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Lex Cryptographia: Legal Extensions of Smart Contract Breaches and Governance in Blockchain Systems

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ABSTRACT: The development of smart contract in a decentralized blockchain system raises various problems in the legal field marked by cases of smart contract violations such as the DAO, Parity Wallet, and PlayDapp cases. The breach of smart contract in the blockchain system affects the application and enforcement of conventional law in a virtual world that has no geographical jurisdiction. The limitations of conventional law in regulating the virtual world gave birth to various new legal concepts such as lex cryptographia and virtual state. This research aims to examine the expansion of law in blockchain systems and smart contract, especially in cases of breach of smart contract and the birth of new governance. This research uses doctrinal research methods with a case study approach and literature research. Based on the results of this research, the existence of smart contracts affects the legal expansion of their legitimacy and application as contracts that have legal force. Smart contract that has no ties to territorial jurisdiction give the parties to the smart contract complete freedom to regulate the settlement of contract violations, so that smart contracts become law, legal procedures, and punishment itself in carrying out its functions. In addition, the existence of smart contracts in the blockchain system also gave birth to lex cryptographia as a new law and a blockchain-based virtual state as a new governance model that is not limited by geographical areas.

KEYWORDS: Blockchain; Lex Cryptographia; Smart Contract; Virtual Nation.

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I. INTRODUCTION

The growth of the digital economy plays an important role in strengthening a country's economy to deal with pressures during the global recession that affect the resilience and growth of the national economy.[1] The development of the digital economy is characterized by the use of information technology to create, adapt, market, and consume goods and services based on the use of information technology to generate income.[2] The scope of the digital economy includes digital banking, e-commerce, virtual education, smartphone applications, and collaboration platforms. One of the challenges in the digital economy is characterized by the existence of cryptocurrencies and smart contract in the digital economy. Cryptocurrencies and smart contract are playing an important role in revolutionizing the financial and banking sectors through the use of blockchain technology and cryptographic concepts.[3] The increasing development and deployment of cryptocurrencies significantly contributes to the decentralization of centrally controlled financial systems.[4] The decentralized structure of cryptocurrencies, cross-border transactions, and the potential for financial inclusion are causing significant changes in conventional financial practices.[5] The consequent proliferation of

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1 Nefo Indra Nizar & Achmad Nur Sholeh, "Peran Ekonomi Digital Terhadap Ketahanan dan Pertumbuhan Ekonomi Selama Pandemi COVID-19" (2021) 4:1 Jurnal MADANI: Ilmu Pengetah Teknologi Dan Humaniora, 87–99.

2 Oliver Nguyen, *Digital Economy and Its Components: A Brief Overview and Recommendations* (München: University Library of Munich, Germany, 2023).

3 Umar Kayani & Fakhrul Hasan, "Unveiling Cryptocurrency Impact on Financial Markets and Traditional Banking Systems: Lessons for Sustainable Blockchain and Interdisciplinary Collaborations" (2024) 17:2 Journal Risk and Financial Management, 1–15.

4 Meiryani Meiryani et al, "The effect of global price movements on the energy sector commodity on bitcoin price movement during the COVID-19 pandemic" (2022) 8:10 Heliyon, 1–10.

5 Fakhrul Hasan et al, "A comparative analysis between FinTech and traditional stock markets: using Russia and Ukraine war data" (2023) 24:1 Electronic Commerce Research, 629–254.

cryptocurrencies poses a serious threat to monetary policy and financial stability, particularly to central bank monopolies on currency supply.[6]

Based on the Cryptocurrency Ownership Data report, it is recorded that the global level of cryptocurrency ownership in 2024 has reached 6,8% with more than 560 milion users. The percentage of crypto asset ownership in 2024 is mostly owned by users from the United Arab Emirates which reaches 25.3% and Indonesia occupies the 12th position with the percentage of crypto asset ownership reaching 13.90%.[7] The data published by the Ministry of Trade of the Republic of Indonesia explains that cryptocurrency transaction in Indonesia in 2023 reached 149 trilion. Meanwhile, at the beginning of 2024 in the January to April timeframe, cryptocurrency transactions had reached 211 trilion.[8] The increase in the number of cryptocurrency transactions indicates a significant growth in the digital economy. However, cryptocurrency transactions and the existence of smart contracts on decentralized blockchains, as well as limited regulation, have the potential to increase the risk of asset misuse crypto crimes such as fraud, money laundering, and breach of contract.[9]

Based on data from the 2024 Crypto Crimes Report, the misuse of crypto assets in 2023 has caused losses through unauthorized transactions with a transaction value of $24,2 bilion and in 2022 reaching $20.6 billion.[10] The high number of losses shows the urgency, especially in the security of smart contract used in blockchain systems. Smart contract security vulnerabilities are influenced by programming languanges, open network environments, and the tamper-proof and immutable nature of blockchain, so hacking

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6 David Yermack, "Chapter 2 - Is Bitcoin a Real Currency? An Economic Appraisal" in David Lee Kuo Chuen, ed, *Handb Digit Curr* (San Diego: Academic Press, 2015) 31.

