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Blockchain Application in Preventing Double Land Certificate Disputes

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Abstract. *This study aims to analyze: 1) The application of blockchain technology can prevent the occurrence of dual land certificate disputes. 2) Challenges faced in the application of blockchain to prevent dual land certificate disputes in Indonesia. This type of research is normative legal research. The approach method in this study is the statute approach. The type and source of data in this study are secondary data obtained through literature studies. The analysis in this study is prescriptive. The results of the study concluded: 1) Blockchain offers an innovative solution in preventing dual land certificate disputes with a transparent, secure, and non-manipulable recording system. This technology uses a decentralized system where each land transaction is verified by a node as a validator, ensuring the validity of the data and eliminating the risk of duplication and forgery of certificates. With this system, land ownership records become more accurate, cannot be changed unilaterally, and can be verified openly. However, the application of blockchain requires comprehensive regulations, adequate technological infrastructure, and education for the community and stakeholders to support effective implementation. 2) The implementation of blockchain in the land system in Indonesia faces various challenges, such as the absence of specific regulations, limited technological infrastructure, and lack of understanding and readiness of human resources in managing this system. In addition, the integration of blockchain with the national land system which is still based on conventional digital is a separate obstacle. Therefore, it is necessary to formulate clearer regulations, improve technological infrastructure, and provide education and training for the community and stakeholders so that the implementation of blockchain in land can run optimally.*

Keywords: *Blockchain; Certificate; Dispute; Land.*

1. Introduction

Land has an important meaning for the life of the Indonesian nation, this is because Indonesia is an agricultural country, so that every activity carried out by most of the Indonesian people always requires and involves land issues. Even most people, land is considered something sacred, because there is a symbol of social status that it has.[1]

The proliferation of buildings in various areas of life has caused land to become a commodity that has a very high economic value and is difficult to control. This condition is caused by the need for land which continues to increase very rapidly, while its supply is limited so that it is not uncommon for it to cause land conflicts/cases, both in the form of ownership conflicts and conflicts concerning the use/designation of the land itself.[2] The government has continuously tried to implement land registration throughout the country to ensure legal certainty. HoweveruntilCurrently, the implementation of land registration has not provided satisfactory results. The area where land registration has been carried out has not reached 100%. If it is not immediately improved, various land conflicts and disputes will arise.[3]

The purpose of land registration in Indonesia is to provide legal certainty (rechts kadaster) for land rights and legal protection for land ownership. The document as proof of these rights is referred to as a land certificate by Government Regulation Number 10 of 1961 and Government Regulation Number 24 of 1997. A land certificate is a document that proves rights to land, management rights, waqf land, ownership rights to apartment units and mortgage rights, each of which has been recorded in the relevant land book. The physical land certificate is a crucial document for the community. This can cause problems, ranging from falsification of certificate data by land mafia to the many cases of land disputes caused by duplicate certificates. Duplicate certificates arise due to legal and physical defects, which in this case occur in certificates that are not mapped correctly on the land registration map by the local Land Office.[4]

Duplicate land certificates occur because the land certificates are issued on one land plot object that overlaps (partially or completely) with another land plot. This

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[1]Bagas Imam Arianto & Gunarto. (2019). Tinjauan Yuridis Pelaksanaan Pendaftaran Tanah Sistematis Lengkap (PTSL) Di Kantor BPN Kabupaten Grobogan, Prosiding *: Konferensi Ilmiah Mahasiswa Unissula (KIMU) 2*, Unissula Semarang.

[2] Adrian Sutedi. (2018). *Peralihan Hak Atas Tanah dan Pendaftarannya,* Jakarta: Sinar Grafika. p. 22

[3]Maulida Soraya Ulfah & Denny Suwondo. (2019). Pelaksanaan Pendaftaran Tanah Sistematis Lengkap (PTSL) Di Kabupaten Demak, *Prosiding : Konferensi Ilmiah Mahasiswa Unissula (KIMU) 2*, Unissula Semarang. p. 2

[4]Agus Salim. (2019). Penyelesaian Sengketa Hukum terhadap Pemegang Sertifikat Hak Milik dengan Adanya Penerbitan Sertifikat Ganda, *Jurnal USM Law Review*, Volume 2, Nomor 2. p. 183

kind of thing is also called overlapping certificates. Duplicate land certificates are further exacerbated by the change in the administration system from analog to digital, through the process of digitizing land data. The land digitization process will change land certificates in printed form into land certificates in digital form. However, in this digital land certificate, it is very easy to duplicate and manipulate land data, due to the insecurity of the system on the land server. In addition, land certificate data that has been digitized still has several weaknesses, including:[5]

1) The server is too conventional and easy to hack. So far, the server used in the land office is still a server that is relatively weak or easy to hack its data.

