adapt to technological advancements and the changing needs of members, requiring continuous updates to software and rules.

6-**Financial and Economic Stability**: DAOs may face challenges in managing financial and economic stability, especially amidst market fluctuations and digital value changes.

7-**Despite these challenges**, Decentralized Autonomous Organizations continue to offer exciting and innovative opportunities for collaboration and effective resource management, potentially contributing to achieving further transparency and democracy in various fields.

The governance rules of DAOs are recorded in smart contracts, benefiting from the stability of the blockchain infrastructure to automate certain governance elements such as "reducing operational costs and improving internal controls while increasing the overall transparency of the organization at the same

time." When members wish to propose a vote, it must be presented to the community, which decides whether to accept or reject it, allowing collaboration among members to achieve common goals [8].

Their participation is ensured through encrypted economic incentives that reward beneficial behavior. These mechanisms are inspired by those that allow public blockchain networks like Bitcoin and Ethereum to function as global networks. Furthermore, smart contracts containing DAO governance rules are spread across all computers in the blockchain network, and no individual, entity, or government has the right to update or change the code in a way that contradicts the governance rules. Therefore, they are borderless, independent, and not subject to regulation[9].

"The DAO" was the first widely recognized Decentralized Autonomous Organization (DAO) and emerged in 2016 as an investment fund on the Ethereum blockchain platform. This project allowed participants to submit projects for funding, with decision-making distributed among about 10,000 token holders of the DAO. In a short period, the project raised investments worth $150 million, making it the largest crowdfunding project at the time. The founders' goal was to create an organizational structure similar to institutions but without relying on traditional structures, replacing traditional agency relationships with governance rules built on cryptography. Unfortunately, a technical flaw was exploited by a malicious actor, leading to the draining of a significant portion of the funds, resulting in the collapse of the project and highlighting the risks associated with blockchain technology[10].

As there is no governmental authority responsible for DAOs or blockchain, it was difficult for investors to recover their funds. Since a significant portion of Ethereum was invested in the DAO, the breach posed a threat to the entire blockchain network. Key players in the Ethereum community decided to reverse the

transactions made by the attacker to protect the interests of the Ethereum community, leading to the issuance of a version of the Ethereum blockchain that does not contain the attacker's transactions. Consequently, the network split. Despite The DAO project's failure, it provided valuable lessons for the blockchain community, emphasizing the importance of stability and security in decentralized networks and the need for mechanisms to settle disputes that align with smart contracts and the needs of DAO users[11].

Decentralized Autonomous Organizations (DAOs), rooted in blockchain technology, embody organizational frameworks facilitating democratic and transparent decision-making through member voting. Disputes within DAOs may arise from various catalysts, including:

1- Disagreements on decisions: Given DAOs' reliance on a voting mechanism, discrepancies may emerge among members concerning made decisions or the organization's trajectory.

2- Governance complexities: Ambiguities regarding governance protocols or their implementation may spark participant disputes.

3- Technical impediments: Software code glitches or vulnerabilities inherent in DAO operations can precipitate legal or financial dilemmas.

4- Integrity and credibility concerns: Despite striving for transparency, apprehensions regarding distrust or manipulation of votes may foment internal conflicts.

Resolving such disputes proves arduous due to DAOs' decentralized nature and the absence of conventional hierarchical structures typical in traditional corporate settings[12].

Therefore, DAOs have been updated, and many of these decentralized organizations (DAOs) have been created. DAOs, or Decentralized Autonomous Organizations, are organizational structures that rely on blockchain technology and allow members to

vote on important decisions democratically and transparently. Disputes in DAOs can arise for several reasons, including disagreements on decisions, governance issues, technical challenges, transparency, and trust issues. These disputes can be challenging to resolve due to the decentralized nature of DAOs and the absence of traditional power structures found in conventional companies.

There are various types of platforms considered ready-made models for DAOs, varying in their functions between managing charities, independent networks, or investment funds. These DAOs provide alternatives to traditional company structures, enabling users worldwide to participate in economic and social activities through decentralized organizational structures. DAOs have become a significant part of the rapidly evolving Decentralized Finance (DeFi) system, with its value reaching about $100 billion, expanding the use of blockchain beyond simple value transfer to complex financial applications. These platforms rely on artificial intelligence, where disputes are completely settled in a smart environment. Among these systems are:

1-**Aragon Court**: A platform that enables the creation and management of DAOs. Aragon Court provides a mechanism for resolving disputes within decentralized organizations, where cases are presented to a group of randomly selected jurors who decide the outcome based on the evidence provided. It primarily operates on blockchain and offers its services to users globally online. Founded in Spain, Aragon provides its services to the global community and is not limited to a specific geographic area[13].

2-**Kleros**: A decentralized arbitration platform that uses smart contracts to arbitrate a variety of disputes, from commercial disputes to challenges in online content. Kleros uses a "trust arbitration" mechanism where issues are adjudicated by randomly selected individuals. It is a blockchain-based platform that operates globally

and provides its services via the Internet. It has no central location but operates in the digital economy[14] .

3-**eBay:** Resolves approximately 60 million disputes annually between traders on the eBay platform using smart technologies. Disputes range from non-payment by buyers to complaints about goods not matching the description. Users are initially encouraged to attempt to resolve disputes themselves through online negotiation, with clear guidelines to avoid misunderstanding and reach solutions. In case of failed negotiation, eBay provides a compulsory dispute resolution service, with strict time limits for filing claims[15] .

4- The Rechtwijzer system, developed by the Hague Institute for Innovation of Law (HiiL) in collaboration with the Dutch Ministry of Justice and Security, aims to assist parties in resolving disputes through a diagnostic process that utilizes questions and answers to guide the parties. The service is currently available for divorce disputes and related issues such as custody and alimony, with plans to expand to include other disputes such as those between landlords and tenants or neighbors. If negotiations fail, parties transition to online dispute resolution using mediation or arbitration[16] ..