7 Triple-A, "Cryptocurrency Ownership Data", (2024), online: *Triple-Aio* <https://triple-a.io/cryptocurrency-ownership-data/>.

8 Kementerian Perdagangan Republik Indonesia, "Transaksi Kripto Indonesia Sentuh Rp 211 Triliun hingga April 2024", (2024), online: *kemendag.go.id* <https://www.kemendag.go.id/berita/pojok-media/transaksi-kripto-indonesia-sentuh-rp-211-triliun-hingga-april-2024>.

9 Muh Afdal Yanuar, "Risiko Dan Posibilitas Penyalahgunaan Aset Kripto Dalam Kejahatan Pencucian Uang" (2022) 52:2 Majalah Hukum Nasional, 169–188.

10 Chainalysis, "The Chainalysis 2024 Crypto Crime Report", (2024), online: *go.chainalysis.com* <https://go.chainalysis.com/crypto-crime-2024.html>.

causes developers or companies to be unable to defend or prevent the implementation of smart contract.[11] The issue of smart contract vulnerabilities is also marked by the case pf DAO attacks in 2016, namely the exploitation of DAO (decentralized atomic organization) contract vulnerabilities that stealing around $60 million Ethereum Ether.[12] The parity wallet case in 2017 was a security vulnerability exploit attack that led to the freezing of $100 million of $30 million Ethereum in the second attack.[13] In addition, there is the latest problem marked by the PlayDapp case on February 9, 2024.[14] The PlayDapp case involved unauthorized access to platform access by minting 200 million PLA tokens, worth $31 million.

Problems in the development of blockchain systems and smart contract are also marked by the possibility of the emergence of new government systems with more democratic or participatory and decentralized decision making.[15] The new systems of government operate through a computer network without the intervention or control of the government human intervention. Blockchain has the potential to shift the balance of power away from centralized authority in the fields of communication, business, politics, and law.[16] The decentralized nature of blockchain has the potential to replace power and legal control with the emergence of a driving force for new areas of law and sovereignty in the blockchain world.[17] However, the possibility

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[11] Xia Feng et al, "An Interpretable Model for Large-scale Smart Contract Vulnerability Detection", (2024) 5:3 Blockchain: Research and Applications, 1–10.

[12] Terje Haugum et al, *Security and Privacy Challenges in Blockchain Interoperability - A Multivocal Literature Review* (Gothenburg Sweden: ACM, 2022).

[13] Christof Ferreira Torres et al, "The Eye of Horus: Spotting and Analyzing Attacks on Ethereum Smart Contracts" (2021) Finance Cryptography Data Security 25th International Conference, 33–52.

[14] Rony Roy, "Coinbase suspends PlayDapp token trading in response to smart contract security breach", (14 February 2024), online: *CryptoNewa* <https://crypto.news/coinbase-suspends-playdapp-token-trading-in-response-to-smart-contract-security-breach/>.

[15] Primavera De Filippi, Morshed Mannan & Wessel Reijers, "The Alegality of Blockchain Technology" (2022) 41:3 Policy and Society 358–372.

[16] Aaron Wright & Primavera De Filippi, "Decentralized Blockchain Technology and the Rise of Lex Cryptographia" (2015) SSRN Electronic Journal, 1–58.

[17] Katrin Becker, "Blockchain Matters—Lex Cryptographia and the Displacement of Legal Symbolics and Imaginaries" (2022) 33:2 Law and Critique, 113–130.

of the emergence of a new system of government is negated by the formation of a blockchain based virtual state that is a new concept in the digital world that seeks to fulfill various needs of society and government such as reduced bureaucracy, better legal systems, inclusivity, and democratic decision-making. The emergence of country the emergence of virtual states is motivated by decentralized and blockchain-based communities that offer potential benefits such as digital sovereignty, transparancy, and community-based governance.[18]

Based on previous research that examines legal developments in the blockchain system, it explains that technological developments expand the application of smart contract to various fields of social systems such as law, finance, and industries such as derivatives trading, copyright management, and the internet of things. The existence of smart contract changes the relationship of rights and obligations between equal subjects and must be included in contract law regulations, but existing laws and regulations have not been able to provide further explanation to fill the legal gaps and stability of the new transaction environment.[19]