2) Servers are physical, so if something happens to the server, land data will be lost.

3) The large amount of land data that is piling up. This problem can be caused by repetition of incorrect data.

4) Unorganized land data.

In today's digital era, blockchain technology has emerged as a potential solution to overcome these problems. Blockchain is a secure and unmanipulated distributed system that stores transaction records cryptographically. In short, Blockchain consists of many servers that are interconnected like a chain, then the data entered into the system will be verified by other servers and all Blockchain users can access it and can find out if there are changes. In its implementation, Blockchain not only applies transparency but the data that has been entered is not easy to manipulate and duplicate so that the authenticity of the existing data will be more guaranteed.[6]

In the Land sector, Blockchain can also be used to secure electronic land documents. Blockchain technology, as a decentralized system that ensures transparency and data security, offers a potential solution to overcome this problem. Every transaction or change related to land ownership recorded in the blockchain cannot be changed or manipulated, thus preventing the issuance of duplicate land certificates. With the implementation of blockchain, the government and related parties can create a more transparent, secure, and efficient system, while reducing the potential for conflict. However, although

[5]Joshua Nugraha & Aris Kurniawan. (2022). Penerapan Blockchain Untuk Pencegahan Sertipikat Tanah Ganda Di Kementerian Agraria Dan Tata Ruang/Badan Pertanahan Nasional, *Jurnal Bhumi,* Vol. 2, No. 2. p. 3

[6]Joshua Pangkah. (2024). Prospek Pemanfaatan Teknologi Blockchain Untuk Mengoptimalkan Keamanan Dokumen Pertanahan Elektronik, *Skripsi,* Kemeterian Agraria Dan Tata Ruang/ Badan Pertanahan Nasional Sekolah Tinggi Pertanahan Nasional Yogyakarta. p. 2

blockchain technology offers many benefits, its application in the land system still faces various challenges.

2. Research methods

This type of research is normative legal research. The approach method in this research is the statute approach. The type and source of data in this research are secondary data obtained through literature studies. The analysis in this research is prescriptive.

3. Results and Discussion

3.1. Implementation of Blockchain Technology Can Prevent the Occurrence of Duplicate Land Certificate Disputes

The creation of legal certainty regarding land rights requires a strong legal foundation. The legal foundation related to agrarian issues in Indonesia is generally regulated in Law Number 5 of 1960 concerning Basic Agrarian Principles, better known as the Basic Agrarian Law (UUPA). The term agrarian according to UUPA has a meaning not only limited to land, but also includes the earth, water and natural resources contained therein. Even according to Boedi Harsono, space is also included in it, where above the earth and water contain energy and elements that can be used for efforts to maintain and develop the fertility of the earth, water and natural resources and other things related to these.[7]

The Basic Agrarian Law (UUPA) regulates land registration with the aim of providing legal certainty. Because UUPA only regulates land matters in basic matters, implementing regulations are needed that function to perfect the substance of this UUPA. The government regulation that regulates land registration is Government Regulation Number 24 of 1997 as a replacement for Government Regulation Number 10 of 1961 concerning Land Registration. The function of land registration is to obtain strong evidence (Article 19 Paragraph (2) Letter c UUPA concerning the validity of legal acts concerning land). For this reason, a Certificate is given as proof of land ownership rights containing a copy of the Land Book & Measurement Letter.[8]

Land registration is an important and basic activity in land management. For this reason, a number of provisions and policies related to land registration have been issued, but in reality there are still many problems with land registration. In addition to among the community, both between families, land disputes also often occur between stakeholders (businessmen, BUMN and the government). This

[7]Rahmat Ramadhani. (2017). Jaminan Kepastian Hukum Yang Terkandung Dalam Sertipikat Hak Atas Tanah, *Journal De Lega Lata,* Volume 2, Nomor 1. p. (139)
[8]Novita Riska. (2021). Analisis Yuridis Sertipikat Tanah Hak Milik Elektronik (*E-Certificate*) Demi Mewujudkan Kepastian Hukum, *Jurnal Signifikan Humaniora,* Vol. 2, No. 4 August, p. 8

proves the importance of land certificates as legal evidence of land owned. If the community understands how important it is to have an official land certificate recognized by the government, it may minimize the occurrence of land cases in an area.[9] Land title certificates also function as strong evidence of land ownership rights. This has been implicitly stipulated in Article 19 paragraph (2) letter c of the UUPA.