Both Aragon and Kleros are widely recognized platforms in the global blockchain community and are not centralized in a specific geographical location. However, these platforms operate under the laws and regulations governing registered companies in the countries where they are incorporated. Both platforms demonstrate how DAOs can use smart arbitration to provide effective and objective solutions to disputes while maintaining integrity and transparency in the process. They utilize blockchain technology to provide a decentralized environment where arbitration and dispute resolution can be conducted reliably and transparently, making them accessible to users from different countries without the need for adherence to a specific geographical location[17] .

Moreover, DAOs also allow other types of economic and social entities to exist. For example, the DAO stack provides a mechanism for settling disputes within the digital economy, enabled by blockchain technology to provide an independent judicial environment[18], There is a growing trend towards using blockchain to create virtual jurisdictions for all disputes related to digital assets such as cryptocurrencies and smart contracts[19].

The Aragon network intends to establish a digital jurisdiction operating on the Ethereum blockchain, where requests can be submitted in exchange for cryptocurrency payment. Costs are refunded if the request is justified. Candidates for judiciary positions must make a deposit, and five judges are randomly selected to form the primary court of the Aragon network. Decisions are made by majority vote, and the winning judge is rewarded, while losers forfeit their deposits[20] Subsequently, decisions can be appealed to the Court of Appeal, where all network judges participate. If a precedent-setting decision is made, it can be further appealed to the Supreme Court of the network, consisting of nine judges considered the most proficient. If this court upholds the decision, the judges from the previous round are financially rewarded, while those who dissent are penalized in the same manner[21].

Another example of virtual jurisdiction is the Kleros dispute resolution protocol, which also operates outside the Ethereum blockchain. Its operation closely resembles Aragon's network but with less human intervention. Algorithms based on game theory are used to determine jurors' decisions, who are randomly selected from among network participants. After evaluating evidence and arguments, jurors vote on one of the options provided by the system, and the final decision depends on the majority. This decision is subject to appeal, and if the decision changes, rewards are redistributed among jurors who voted for the new decision[22].

In traditional disputes, we often find that the international system adopts universally applicable principles to determine jurisdiction and competence in international disputes to achieve justice [23]. However these virtual judicial systems aim to allow blockchain to operate independently of state court intervention, providing an environment where disputes related to digital assets can be resolved within their own ecosystem. The ability to bypass jurisdictional rules, especially direct international judicial jurisdiction, is a significant step towards the autonomy of these systems and their ability to self-manage legal complexities arising from digital transactions[24].

Subsection Two
Procedures for Smart Arbitration in DAOs Disputes

Initially, merging "arbitration and artificial intelligence embodied by DAOs" may seem inappropriate, as the former is a system for private dispute resolution and the latter is a technology that uses machines to simulate human intelligence. However, the widespread use of artificial intelligence in various aspects of modern life has led to the emergence of platforms where disputes are resolved using artificial intelligence. Arbitration is a form of private dispute resolution where parties choose arbitration as a system to resolve disputes independently and agree to opt-out of the state-led dispute resolution system governed by the state's arbitration convention[25].

The entire dispute resolution process is carried out using a BDR [26], mechanism fully on the blockchain, designed to be executed using smart contracts. Due to these characteristics, using automated dispute settlement through smart arbitration does not require parties to disclose their true identities, and they can support pseudonyms. All operations on the blockchain are linked to a public key known as the digital wallet of the owner, whether it's for signing a smart contract, joining a decentralized organization, or transferring

cryptocurrencies and other digital assets. Since the public key acts as an identity within the blockchain environment, automated dispute settlement through smart arbitration can enforce any decision on the parties without the need to reveal their identities, and any decision must be enforceable according to the properties of the smart contract.

One advantage of smart contracts is that any action on the blockchain can be conditioned on a set of predefined rules. This feature can be leveraged to make self-executing decisions, and the effectiveness of dispute settlement does not depend on the parties' willingness to comply with the decision. Therefore, there is no need to use mechanisms to incentivize parties for voluntary compliance, as is the case with most online settlements. The primary advantage of self-settlement mechanisms for disputes through smart arbitration is their ability to enforce decisions directly and automatically on the blockchain itself using smart contracts, allowing parties to implement decisions without relying on the intervention of coercive government authorities. This makes self-settlement mechanisms for disputes through smart arbitration independent, and self-reliant, and represents a significant improvement over ODR mechanisms that do not use this technology[27].

Blockchain technology provides certainty in enforcing judgments and decisions through platforms such as Kleros and Aragon Court, which are currently working to resolve disputes on the blockchain. Kleros was launched on the Ethereum blockchain in July 2018, making it the first platform for the self-settlement of disputes through smart arbitration to operate. Aragon Court was launched in November 2019. These platforms rely on collective commitment in the dispute resolution process, where disputes are resolved by a panel of judges composed of individuals who may not necessarily be legally qualified but possess personal experience and necessary technical qualifications. This approach enhances the

diversity of perspectives and understanding in the arbitration process, contributing to justice and efficiency.

This new model of dispute settlement using blockchain technology (BDR) differs from traditional online dispute resolution (ODR) methods. In traditional models, the execution of decisions often relies on social and economic incentives to encourage the losing party to voluntarily comply with the decision[28].

In platforms such as Kleros and Aragon Court, leveraging blockchain technology, an arbitration system has been meticulously crafted. This system hinges on the participation of arbitrators selected randomly from a pool of registered counterparts. These arbitrators acquire platform-specific tokens to qualify, obligatorily investing a portion thereof to demonstrate their commitment to case participation. The likelihood of selection correlates with the magnitude of token investment, designed to economically incentivize arbitrators toward consensus decision-making. Moreover, a rewards framework incentivizes arbitrators to cast votes aligning with the majority's perceived most acceptable decision. Conversely, arbitrators' risk economic penalties in the event of backing an unsuccessful decision. Compensation is contingent upon voting congruent with the majority, entitling arbitrators to a share of arbitration fees and a fraction of tokens staked by dissenting arbitrators. This dual economic incentive model ensures arbitrators' alignment with anticipated majority support [29]

Hence, smart arbitration fundamentally transforms the landscape of legal procedures by integrating intricate elements such as legal analysis and predictive case outcomes. The advantages of employing this form of arbitration in DAO disputes are manifold: 1-Enhanced Efficiency: Artificial intelligence capabilities enable rapid processing of vast datasets, expediting procedures and reducing expenses. 2-Decision Support: Precise analysis of precedents and data facilitates informed decision-making. 3-Resource Optimization:

Deployment of intelligent tools diminishes the need for human intervention in certain facets of case management, enabling arbitrators to concentrate on nuanced and critical aspects[30].