There are other studies that also examine the law in blockchain which explain that the creation of decentralized currencies is inseparable from the existance of seld executing digital contracts through smart contract and smart assets (smart property). Smart contract and smart assets that can be controlled by the internet have the potential to give rise to a broad application that leads to the expansion of a new subset of laws, namely lex cryptographia.[20] Based on the background that has been presented, due to the absence of research that examines the expansion of the law on the use of smart contract and governance in the blockchain system. Therefore, this research is intended to examine the expansion of the law on the blockchain

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[18] Hristina Yordanova, "Blockchain-based virtual nations: A new era of governance and inclusivity — Q&A with Jur Network and Draper Startup House", (2023), online: *cointelegraph.com* <https://cointelegraph.com/news/blockchain-based-virtual-nations-a-new-era-of-governance-and-inclusivity-qa-with-jur-network-and-draper-startup-house>.

[19] Wenzhe Ma, "The Legal Effect and Application of Smart Contracts under the Administrative Law System" (2024) 9:1 Applied Mathematics and Nonlinear Sciences, 1–14.

[20] Wright & De Filippi, *supra* note 16.

system, namely lex cryptographia, which is focused on dispute resolution against violations of smart contract and the emergence of new governance in the blockchain system. The purpose of this research is to find out the extent of legal expansion that occurs in the blockchain systems that changes the applicability of conventional law in the digital space.

II. METHODS

The writing of this research uses a doctrinal research methods to provide a systematic explanation of the rules governing a particular category of law, analyse the relationship between rules, explain difficult areas, and enable predictions of future developments.[21] This research is supported by 2 (two) approaches, namely case study approach and library research. The case approach is conducted by reviewing and analysing smart contract hacking cases such as the DAO case, the parity wallet case, and the PlayDapp case. Meanwhile, the library study approach is carried out by reviewing various literature related to legal expansion in the blockchain system.

III. LEGAL EXPANSION OF SMART CONTRACT BREACHES IN BLOCKCHAIN SYSTEMS

A smart contract is a computer program coding in the form of a blockchain data-based electronic agreement to automatically execute agreements between parties.[22] Smart contracts are composed of a series of data codes in a blockchain network that has the form of a conventional contract agreement made in real form.[23] The existence of smart contracts has

[21] Peter Mahmud Marzuki, *Penelitian Hukum* (Jakarta: Kencana Prenada Media Grup, 2005).

[22] Hesti Ayu Wahyuni, Yuris Tri Naili & Maya Ruhtiani, "Penggunaan Smart Contract Pada Transaksi E-Commerce Dalam Perspektif Hukum Perdata di Indonesia" (2023) 2:1 Jurnal Hukum In Concreto, 1–11.

[23] Haoran Wu et al, "Mutation Testing for Ethereum Smart Contract" (2019) ArXiv 1–12.

developed with the existence of cryptocurrencies which divide smart contract into 5 (five) forms based on application and function, namely:[24]

1. *Basic Token Contract*

   A contract that contains account addresess and balances that represent values specified by the contract maker. The balances or collateral in the contract represent physical objects and monetary value tokens.

2. *Crowd Sale Contract*

   Contract management of tokens in bulk as a means of payment agreed upon in the contract.

3. *Mintable Contract*

   Non-fungible token (NFT) purchase and sale agreement contract which is a digital asset that represent a real object.

4. *Refundable Contract*

   An additional contract in the crypto sale and purchase agreement guarantees the return of assets from investors in the event of a failure in the execution of the agreement.

5. *Terminale Contract*

   A contract that contains an online purchase and sale agreement and the execution of a blockchain program in the fintech field.

The existence of smart contracts is inseparable from the principle of contract law in general, which gives the contracting parties the right to determine the content and form of their own contracts without outside interference.[25] Based on Article 1338 of the Indonesian Civil Code, it explains as follows:

> *"All agreements made in accordance with the law shall apply as law to those who make them. The agreement cannot be withdrawn other than by agreement of both parties, or for reasons determined by law. The agreement must be carried out in good faith."*

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[24] Christover Ramanda Moa, *Pembangunan Freelancing Marketplace Dengan Sistem Smart Contract Berbasis Teknologi Blockchain* (Thesis, Universitas Komputer Indonesia, 2020) [unpublished].

[25] F H Buckley, *The Fall and Rise of Freedom of Contract* (Durham: Duke University Press, 1999).