One of the focuses is the digitalization of land title certificates under the name of electronic certificates. The Ministry of ATR/BPN has developed electronic certification to accelerate the process of land registration and certification. When compared to developed countries, Indonesia can be said to be still lagging behind in terms of electronic land certificates, because most still use conventional certificates, and some even do not have land certificates at all.[10]This electronic certification allows the process of land registration and certification to be done online and more efficiently. Land registration systems around the world have undergone a process of modernization through the use of information and communication technology.[11]

The Indonesian government has attempted to improve the land system by issuing Regulation of the Minister of ATR/Head of BPN Number 1 of 2021 concerning electronic certificates. which has now been revoked and replaced by the Regulation of the Minister of ATR/Head of BPN Number 3 of 2023 concerning the Issuance of Electronic Documents in Land Registration Activities. This certificate uses a hash code and QR Code that allows landowners to access data digitally through the Ministry of ATR/BPN system. However, the existing system is still based on conventional servers that are vulnerable to manipulation and data loss due to hardware damage.

The adoption of electronic land certificates has a significant impact on the security of data related to land ownership, both in terms of positive aspects and challenges that must be overcome. Article 1 Paragraph 13 of the Regulation of the Minister of ATR/Head of BPN No. 3 of 2023 concerning the Issuance of Electronic Documents in Land Registration Activities, explains that data is information about something including but not limited to writing, sound, images, maps, designs, photos, electronic data interchange (EDI), electronic mails (electronic mails, telegrams, telex, telecopy or the like, letters, signs, numbers, access codes,

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[9]Andhi Nur Rahmadi. (2022). Efektivitas Program Pendaftaran Tanah Sistematis Lengkap (PTSL) Dalam Pencegahan Mafia Tanah Di Kota Probolinggo, *Jurnal Ilmu Sosial dan Ilmu Politik Malikussaleh* (JSPM), Volume 3 Nomor 1. p. 43

[10]Sudarmanto Kukuh, Arifin Zaenal, & Tatara Tirsa. (2023). Tindak Pidana Korupsi Bidang Pertanahan Terhadap Program Pendaftaran Tanah Sistematis Lengkap (PTSL), *Jurnal USM Law Review,* volume 6, nomor 1. p. 310

[11]Ana Silviana. (2021). Urgensi Sertipikat Tanah Elektronik Dalam Sistem Hukum Pendaftaran Tanah Di Indonesia," *Administrative Law and Governance Journal,* Volume 4, nomor 1. p. 8

symbols, or perforations.

Electronic land certificates as proof of electronic ownership recognized by the Electronic Information and Transactions Law (UU ITE) specifically regulated in Article 6 of the Electronic Information and Transactions Law (UU ITE). Law of the Republic of Indonesia Number 11 of 2008 concerning ITE is a manifestation of the responsibility that must be borne by the state and has been revised by Law No. 1 of 2024 concerning the Second Amendment to Law Number 11 of 2008 concerning Electronic Information and Transactions, providing maximum protection for all activities that use information and communication technology, so that they are legally protected from possible crimes and manipulation of technology.[12]

The adoption of electronic land certificates can improve data security and efficiency of land administration, but also presents challenges related to cyber attacks and privacy protection. To ensure success, investment in technological infrastructure, adequate regulation, and public education are needed so that this adoption has a maximum positive impact. One of the problems that often occurs in the context of land is the issuance of duplicate certificates, which is a condition where more than one certificate is issued for the same plot of land. The main cause of this problem is overlapping land data that is not well organized.[13]

The duplication process is also very easy to do on certificates in digital form. The manipulation process on digital data is also easy to do.[14]So a mechanism is needed to know that a digital certificate has not changed from the original. Technology that can guarantee the authenticity and integrity of digital certificates is very important so that they cannot be manipulated or duplicated.

Block chain become one of the innovations that are increasingly being discussed in various sectors because of its ability to create transparent, secure, and immutable systems. Its capabilities make Blockchain a potential solution in digital data management, including electronic certificates. The Blockchain concept, which was initially only applied to the Bitcoin world, has caused a paradigm shift. This then led to considerations to re-develop the concept so that it can be used in various other fields, one of which is archiving. So then, Blockchain technology