Concerning arbitrators' roles, economic gain correlates directly with reputation. A higher share of tokens signifies greater presumed capacity among arbitrators to adjudicate majority-supported rulings and accrue more tokens. This token allocation serves as an indicator not only of arbitrators' reputation but also of their efficacy, predominantly measured by their ability to forecast majority decisions. The economic incentivization of this predictive prowess aligns with the system's vested interest in fostering consensus-based resolutions. As arbitrators' reputations ascend, so does the credibility of Automated Dispute Resolution through Intelligent Arbitration, facilitating facile consensus attainment and subsequent token rewards. Consequently, arbitrators' behavior garners meticulous attention from Blockchain Dispute Resolution (BDR) architects such as Kleros and Aragon Court, surpassing the focus on litigant behavior. This novel Blockchain Dispute Resolution (BDR) model diverges from conventional Online Dispute Resolution (ODR) approaches, where compliance with decisions often hinges on social and economic inducements rather than automated enforcement mechanisms[31].

In self-settlement mechanisms for disputes through smart arbitration platforms like Kleros and Aragon Court, the risks associated with reputation are linked to the decision-making process of the arbitrators rather than the execution of the decision itself. In this system, the risk of damaging reputation shifts from the losing party to the minority arbitrators who do not vote with the majority. Overall, the reputation of the parties is always somewhat affected when the existence of the dispute becomes known, as is the case in disputes involving DAOs[32].

When a dispute arises concerning the execution of a smart contract, the resolution of the dispute is entrusted to automated dispute settlement through smart contracts, selected by the parties involved in the smart contract. The appointed third party by the BDR mechanism, responsible for issuing decisions, must analyze the smart contract, and reasons for its non-execution or improper execution, and adjudicate based on an evaluation of the facts and evidence presented. Kleros may be chosen by the parties to the smart contract to settle disputes arising from non-execution or improper execution of the smart contract. When developing their smart contract, the parties must specify and implement dispute resolution standards that determine how and when dispute settlement procedures can commence. Once a dispute arises, the parties must identify the available options for arbitrators to vote on, with cryptocurrencies placed under the authority of automated dispute settlement through smart contracts. This is usually done automatically through the smart contract that governs their contractual relationship, akin to an escrow arrangement.

If this does not occur automatically, the parties must agree to transfer the disputed cryptocurrencies or crypto assets to the authority of automated dispute settlement through smart contracts, with a subsequent smart contract. Achieving this second option may be challenging as it inherently implies that both parties voluntarily subject themselves and the disputed assets to the authority of automated dispute settlement through smart contracts. After the dispute and once the options are presented to the arbitrators, they vote for one of the options to resolve the issue based on their technical knowledge and personal expertise. Each arbitrator's opinion remains confidential to prevent it from influencing others, and parties can appeal an indefinite number of times, with each new appeal doubling the previous number of arbitrators plus one, increasing arbitration fees accordingly. When there are no further

appeals, the decision becomes final and is executed directly and automatically through the computer system[33].

In the Kleros system, the use of pseudonyms and anonymous identities does not hinder dispute resolution. It does not require parties to disclose their identities to participate in proceedings or to execute the decision. Instead, parties merely need to sign the smart contract using their public key. This contract must contain a clause authorizing BDR mechanisms over their contractual relationship. This condition can easily be met by any DAO or anyone owning a crypto wallet. Regarding dispute resolution procedures and executing decisions, they commence automatically through the smart contract and the Kleros system. This means that the entire process is efficient and requires no manual intervention, thereby expediting dispute resolution and enhancing transparency.

It is noteworthy that Kleros' utility is not limited to disputes occurring solely on the blockchain but also serves as an alternative to traditional online dispute resolution (ODR) methods, which are often slow or costly. Kleros offers its services for resolving disputes between parties outside the blockchain concerning the execution of traditional contracts, providing a fast, cost-effective, transparent, and reliable solution for parties seeking final decisions. For instance, Kleros was used to resolve a dispute between a cruise company and a couple who booked an all-inclusive river trip. In this case, the arbitrators had to decide whether to grant the couple 70% of the trip cost, the amount they hoped to recover, or a smaller amount plus a voucher for a future cruise[34].

It should be remembered that the capabilities of blockchain-based dispute resolution mechanisms (BDR) are limited by their technologies. For example, in Kleros, disputes presented to it must be self-resolvable and automated through smart contracts to ensure effective implementation of decisions. In the river trip case mentioned, arbitrators had to choose one of the proposed offers from

the parties to settle the dispute. However, it was unclear whether the parties had placed the necessary funds under the control of the BDR mechanism for self-execution or if the decision should be executed outside the blockchain by the cruise company.

In the latter case, automated execution by the system would not be possible, thus depriving the parties of the main advantage of using BDR: the speed and efficiency of execution. If the reputation-related penalties were not sufficient to ensure the cruise company's compliance with the decision, the couple might have to seek legal assistance to enforce Kleros' decision forcefully. However, there remains doubt about the recognition of a decision from Kleros and its enforcement within the state judicial system.

Among the countries interested in these systems is China, where the Ministry of Justice has developed a comprehensive plan and advanced, organized features, forming an innovative and sophisticated path for legal services with Chinese characteristics focusing on the people? New technologies such as artificial intelligence have achieved significant success in building legal service areas such as legal consultations, assistance, mediation, and arbitration. In July 2016, China issued the "General Plan for National Informatization Development," which called for the active use of informatics in national governance to "meet the modern development needs of the country, use informatics to better understand social conditions, facilitate communication channels, and assist in scientific decision-making." China has enhanced the deep integration between advanced manufacturing industries and modern services, establishing industrial design centers and industrial internet platforms, and promoting innovation in applying new information technologies such as big data, industrial internet, and artificial intelligence in manufacturing.