Based on Article 1338 of the Indonesian Civil Code, the existence of a contract cannot be separated from 3 principles, namely the principle of freedom of contract, the principle of pacta sunt servanda, and the principle of good faith. The principle of freedom of contract relates to the freedom of the parties to make or not make agreements, enter into agreements with anyone, determine the contents of the agreement, its implementation and terms, and determine the form of the agreement. Meanwhile, the principle of pacta sunt servanda relates to legal certainty relating to the consequences of the agreement. Finally, the principle of good faith relates to the implementation of the substance of the contract based on trust or firm belief and good will of all parties.[26] The three principles become a reference in the formation, implementation and completion of contracts. However, in the development of smart contracts, the application of the three principles triggers its own urgency, especially regarding the validity and resolution of problems due to the agreement.

The development of smart contracts is inseparable from the emergence of security issues that cause hacking vulnerabilities in smart contract.[27] The vulnerability is characterized by the case of DAO which experienced a hacking attack. DAOs are decentralized investment funds that are used for as a smart contract on Blockchain and Ethereum managed by the fund's investors collectively.[28] Collective management led to massive vulnerabilities with the discovery of DAO smart contract code that was exploited to drain funds worth more than USD $60 million.[29] Decentralised decision-making derived from anonymously hacking the DAO, exploiting smart contracts encoded on the blockchain.[30] The issue of the DAO case raises the pros and cons of the harmful act, referring to the classification of the act whether it qualifies as theft due to the drain of

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[26] Kunarso Kunarso & A Djoko Sumaryanto, "Eksistensi Perjanjian Ditengah Pandemi Covid-19" (2020) 1:1 Batulis Civil Law Review 33–46.

[27] Feng et al, *supra* note 11.

[28] Wulf A Kaal, "Blockchain Innovation for Private Investment Funds" (2017) 17:21 SSRN Electron J 1–36.

[29] Muhammad Izhar Mehar et al, "Understanding a Revolutionary and Flawed Grand Experiment in Blockchain: The DAO Attack" (2019) 21:1 Journal of Cases on Information Technology 19–32.

[30] Robbie Morrison, Natasha C H L Mazey & Stephen C Wingreen, "The DAO Controversy: The Case for a New Species of Corporate Governance?" (2020) 3:1 Frontiers in Blockchain: Policy and Practice Review 1–13.

funds contrary to the original intention of the parties and the unauthorized taking of assets or whether it qualifies as an unauthorized act because the act does not actually violate the provisions (unintentional defects) of the smart contract code which is considered the law in smart contracts.[31] In addition, the DAO as a manager is not a registered company in any jurisdiction, but rather a decentralized software entity replicated on the computers of all network nodes to participate in the maintenance of the Ethereum Blockchain.[32] Several attempts were made to stop cryptocurrency theft. However, the required voting consensus could not be obtained from the collective in a short period of time. DAOs do not have a system of managers who can take appropriate actions and responses in the resolution of cryptocurrency hacking cases, so any remedial actions taken by the DAO must be with the consent of its members and become an integral part of the smart contract code. The issue of smart contracts in the DAO case is inseparable from the terms of the smart contract which dictate that the smart contract code and DAO members all agree to be exclusively bound by the smart contract code. All members can make use of the code in the smart contract only to exercise their rights under the contract, so the act of fund-raising is difficult to be categorised as hacking or theft because fund-raising makes use of a feature that is intentional and explicitly coded under the terms of the smart contract. The DAO case also raises issues of accountability and legal responsibility. DAO members are fully responsible for the losses and gains of the cryptocurrencies they manage. The lack of centralised governance or the use of decentralised DAO systems leads to an inability to hold individuals accountable for problems. [33]

Another case related to smart contract vulnerabilities is the parity wallet case. The parity wallet case is a case where the parity wallet was hacked twice due to a bug in the access control logic. The hack triggers the party claiming ownership to be able to perform any activity including the transfer of funds to the destruction of smart contracts. The bug meant that anyone could claim ownership of the smart contract and take control of all funds.[34] The hack of the parity wallet led to the freezing of $100 million Ethereum

[31] Xiangfu Zhao et al, *The DAO attack paradoxes in propositional logic* (Hangzhou: IEEE, 2017).
[32] De Filippi, Mannan & Reijers, *supra* note 15.
[33] Morrison, Mazey & Wingreen, "The DAO Controversy", *supra* note 30.
[34] Torres et al, "The Eye of Horus", *supra* note 13.