These developments demonstrate China's commitment to integrating modern technology into governance and legal services to

improve efficiency and effectiveness in these areas. The use of new technology in various fields will inevitably lead to the emergence of disputes, We find that artificial intelligence has an impact on self-driving cars[35], medical robots[36], educational systems and even in evidence searching [37] Thus, arbitration can provide a guarantee for resolving disputes arising from the application of new technology. Additionally, support from artificial intelligence can also contribute to the development of arbitration, adapting quickly to new economic and social developments, given the inherent flexibility of dispute resolution methods like arbitration. From the outset, most arbitration institutions have taken measures to adapt to technological advancements. For example, they have adopted new arbitration procedures and issued guidelines to encourage the use of digital technologies and artificial intelligence aids to ensure the conduct of virtual hearings. Some institutions have developed projects on conducting virtual hearings, thus solving some practical challenges such as cyber-attacks. However, there are still issues regarding the legitimacy of procedures, so the actual procedures and outcomes depend on the technical expertise and knowledge of all relevant parties[38].

In conclusion, it becomes clear that smart arbitration in DAO disputes relies on smart contracts executed on blockchain networks. These contracts contain pre-programmed terms and conditions that are automatically executed based on agreed-upon conditions. In the context of DAOs, smart arbitration can act as a mediator in resolving disputes through the following steps:

First Contract creation: A smart contract is drafted defining arbitration mechanisms, including rules, timelines, and penalties.

Second Contract activation: When a dispute arises, the smart contract is automatically activated to review the facts and evidence presented based on the data recorded in the blockchain.

Thirdly, vector: the new smart object analyzes the data and issues a decision on the programmed conditions, with a cooperation that is final and binding within the network of DAOs.

Section Two
Implementation and Evaluation of Smart Arbitration Decisions in DAOs Disputes

In light of the rapid evolution of blockchain technology and the emergence of smart contracts, we have witnessed the emergence of numerous platforms providing mechanisms for dispute resolution within decentralized and non-centralized environments such as DAO organizations. Implementing decisions in this type of settlement and evaluating their effectiveness are crucial aspects that warrant careful analysis, not only to understand how these mechanisms operate but also to assess their compatibility with legal standards and traditional justice.

Therefore, we will divide the chapter into two demands: the first is to elucidate the extent of implementing smart arbitration decisions, while the second demand will delve into evaluating smart arbitration in DAO disputes.

Subsection One
Extent of Implementation of Smart Arbitration Decisions in DAOs Disputes

Within the framework of smart arbitration procedures, decisions are issued by the arbitration system known as "BDR," which is a decentralized system not subject to the law of any specific state. Due to this, the decisions issued by BDRs cannot be enforced by governmental authorities as court judgments are, contrary to arbitration decisions in classic arbitration. It's worth noting that the

term "BDR" is limited to mechanisms that use blockchain technology for dispute resolution and decision enforcement[39] .

The term "BDR" is used to refer to a dispute resolution system that solely relies on blockchain technology to issue and enforce decisions. This system operates independently of traditional judicial systems and is not tied to any specific geographical location. This necessitates specific procedures to convert such decisions into legally recognized and enforceable judgments by the state. To illustrate how a decision issued by a BDR can be converted into a legally recognized arbitration decision: in the state of Jalisco, Mexico, two parties used the Kleros platform, a type of BDR system based on blockchain, to resolve a real estate dispute. The arbitrator in charge of the case submitted it to the Kleros platform and obtained a decision from three anonymous arbitrators. Subsequently, this decision was transformed into an arbitration decision in compliance with local laws in Jalisco. This decision thereby became recognized by the Mexican authorities and executed as a regular court judgment. This process demonstrates how BDR decisions based on blockchain can become legally recognized judicial decisions if adapted to comply with the requirements of the local judicial system[40] (

When a decision is issued within the framework of a BDR mechanism in international arbitration, this decision must be evaluated according to the New York Convention to determine its recognizability and enforceability in contracting states. The New York Convention provides specific grounds for refusing to recognize or enforce arbitration decisions, and in the case of BDR decisions, these grounds may not directly apply. Some of these grounds include:

Firstly, the refusal to enforce a decision if the arbitration agreement is invalid or void, for example, in cases where parties lack the legal capacity to enter into agreements, such as entities formed electronically like DAOs. There are also questions about whether

electronically concluded arbitration agreements meet the necessary legal requirements.

Secondly, if the decision exceeds what was agreed upon in the arbitration agreement, and the scope of the BDR mechanism is limited, enforcement of the decision may be challenged outside this scope if there is no clear agreement between the parties on this point.

Thirdly, if the decision is not binding on the parties, since BDR decisions may not be binding under state laws, countries may differ in interpreting whether the decision is "binding" according to the standards of the New York Convention.

Fourthly, violation of public policy and the lack of legal justice in a BDR decision raises concerns about public policy, and the final decision regarding recognizing a BDR decision as enforceable is left to the authorities in the state where enforcement is sought to determine whether it conflicts with public policy or not.

This analysis shows that applying the New York Convention to decisions issued by BDR mechanisms or broader dispute resolution mechanisms such as Online Dispute Resolution (ODR) raises unresolved questions. Some countries may decide in the future to recognize and enforce BDR decisions according to the New York Convention, but it is unlikely that this recognition and enforcement will be uniform among all contracting states. Instead, some countries may choose to enforce BDR decisions according to their national legal procedures or local rules, provided that these decisions are treated as arbitration decisions and are compatible with the public policy of the state where enforcement is sought[41].

Regarding the possibility of enforcing a BDR decision as a foreign judgment, given the challenges associated with recognizing these decisions as arbitration awards under the New York Convention, the main question is whether they can be recognized as foreign judgments under laws that allow for this. Three relevant international agreements deal with the recognition and enforcement

of foreign judgments in this context, although BDR decisions may not fully comply with the traditional way of enforcing judgments[42].