in the first attack and the theft of $30 million Ethereum in the second attack. Security vulnerabilities and insecure code flaws raise the issue of software developers' liability for losses. Software developers for losses incurred by negligence in safeguarding digital assets. However, the implementation of library smart contracts supports a multi-party wallet system, so that technical ownership can be contested by anyone. The multi-sig party system is a smart contract created on the ethereum blockchain to store the user's cryptocurrency keys for all transactions. The vulnerability of the parity wallet smart contract was exploited by an anonymous party using the pseudonym devops199. The hack resulted in all the wallet accounts that dependent on the smart contract library suffered a paralysis of 584 wallets containing 513,774.16 ETH or approximately US$243 million.[35] The use of a frozen multi-sig wallet system is designed without giving its owner the ability to link to another library contract if the original linked library contract is inactive or deleted. Therefore, freezing encourages the adoption of hard forks. A hard fork is a process of protocol change by splitting or diverging a blockchain into two copies of the same blockchain, but not directly affecting each other. The use of blockchain copies in the hard fork process treats new transactions on the previous blockchain block or the old blockchain as invalid or unconfirmed. All blockchain users are encouraged to use the copy blockchain or the new blockchain as an acknowledgement or confirmation of the blockchain. When all users agree to use the new blockchain resulting from the hard fork process, the new blockchain effectively replaces the old hacked blockchain. However, on the contrary, when both the old and new blockchains are approved or used by many users, the hard fork process is declared as creating a new blockchain or a new cryptocurrency.[36]

Problems in the development of smart contract were also marked by the exploitation of the PlayDapp cryptocurrency smart contract in February 2024. The breach in the PlayDapp case arose after a security breach of unauthorized access to the platform's private key that led to the minting of

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[35] Jenny Leung, "Legal issues surrounding Parity wallet's 'kill' switch", (2017), online: *Medium* <https://medium.com/blockmatics-blog/legal-issues-surrounding-parity-wallets-kill-switch-c551f02247d3>.

[36] Tae Wan Kim & Ariel Zetlin-Jones, "The Ethics of Contentious Hard Forks in Blockchain Networks With Fixed Features" (2019) 2:1 Frontiers in Blockchain: Perspective 1–6.

200 million PLA tokens or approximately $31 million. The breach of the smart contract led to a significant drop in the value of PLA tokens from $0.1823 to $0,1482. The breach of the smart contract caused by the hack also caused considerable downtime in PlayDapp's customer service, so users also suffered losses due to the decrease in token value.[37]

The legal extension of smart contract refers to the legitimization or acceptance and recognition of smart contract as contracts. A contract is defined as a promise or agreement that has legal force.[38] The binding legal force requires the contract to fulfill several conditions, namely the existence of parties, the capacity of the parties, mutual consent, consideration, and enforcement of the contract. Legal expansion in smart contract legalizes the use of clickwarp and brown wrap concepts as mutual consent in the formation of agreements. The user's consent in a clickwarp agreement is done expressly by clicking a box stating that he agrees to all the terms listed. While the brown warp agreement, the consent is done without any affirmative consent from the user but the developer does the actual notification of the contract terms.

Enforcement and legal proof in smart contract also have their own problems, especially in dispute resolution. Dispute resolution in smart contract is fully enforced like conventional contracts. The main problem with smart contract refers to the indeterminacy of jurisdiction. Smart contract operate on the main distributed and decentralized blockchain technology. Blockchain technology has the ability to identify the parties to a transaction but the parties' information is still anonymous, which creates problems in determining the appropriate place to resolve disputes.

Smart contract law, which is not tied to a corpus or territory, gives legitimacy to the contract, decentralized and algorithmic. Decentralized law provides freedom of settlement on a case-by-case basis or depending on the wishes and conditions of each party to the transaction.[39] Dispute resolution in smart contracts applies the principle of choice of court. The principle of choice of court is a freedom of contract that gives the parties to a contract the right to set their own rules, including rules for resolving disputes

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[37] Roy, *supra* note 14.

[38] Reggie O'Shields, "Smart Contracts: Legal Agreements for the Blockchain" (2017) 21:1 UNC School of Law: North Carolina Banking Institute 176–194.

[39] Becker, *supra* note 17.

relating to the contract.[40] Individual customization of the applicable norms allows individuals to determine the rules that apply to them with their respective preferences.[41] The freedom to set norms in smart contracts gives rise to a new law consisting of a system of interconnected rules without any third-party institution or judiciary to enforce the rules.[42]

Parties to smart contract are anonymous and jurisdiction is not based on territorial boundaries orming a new state that is formed virtually. The formation of a borderless virtual state that stems from a virtual community that contrasts the virtual world and the real world, giving rise to a range of cyberspace that knows no law and cannot be regulated to understand the direction of internet law and policy itself.[43] Therefore, the community formed in a smart contract can become a country that is not limited by territorial boundaries, and is regulated through a series of algorithmic rules that are set and enforced through voting mechanisms or freedom of contract.[44]

The breach of smart contract gave birth to the concept of blockchain-based arbitration. Dispute resolution in blockchain-based arbitration is not much different from traditional arbitration. The arbitration agreement is part of the smart contract and arbitrators are selected using random numbers drawn from blocks on the blockchain.[45] Developments in the application of traditional arbitration allow for incompatibilities, so that the rise of various decentralized justice system concepts such as the cleros court, Aragon, and Jur. Decentralized justice systems are decentralized blockchain-based

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[40] Afifah Kusumadara, "Jurisdiction of courts chosen in the parties' choice of court agreements: an unsettled issue in Indonesian private international law and the way-out" (2022) 18:3 Journal of Private International Law 424–449.