The Hague Convention, signed on July 2, 2019, provides a framework for states to recognize and enforce foreign court judgments. However, BDR decisions, which are technology-based and not issued by traditional courts, being decentralized and non-governmental, are not considered "judgments" under the convention's definition since they do not come from a "court" under state authority.

Another convention signed on June 30, 2005, known as the "Choice of Court Convention," aims to facilitate the recognition and enforcement of judgments between contracting states when parties choose a specific court in their agreement. Although BDR decisions arise from an agreement between parties, they still do not fall under the definition of "judgment" in this convention either, as they do not come from a governmental court, thus the rules of this convention cannot be applied to BDR decisions[43].

The third convention is the Lugano Convention, signed in 1988 and amended on October 30, 2007, and entered into force in 2010. It is an international treaty regulating jurisdiction and the recognition and enforcement of judgments in civil and commercial matters between EU member states and some other European countries such as Norway, Iceland, and Switzerland. Regarding the recognition of a judgment issued by a BDR mechanism under the Lugano Convention, this type of judgment faces several major challenges:

1- Concept of Judgment: The Lugano Convention considers judgments as those issued by the "courts" of member states. However, judgments issued by BDRs, which are typically non-governmental and rely on blockchain technology, may not align with the convention's definition of "judgment" according to its standards.

2- Recognition and Enforcement: For a foreign judgment to be recognized and enforced according to the Lugano Convention, the procedures leading to the judgment must be compatible with the fundamental principles of procedural justice as understood in the state where recognition and enforcement are sought.

3- Public Policy: Recognition of a BDR judgment may be refused if its enforcement is believed to conflict with the public policy of the state where recognition and enforcement are sought.

The three international conventions - The Hague Convention and the Lugano Convention - require that judgments subject to them be issued by a governmental authority in a contracting state, posing a significant obstacle to their application to BDR decisions not tied to any governmental authority. This means that what applies to the New York Convention also applies to The Hague and Lugano Conventions. All these conventions share a fundamental condition that the procedures leading to the judgment must be compatible with the fundamental principles of procedural justice in the state where enforcement is sought.

The absence of a specific international agreement tailored to the enforcement of BDR decisions makes the application of these decisions difficult. It is unlikely that BDR decisions will be recognized and enforced without legal changes expanding the definition of judgment to include this type of decision, or unless countries amend their national laws to allow for their enforcement. Therefore, countries need to decide whether they will consider a BDR decision as a foreign judgment enforceable under their legislation or not [44]. However, this process remains fraught with uncertainty and significantly differs from the usual method of enforcing arbitration awards.

Subsection Two
Evaluation of Smart Arbitration in DAOs Disputes

Mechanisms for resolving disputes through direct computer communication are increasingly being used to settle disputes arising from electronic transactions. These systems provide an efficient and economical way to deal with small claims in e-commerce, often being the only practical means to enforce rights in such transactions. They offer a simple, fast, and cost-effective means of accessing justice, especially when the traditional judicial system is unable to handle the large volume of disputes due to the financial and procedural burden it entails. However, these mechanisms face a significant challenge in that they may not be able to issue enforceable decisions by governmental authorities. Mechanisms that do not produce enforceable decisions do not provide effective access to justice, according to the standards set out in Article 6(1) of the European Convention on Human Rights, which includes the right to enforce judicial decisions. Therefore, actual enforcement of decisions is an essential element in building users' trust in the system, which in turn affects the general trust in the business environment and contributes to its development[45].

In the field of e-commerce, experience has shown that the ability of the justice system to inspire user confidence plays a significant role in regulating the business environment, increasing market participants' confidence, and supporting commercial development. This experience can be applied to the cryptocurrency economy. A blockchain environment must include a judicial system that enhances user confidence, which is necessary for its future growth, especially for organizations like DAOs and other entities that may prefer to remain anonymous.

Blockchain Dispute Resolution (BDRs) technology, which uses blockchain technology and smart contracts, enables decisions to be executed directly and automatically, solving the problem of relying on external authorities to enforce decisions. This makes the system more independent and efficient[46]   However, resolving

disputes related to DAOs on the blockchain faces multiple challenges, including:

1-Confidentiality: Maintaining the confidentiality of information can be difficult due to the technological interventions necessary to operate smart arbitration.

2-Ethics and Empathy: Smart arbitration may lack the ability to assess the complex human intentions and circumstances that humans can understand and appreciate.

3-Data Reliability: With the advancement of artificial intelligence techniques, the possibility of evidence forgery increases, and distinguishing between real and fake becomes more difficult[47] .

4-Location Determination: Operations on the blockchain do not follow specific geographic boundaries, making location determination complex and the application of national laws difficult.

5-Entities without Legal Personality: Many DAOs operate as organized entities via blockchain without recognized legal personality, making it difficult to file lawsuits against them.

6-Anonymous Participants: In many cases, participants in DAOs are anonymous, complicating the issue of suing specific individuals or holding them legally accountable.

7-Forced Execution of Decisions: Actual enforcement of decisions becomes almost impossible, especially when it involves transferring cryptocurrencies or other assets on the blockchain. The decentralized and encrypted nature of these assets makes the forced execution of judgments without the losing party's cooperation extremely difficult.

BDRs systems play a crucial role in addressing these challenges, providing dispute resolution mechanisms capable of self-execution and independent of traditional authorities. These systems enable blockchain participants to access justice effectively and help

ensure stability and trust in the global cryptocurrency business environment [48].

Arbitration based on blockchain technology (BDRs) faces major challenges that limit its effectiveness compared to traditional judicial systems. Some of these challenges include:

1-Uncertainty in Results: In BDRs, arbitrators often make decisions based on vaguely defined criteria, such as personal fairness, rather than relying on specific laws or legal precedents. This leads to variable outcomes for the same situation, creating legal uncertainty [49].

2-Litigation Risks: Due to the uncertainty of outcomes, litigation risks remain high in complex contracts subject to dispute settlement in BDRs.

3-Execution of Decisions: While automated dispute settlement through smart arbitration may be able to resolve disputes, the execution of its decisions depends on the parties' willingness to comply. In cases of fraud or harm, it may only be possible to enforce decisions if the defendant agrees to place the disputed assets under BDR jurisdiction, which is unlikely [50].

In cases of fraud involving cryptocurrency investments within DAOs, the use of BDRs presents significant challenges, especially if intruders do not agree to place stolen assets under the jurisdiction of these mechanisms. In these cases, automated dispute settlement decisions through smart arbitration become symbolic and ineffective in achieving justice. However, some strategies can be used to achieve indirect enforcement of BDR decisions, even without direct control over the disputed cryptocurrency assets. For example, victims of hacks can unilaterally file a complaint in a BDR, where the claim is announced, and the defendant is called to defend themselves. If a decision is issued against the defendant and they refuse to compensate for the damage, the BDR can blacklist the defendant's wallet address. This action is likely to be recognized and

supported by the wider community because the decision is made by an arbitration body representing the forum. Thus, the enforcement of BDR decisions will be achieved indirectly through market participants who refuse to deal with individuals or entities on the blacklist, forcing the defendants to comply with social norms and compensate the victims to avoid economic isolation[51].

To assess arbitration in DAO disputes, two main aspects must be discussed:

Firstly: Providing a Fair Dispute Resolution: Smart arbitration maximizes the benefits of blockchain technology by providing results that are directly and automatically enforceable through computer systems. However, the ability for rapid enforcement alone is not sufficient to ensure real justice in the cryptocurrency economy. Arbitration must gain the trust of participants in the blockchain system by providing fair and equitable dispute resolutions. This trust is essential for enhancing security and reliance on the blockchain economic environment.

The fairness of smart arbitration decisions is not a binary issue that can simply be defined as "fair" or "unfair." It depends on analyzing each case individually and evaluating it based on specific criteria and circumstances. It requires considering the framework through which the defendant views the case. A dispute resolution may be fair from one perspective without necessarily being compatible with traditional legal justice standards. Therefore, the smart arbitration system must be designed in a way that meets the expectations and needs of its users, while taking into account that the state's judicial system is expected to be fair according to recognized legal standards.

Secondly: Enforcement Outside Smart Systems: Smart arbitration platforms in DAO disputes, such as Kleros and Aragon Court, can provide decisions that are automatically enforceable within the blockchain system, facilitating fair and effective access to

justice. However, there are difficulties or challenges in enforcing decisions outside the blockchain system. Decisions related to non-encrypted assets or those requiring legal interventions outside the blockchain may not be directly enforceable through smart contracts [52].

Since the intervention of judicial authorities is necessary for enforcing decisions in the physical world, the effective recognition and enforcement of smart arbitration decisions outside the blockchain depend on their recognition by judicial authorities. If countries do not recognize the legitimacy of smart arbitration decisions in DAO disputes, their effectiveness will be limited to encrypted assets only[53].

To obtain state recognition for enforcing smart arbitration decisions in DAOs disputes outside the blockchain, the following considerations must be taken into account:

1-Procedural Rights: At the time of enforcement, it must be ensured that the procedural rights of the parties involved are respected.

2-Public Policy: If there is partial or complete enforcement of decisions outside the blockchain, the decisions must comply with principles of justice and not conflict with the public policy of the state [54].

Conclusion

Firstly: Results:

1- **Smart arbitration** relies on smart contracts executed on blockchain networks. These contracts contain pre-programmed clauses and conditions that are automatically executed based on agreed-upon terms. In the context of DAOs, smart arbitration can act as a mediator in resolving disputes automatically after contract activation, with execution also being automatic.

2- **Development of digital governance**: Platforms like Kleros and Aragon Court have introduced effective models of digital governance and dispute resolution using smart contracts and blockchain technology, enabling them to execute decisions automatically and independently.

3- **Challenges of legal recognition and enforcement**: Despite the system's effectiveness in settling disputes within the blockchain environment, there is still ambiguity regarding the legal recognition of decisions outside this environment, complicating their enforcement in traditional legal systems.

4- **Security and reliability**: Studies show that blockchain-based systems provide a high level of security and transparency, but they are not immune to cyber-attacks, as demonstrated by "The DAO" incident.

5- **Judicial and legal challenges**: DAOs face challenges in determining jurisdiction and dealing with traditional laws, leading to difficulties in settling disputes involving parties outside the network.

6- **Lack of state authority**: Smart arbitration decisions (BDRs) made through blockchain technology are not necessarily

subject to any specific state law, making their enforcement by governmental authorities a significant challenge.

7- **Enforcement as foreign judgments**: The non-alignment of smart arbitration BDR decisions with international legal frameworks such as the Hague, Lugano Conventions, and the Convention on Choice of Court Agreements due to their non-governmental and decentralized nature, thus making the enforcement of their judgments impossible.

8- **Legal uncertainty**: The high risks of smart arbitration BDRs due to the absence of specific decision-making standards, lead to variable results and legal instability.

Secondly: Recommendations:

1- **Enhancing international cooperation**: Working on developing an international legal framework that recognizes smart contracts and DAO decisions as legally enforceable across national borders by reviewing international agreements to include new forms of smart arbitration BDR, with the possibility of creating a new international legal framework addressing blockchain and smart arbitration challenges.

2- **Improving blockchain security**: Intensifying research and development to enhance security protocols in blockchain technologies to prevent cyber-attacks and improve trust in using these systems.

3- **Developing appeal mechanisms**: Establishing and developing appeal mechanisms within dispute resolution platforms to ensure more fairness and equality in judgment.

4- **Awareness and training:** Conduct awareness campaigns for individuals and institutions on how DAOs and smart contracts work, and provide necessary training for lawyers and judges on these technologies to improve their understanding and handling of digital technology issues.

5- **Utilizing encrypted assets:** Considering the potential for expanding the use of encrypted assets as a means to secure party obligations and effectively enforce decisions within the blockchain ecosystem.

6- **Building trust and legitimacy:** Building user trust in BDR systems by developing and implementing specific and uniform legal standards that ensure fairness and integrity in arbitration procedures.