[41] Michèle Finck, *Blockchain regulation and governance in Europe* (Cambridge: Cambridge University Press, 2019).

[42] Wright & De Filippi, *supra* note 16.

[43] Gerard Goggin, "The emergence of the Internet in Australia. From researchers tool to public infrastructure" in *Virtual Nation Internet Aust*, 1st ed (Sydney, NSW: UNSW Pres, 2004) 30.

[44] Wright & De Filippi, *supra* note 16.

[45] Gabriela Cosío Patiño, "Lex Cryptographia Guidelines for Ensuring Due Process in Transnational Blockchain-Based Arbitration: Study on the Kleros Model", (2022), online: *TDM Ogemid* <https://www.transnational-dispute-management.com/article.asp?key=2937>.

arbitration solutions that rely on smart contract and crowdsourced juries.[46] Compliance with due process requirements is a built-in feature of the protocol as stages such as proper notice to the parties, composition of the jury panel, exchange of evidence, and parties' responses are automatically executed by the smart contract.[47] Decentralized justice systems are emerging as a potential solution to problems associated with traditional legal systems such as cost, slow and bureaucratic decision-making processes, lack of trust in justice, as well as impartiality of the justice system.[48] Legal expansion in the practice of decentralized justice systems is characterized by penalties for jury members who do not vote consistently with the majority, resulting in legal evolution that results in the same norms being applied continuously. However, in the case of obsolete legal norms, the jury will apply a rule that is different to create jurisprudence and the subsequent evolution of legal rules. Decisions are made in isolation of the jury, with each juror only voting and justifying their vote to resolve the dispute.[49]

IV. LEGAL EXPANSION OF GOVERNANCE IN BLOCKCHAIN SYSTEMS

The development of smart contract and blockchain systems gave birth to the expansion of a new subset of laws in the world of technology and law called Lex Cryptographia. Lex Cryptographia is defined as regulation administered through self-executing, decentralized smart contract. Lex Cryptographia are laws that are no longer legitimized by culturally defined symbolic references that are no longer necessary because there is no longer a need for recognition or trust. Programming code gives parties to a smart contract the power to legislate, imply and encode the values they deem

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[46] Luis Bergolla, Karen Seif & Can Eken, "Kleros: A Socio-Legal Case Study Of Decentralized Justice & Blockchain Arbitration" (2021) 37:1 SSRN Electron Journal 56–98.

[47] Kleros, *Dispute Revolution: The Kleros Handbook of Decentralized Justice* (Buenos Aires: Kleros, 2019).

[48] Alesia Zhuk, "Applying blockchain to the modern legal system: Kleros as a decentralised dispute resolution system" (2023) 4:3 International Cybersecurity Law Review 351–364.

[49] Michael Buchwald, "Smart Contract Dispute Resolution: The Inescapable Flaws of Blockchain-Based Arbitration" (2020) 168:5 University of Pennsylvania Law Review 1369–1424.

fundamental, and initiate a law. automatic execution of the law. Lex cryptographia separates the concept of law in general from the three dimensions of human life that are constitutive of the need to agree on a common representation of the world, and are core elements of the symbolic framework, the imaginary institutional system, and the law of society.[50] Lex cryptographia breaks away from these three elements and proves to have an anti-representational form of law. The encoding in the blockchain proves to be a language without representation that removes the pieces that open up the fictional space and stage of representation for all intents and purposes.[51] Lex cryptographia operates on the logical principle of non-contradiction which is understood to be free from anything ambivalent or paradoxical.[52] The freedom in question is free from the irrational and unreasonable dimensions that define human and social life, so that programming acts as law, stages of legal procedure, and punishment itself. Automated law and carried out independently of any controlling entity.[53]

The emergence of lex cryptographia is inseparable from the ideology of Governance by Numbers, which considers law and the state as a trick of power and a violation of individual sovereignty.[54] The acceptance of lex cryptographia and the ideology of Governance by Numbers is based on the exhaustion of people's trust in institutions, thus triggering the phenomenon of a mediated society that is liberated from social construction due to the influence of numbers and algorithms.[55] The influence of the phenomenon on society led to a major transformation that illustrates the transition from governance by law to governance by numbers.[56] The shift in governance is a global institutional crisis that alienates workers from work, politics, and

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50 Becker, *supra* note 17.