7- **Judicial intervention:** Providing mechanisms for cooperation between BDR platforms and traditional judicial systems to ensure effective enforcement of decisions outside the scope of the blockchain, especially concerning non-encrypted assets.

8- **Developing procedural justice standards:** Ensuring respect for procedural rights and legal standards at all stages of arbitration in BDRs to enhance international recognition of their decisions.

Implementing these recommendations requires close cooperation among stakeholders in the blockchain field, and international institutions to develop a comprehensive judicial system that keeps pace with technological developments and ensures effective justice.

Footnots

(1)The abbreviation "DeFi" stands for "Decentralized Finance".

(2) "ODRs" is short for "Online Dispute Resolution," and refers to the use of digital technology, especially the Internet, to facilitate the dispute resolution process between parties. ODR systems are used to resolve disputes more efficiently and quickly compared to traditional methods such as courts or in-person sessions. They are commonly applied in e-commerce disputes, consumer disputes, and even in some more complex legal disputes

(3) NFTs are short for "Non-Fungible Tokens," or non-fungible tokens. These tokens represent ownership or proof of ownership of a unique digital asset on the blockchain. Unlike cryptocurrencies like Bitcoin or Ethereum, which are interchangeable and each unit is equal in value and function to other units, each NFT is unique and cannot be directly exchanged for another.

NFTs are used in many applications such as digital art, music, digital items in games, and other applications that require proof of authenticity and individual ownership. These tokens are recorded on the blockchain, allowing authenticity to be verified and ownership history to be traced without the need for an intermediary, adding a layer of security and transparency to transfers and sales. See: Diptiben Ghelani Diptiben Ghelani, What is Non-fungible token (NFT)? A short discussion about NFT Terms used in NFT October 2022, available on: https://www.researchgate.net/publication/364155223_What_is_Non-fungible_token_NFT_A_short_discussion_about_NFT_Terms_used_in_NFT# , last visit (2/2/2024) p4-6

(4) See: Aiden Slavin, Kevin Werbach, Decentralized Autonomous Organizations: Beyond the Hype, In collaboration with the Wharton Blockchain and, Digital Asset ProjecT, available: https://www3.weforum.org/docs/WEF_Decentralized_Autonomous_Organizations_Beyond_the_Hype_2022.pdf , last visit (22/4/2024) p.6

(5) See: Cristiano BellavitisChristian FischChristian FischPaul P. MomtazPaul P. Momtaz, the rise of decentralized autonomous organizations (DAOs): a first empirical glimpse, August 2022, available: https://www.researchgate.net/publication/363155263_The_rise_of_decentralized_autonomous_organizations_DAOs_a_first_empirical_glimpse#fullTextFileContent , p.3

(6) See: Vitalik Buterin, "Ethereum White Paper – A Next Generation Smart Contract & Decentralized Application Platform" (Blockchain Lab, November 2013)

https://blockchainlab.com/pdf/Ethereum_white_papera_next_generation_smart_contract_and_decentralized_application_platform-vitalik-buterin.pdf last visit (5/2/2023)

(7)See Primavera De Filippi and Aaron Wright, Blockchain and the Law /Harvard University Press 2018/ p. 38-39.

(8) See Kevin Werbach, "The Siren Song: Algorithmic Governance by Blockchain", in Kevin Werbach (ed), After the Digital Tornado – Networks, Algorithms, Humanity Cambridge University Press 2020, p.215.

(9) See: Florence Guillaume & Sven Riva, BLOCKCHAIN DISPUTE RESOLUTION FOR DECENTRALIZED AUTONOMOUS ORGANIZATIONS: THE RISE OF DECENTRALIZED AUTONOMOUS JUSTICE, avelable on

https://papers.ssrn.com/sol3/papers.cfm?abstract_id=4042704 , last visit (1/12/2023), p4

(10) See: Wulf A. Kaal, "Blockchain-Based Corporate Governance" (2021) 4 Stanford Journal of Blockchain Law & Policy 0،6.

(11)See: Florence Guillaume & Sven Riva, Op.cit, p5

(12) See:Florence Guillaume, Decentralized Autonomous Organizations (DAOs) Before State Courts, How can private international law keep up with global digital entities?the University of Neuchâtel ,available https://papers.ssrn.com/sol3/papers.cfm?abstract_id=4492934 (Switzerland), p.10-15

(13) See: Jun Hong Tan, Duxton Hill Chambers, Blockchain "Arbitration" for NFT-Related Disputes, Contemporary Asia Arbitration Journal, Vol. 16, No. 1, , May 2023,Available on

https://papers.ssrn.com/sol3/papers.cfm?abstract_id=4465828 , p151

(14) See: Yann AouidefFederico AstFederico AstBruno DeffainsBruno Deffains, Decentralized Justice: A Comparative Analysis of Blockchain Online Dispute Resolution Projects. March 2021Frontiers in Blockchain ,Available on https://www.researchgate.net/publication/350092089_Decentralized_Justice_A_Comparative_Analysis_of_Blockchain_Online_Dispute_Resolution_Projects , p 2-3.

(15)see: Online Dispute Resolution Advisory Group, ONLINE DISPUTE, RESOLUTION FOR LOW VALUE CIVIL CLAIMS, available on:

https://www.judiciary.uk/wp-content/uploads/2015/02/Online-Dispute-Resolution-Final-Web-Version1.pdf , last visit (12/1/2024).

(16) see: Online Dispute Resolution Advisory Group, op.cit, p 12

(17) See: Jun Hong Tan, Duxton Hill Chambers, op.cit, p151, See: Yann AouidefFederico Ast Federico Ast Bruno DeffainsBruno Deffains, OP.Cit, p 2-3.

(18) See: Brady Dale, "DeFi Is Now a \$100B Sector" (Coindesk, 29 April 2021) Available on https://www.coindesk.com/defi-100-billiondolla last visit (5 /1/ 2023)., See: Alyssa Hertig, "What is DeFi?" (Coindesk, 18 September 2020) Available on https://www.coindesk.com/what-is-defi last visit (5/1/ 2023).