51 Antoine Garapon & Jean Lassègue, *Justice digitale : révolution graphique et rupture anthropologique*, 1re éd ed (Bruxelles: PUF, 2018).

52 Pierre Musso, "Technique et Politique: Diabolique et Symbolique" (2021) 1 Pist Rev Philos Contemp Éthique Polit Philos Tech 83–113.

53 Garapon & Lassègue, *supra* note 51.

54 Jacques Le Goff, "Alain Supiot. La gouvernance par les nombres . Cours au Collège de France (2012-2014 ? Fayard, 2015, 512 p., 22 €": (2015) 349:6 Revue Project 90–91.

55 Michael Casey & Paul Vigna, *The truth machine: the blockchain and the future of everything*, first edition ed (New York: St. Martin's Press, 2018).

56 Wendy Espeland, "When Numbers Rule - Alain Supiot, Governance by Numbers: The Making of a Legal Model of Allegiance (Oxford/Portland OR, Bloomsbury Publishing, 2017)" (2019) 60:3 European Journal of Sociology 523–527.

each other due to transformations in the world of work, law, the state, and social life.

Implementation law-based governance relies on the subordination of individuals to the rule of law or the enforcement and placement of law in the highest position. Meanwhile, the implementation of numbers-based governance relies on the programming of individuals to continuously respond to information and measurable goals.[57] The shift from subordination to programming represents the adaptation of human thought and action to a cybernetic view that focuses on how things process information, react to information, and change or can be changed into something better.[58] The shift to number-based governance is an expression of the delusion of the cybernetic view that marks the break with the ideals of the rule of law and breakthroughs because the law has lost its sovereign status, becoming merely an instrument for program realization. In addition, number-based governance is also a continuity because number-based governance is closest to the ideal of res publica, which is protected from the arbitrariness of human will, including the will of the majority, namely democracy.[59] Res publica itself is defined as the civic affairs of a particular political community (civitas) and communal political space where they manage the direction of the community.[60]

The expansion of law in blockchain systems means that government agencies and multinational corporations lose the ability to control and shape the activities of different people through existing means. Uncontrolled law potentially creates an increased need for rules that focus on how blockchain technology is regulated, how decentralized organizations are created and implemented in ways that have not been explored under current legal theory. The use of decentralized technologies by individuals can potentially be controlled by a state or other regulatory body through the threat of law enforcement (coercive power), market

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[57] Alain Supiot, *Governance by Numbers: The Making of a Legal Model of Allegiance*, translated by Saskia Brown, Hart studies in comparative public law (Oxford Portland, Oregon: Hart Publishing, 2017).

[58] Kevin Kelly, *Out of control: the new biology of machines, social systems, and the economic world* (Massachusetts: Perseus Books, 1994).

[59] Supiot, *supra* note 57.

[60] Louise Hodgson, *Res Publica and the Roman Republic: "Without Body or Form"* (Oxford: Oxford University Press, 2017).

manipulation (financial incentives and disincentives), development of new social norms (social pressure) and pressure on centralized intermediaries such as internet service providers and social network search gateways.[61] The threat of control by a state or regulatory body is a challenge in an era of numbers-based governance that dismantles the legal order through the subordination of the public sphere to interests. private sector. The threat of control is inseparable from the influence of the paradigm of ordoliberalism. The ordoliberalism paradigm gives the state the political task of establishing and maintaining the institutional framework for a depoliticized economic order directed by market competition.[62] Ordoliberalism conceives of society as a complex of interdependent economic, social, legal, political and moral orders. Societal order has consequences for the other orders, so a stable society requires the various orders to be compatible with each other. compatible. The paradigm of ordoliberalism focuses on the reciprocal relationship with different societal orders such as the reciprocal relationship between economic and legal orders. The reciprocal relationship is characterized in the determination of a legal framework that supports a competitive economic order.[63] Ordoliberalism emphasizes the economic order that must be implemented and maintained by the state, but the role of the government is limited to improving the economic order indirectly by shaping the rules of the game.

Influence of Governance by Numbers ideology and ordoliberalism Paradigm It gave birth to the concept of a virtual nation, which separates the traditional ties between geographical location and the associated government and its policies.[64] The governance revolution in virtual nations is marked by the Decentralized Autonomous Organization (DAO). DAO is one of the concepts of virtual state governance that represents a paradigm shift in the way organizations are structured and governed.[65] The DAO governance model emphasizes on 3 (three) things, namely democratic

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[61] Wright & De Filippi, *supra* note 16.

[62] Federico Bruno, "Ordoliberal ideas on Europe: two paradigms of European economic integration" (2023) 49:4 History of European Ideas 737–756.