(19)See: W. A. Kaal et C. Calcaterra, Crypto Transaction Dispute Resolution, The Business Lawyer, 2017, p. 109.

(20)See:Mathias Audit , Op.Cit, p.675.

(21) See: C. Lesaege et F. Ast, Kleros Short Paper v1.0.6, nov. 2018, disp. à: / https://kleros.io/assets/whitepaper.pdf / last visit (19/2/2023)

(22) See:Mathias Audit , Op.Cit, p.675.

(23)See: Muslim, Nibras Ibrahim, and Mustafa Salim Abed AlBkeet. "Criminal justice of juveniles in the context of crimes of an international character." AL-ANBAR University Journal of Law and Political Sciences 8.2 (2018).

(24) See:Mathias Audit , Op.Cit, p.676.

(25) See: 张靖宁，冯士豪, 人工智能对仲裁机构影响初探, 上海政法学院,

上海, 2022, Available on, https://pdf.hanspub.org/DS20220200000_58238126.pdf , last visit (3/3/2024) p.343

(26) BDR is an abbreviation for "Blockchain Dispute Resolution", which is a term that refers to the use of Block Chain technology in dispute resolution. This method allows the automated settlement of disputes through smart contracts located on the Block Chain, allowing for a transparent, reliable, and efficient settlement process without the need for Disclosing the identities of the parties involved.

(27) See :Federico Ast and Bruno Deffains, "When Online Dispute Resolution Meets Blockchain: The Birth of Decentralized Justice" 2021, 4.2 Stanford Journal of Blockchain Law & Policy, p. 241, 244.

(28) See: Jaap van den Herik and Daniel Dimov, "Towards Crowdsourced Online Dispute Resolution", in S. Kierkegaard and P. Kierkegaard (eds), Law Across Nations: Governance, Policy and Statutes (International Association of

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(29) See: Florence Guillaume, & Sven Riva, OP.CIT, P،45

(30) See: 张靖宁，冯士豪, OP.CIT, p.343

(31) See Jack Gane, "Juror Pre-activation Guide" (Aragon Org Blog, 7 January 2020) <https://aragon.org/blog/jurorpre-activation-guide> last visit (3/12/ 2023). The link between participant reputation-staking and DAO valuation was highlighted by Kaal (n 19), 38-40.

(32) Wulf A. Kaal and Craig Calcaterra, "Crypto Transaction Dispute Resolution" (2017-2018) p.150, Rikka Koulu and Kalle Markkanen, "Conflict Management for Regulation-Averse Blockchains?", in Rosa Maria Ballardini, Petri Kuoppamäki and Olli Pitkänen (eds), Regulating industrial Internet through IPR, Data Protection and Competition Law (Wolters Kluwer 2019), 382.

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(35)See: Al-Saeedi, L. A. H. E. (2022). The Privacy of the Insurance Contract for Self-Driving Cars-A Comparative Study. Journal of Legal Sciences, 37(2).

(36)See: Jaaz, Muna Naiem. "The Implicit fault in the scope of medical liability Study with French and Iraqi judicial decisions." *Iklīl for Humanities Studies* 3.4 (2022).

(37)see: Mihna, Faris Kamil Hasan, et al. "Using Information Technology for Comprehensive Analysis and Prediction in Forensic Evidence." *Mesopotamian Journal of CyberSecurity* 4.1 (2024): 4-16.

(38) See: 张靖宁，冯士豪, Op.cit, p.343

(39) See Maxime Chevalier, "From Smart Contract Litigation to Blockchain Arbitration, a New Decentralized Approach Leading Towards the Blockchain Arbitral Order" (2021) Journal ofInternational Dispute Settlement 1, P.12.

(40) See: Florence Guillaume, & Sven Riva, OP.CIT، P،58-59.

(41) See: Mohamed S. Abdel Wahab, "ODR and E-Arbitration – Trends and Challenges", in Mohamed S. Abdel Wahab, Ethan Katsh and Daniel Rainey

(eds), Online Dispute Resolution: Theory and Practice (eleven 2012), 387, 392-395.

(42) See Francisco Garcimartin and Geneviève Saumier, Explanatory Report of the Convention of 2 July 2019 on the Recognition and Enforcement of Foreign Judgments in Civil or Commercial Matters (HCCH 2020), p. 101-102

(43)See: Florence Guillaume, & Sven Riva, OP.CIT ,p61.

(44)See: Hussein, Assist Prof Dr Lubna Abdel, Assist Prof Dr Hazem Akram, and Lecturer Faris Kamel Hassan. "Legal regulation of artificial intelligent agent" comparative study"." *AL-ANBAR University Journal of Law and Political Sciences* 14.1 bart: 1 (2024).

(45) see: Ruha Devanesan and Jeffrey Aresty, "ODR and Justice – An evaluation of Online Dispute Resolution's Interplay with Traditional Theories of Justice", in Mohamed S. Abdel Wahab, Ethan Katsh and Daniel Rainey, Online Dispute Resolution: Theory and Practice (eleven 2012), 251, 269.

(46) Rikka Koulu and Kalle Markkanen,OP.CIT, P.382.

(47) See: 张靖宁·冯士豪, OP.CIT, p.345.

(48) See: Florence Guillaume, & Sven Riva, OP.CIT ،p،51

(49) See Matthias Lehmann, "National Blockchain Laws as a Threat to Capital Markets Integration" (2021) 26 Uniform Law Review 148, for an analysis of French, English and American blockchain legislations.

(50) See: Florence Guillaume, & Sven Riva, OP.CIT, p51-52

(51) See: Florence Guillaume, & Sven Riva, OP.CIT, ،p،52-53.

(52) See World Economic Forum (WEF), "Bridging the Governance Gap: Dispute Resolution for Blockchain-Based Transactions", 16 /12/ 2020, Available on https://www.weforum.org/whitepapers/93bd1530-0ded-48fa8deee9b2d109d84d >LAST VISIT (5 /11/ 2023)

(53) See World Economic Forum (WEF), op.cit,

(54) See: Florence Guillaume, & Sven Riva, OP.CIT , P56-57.

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