[63] Malte Dold & Tim Krieger, "The ideological use and abuse of Freiburg's ordoliberalism" (2023) 195:3–4 Public Choice 341–361.

[64] Wikiversity, "The Idea Incubator/Virtual Nations", (2021), online: *en.wikiversity.org* <https://en.wikiversity.org/wiki/The_Idea_Incubator/Virtual_Nations>.

[65] Rainer Bauböck, ed, *Debating Transformations of National Citizenship*, IMISCOE Research Series (Cham: Springer International Publishing, 2018).

participation, transparency and accountability, and autonomy and efficiency. Democratic participation gives every virtual citizen the right to participate in decision-making from policy changes and project approval to resource allocation. Meanwhile, transparency and accountability are characterized by the operation of blockchain technology that records every transaction and decision in a public ledger. Every action is visible and accountable to the community to foster trust and integrity in the virtual state. Finally, the DAO model emphasizes self-management through the use of pre-defined rules encoded in smart contracts, there by reducing the need for intermediaries and bureaucratic processes in governance and administration.

Virtual world governance gives birth to new governance concepts such as virtual citizenship. One of the concepts of virtual citizenship is characterized by the e-residency of Estonia which gives anyone the freedom to apply for a smart contract-based Estonian identity card, allowing non-Estonians access to Estonian services such as company formation, banking, payment processing, and taxation.[66] Virtual citizenship is a development of the concept of transnational citizenship that redefines the notion of citizenship and replaces an individual's national allegiance with the ability to belong to multiple states. Therefore, e-residency allows anyone, anywhere to securely identify themselves online, open and run a location-independent business.[67]

VI. CONCLUSION

The legal expansion of the use of smart contract refers to the legitimization of smart contract as valid and legally binding contracts. Contracts that have binding legal force are required to fulfill requirements such as the existence of parties, party capacity, mutual consent, consideration, and contract enforcement. The fulfillment of contractual requirements in smart contracts is characterized by mutual consent in the formation of the

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[66] Marian Männi, "Study: virtual citizenship falls into a grey area businessmen can exploit", (2023), online: *researchinestonia.eu* <https://researchinestonia.eu/2023/07/06/study-virtual-citizenship-falls-into-a-grey-area-businessmen-can-exploit/>.

[67] Clare Sullivan & Eric Burger, "E-residency and blockchain" (2017) 33:4 Computer Law & Security Review 470–481.

agreement. Smart contract legalize the use of clickwarp and brown wrap concepts as legal party consent. Meanwhile, law enforcement in smart contract still has problems with jurisdiction that cannot be determined because smart contracts operate using the main blockchain technology. The information of the parties in the blockchain system is anonymous, causing problems in determinin the right place to resolve disputes. Therefore, dispute resolution in smart contract applies the principle of choice of court. Smart contract that are not bound to a corpus or territory will be given the freedom to settle disputes depending on the wishes and conditions of each transaction party. The freedom in the blockchain system to resolve disputes gave birth to a new judicial system, namely the Decentralized Judicial System. The Decentralized Judicial System is blockchain-based arbitration that relies on smart contract and crowdsourced juries to resolve disputes.

The expansion of law in the blockchain system gave birth to the lex cryptographia, which is a regulation managed through smart contracts that are executed automatically and decentralized. The emergence of lex cryptographia is influenced by the ideology of Governance by Number, which shifts the dependence of individual subordination to the rule of law towards the programming of individuals to respond to information and measurable goals continuously. The view of Governance by Number gives rise to the phenomenon of a mediated society that is liberated from social construction due to the influence of numbers and algorithms. In addition, the birth of lex cryptographia is inseparable from the paradigm of ordoliberalism which emphasizes the economic order implemented by the state but the government is limited only to improving the order indirectly through the establishment of rules of the game. The ideology of Governance by Number and the paradigm of ordoliberalism influenced the birth of the virtual nation concept, which is characterized by the DAO model in blockchain-based virtual state governance. Virtual world governance also gave birth to concepts in governance such as virtual citizenship characterized by the e-residency of Estonia which provides freedom for anyone to apply for a smart contract-based Estonian identity card to gain access to Estonian services such as company formation, banking, payment processing and taxation. The concept of virtual citizenship raises transnational citizenship that provides individuals with

the ability to become citizens of multiple countries. Based on the research results, the author provides 3 (three) policy recommendations. First, the establishment of a Supreme Court Regulation regarding guidelines for digital dispute resolution covering dispute resolution procedures to the execution of decisions. Second, the enforcement of digital security and privacy standards, especially on platforms that involve electronic transactions. Third, the regulation of digital communities which includes supervision to enforcement of certain criminal offenses.

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