[12]Made Restu Hawiwie, I Nyoman Putu Budiartha & Ni Komang Arini Styawati. (2021). Tinjauan Yuridis Terhadap Transaksi Jual Beli Tanah Melalui Internet Banking, *Jurnal Preferensi Hukum,* Vol. 2, No. 2. p. 402.
[13]Mudakir Iskandar Syah. (2019). *Panduan Mengurus Sertipikat Dan Penyelesaian Sengketa Tanah*, Jakarta: Bhuana Ilmu Populer. p. 30
[14]Leonardo Refialy, Eko Sediyono dan Adi Setiawan. (2015). Pengamanan Sertifikat Tanah Digital Menggunakan Digital Signature SHA -512 dan RSA, *Jurnal Teknik Informatika dan Sistem Informasi*, Vol.1, No.3. p. 229.

became a new topic among archivists in various countries.[15]With the overall transition to digital is one form of initiation which is an effort to take on the role of a major player in the use of Blockchain technology and gain extraordinary efficiency in various fields, one of which is in the land sector in Indonesia considering Indonesia's land dispute emergency. Blockchain consists of several important elements that allow this technology to function safely and efficiently, namely:

1) Block

The basic element is the block. Blockchain is a series of blocks containing transaction data. Each block consists of two main parts, namely the header and the transaction counter. The header includes the index number, timestamp, nonce, data, hash value, and other elements. Meanwhile, the transaction counter contains a list of transactions in one block. A new block will be created by one of the nodes in the network and must be verified by the entire network before it can be added to the blockchain chain.[16]

2) Hash Pointers

Hash pointer, which is a reference that connects one block to the previous block using a hash value generated through a cryptographic function. This function ensures the integrity of data in the blockchain, because if there is a change in a block, the hash value will change and affect all subsequent blocks.[17]

3) Merkle Tree

Block chain also uses Merkle Tree, a binary tree structure that allows for more efficient and secure transaction data management. Each node in this tree contains the hash of its two child nodes, meaning any change in one transaction will impact changes throughout the tree.[18]

4) Digital signature

To ensure the authenticity of transactions, blockchain uses digital signatures. Digital signatures are created with a cryptographic algorithm consisting of two keys, namely a private key to sign the transaction and a public key to verify its

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[15]Muhammad Usman Noor. (2020). Implementasi Blockchain di Dunia Kearsipan: Peluang, Tantangan, Solusi, Atau Masalah Baru, *Khizanah al-Hikmah: Jurnal Ilmu Perpustakaan, Informasi, dan Kearsipan*, Vol.8, No.1. p.87.
[16]Antonopoulos, A. M. (2017). *Mastering Bitcoin*, O'Reilly Media. p. 56.
[17]Pilkington, M. (2016). *Blockchain Technology: Principles and Applications*, Cambridge: Cambridge University Press. p.38
[18]Singh, S., & Singh, N. (2016). *Blockchain: Future of Financial and Cyber Security,* New Delhi: Springer. p. 22

authenticity. This algorithm ensures that the digital signature cannot be forged, so that data integrity is maintained.[19]

5) Transaction

Another key element is transactions, which are data sent through the blockchain and include information about the sender, recipient, and a digital signature. Each transaction must be verified by a node before it can be added to a block. Because transactions are timestamped, changes or forgeries of data can be detected immediately.[20]

6) Consensus Mechanism

Block chain using a consensus mechanism to ensure that all nodes in the network have the same data. This mechanism serves to agree on the validity of transactions before a new block is added to the chain. One common consensus mechanism is Proof of Work (PoW), which requires nodes to solve a cryptographic puzzle before they can add a new block.[21]

7) *Inner Working*

Block chain is a series of blocks containing transactional data and linked together using cryptographically generated hash pointers. Each block in the blockchain consists of data, a timestamp for the data, a hash value generated for the data, the hash value of the previous block, and so on. Blocks contain information about transactions that occurred during a specified time period. These transactions are published and only executed when network nodes agree through a consensus mechanism that acts as a trust engine between unknown parties. Transactions are also permanent, meaning that no one can change the data once it has entered the chain. The blockchain verifies itself, making it unique and trustworthy.

Block chain combining several existing technologies to create what can be considered a robust and tamper-proof file database where people can store data in a transparent manner. The application of blockchain technology to prevent disputes over duplicate land certificates can be understood through the workings of the characteristics of blockchain, namely:

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[19]Stallings, W. (2018). *Cryptography and Network Security: Principles and Practice*, Boston: MA Pearson Education. p. 79

[20]Narayanan, A., Bonneau, J., Felten, E., Miller, A., & Goldfeder, S. (2016). *Bitcoin and Cryptocurrency Technologies: A Comprehensive Introduction*. Princeton: NJ Princeton University Press. p. 125.

[21]Garay, J., Kiayias, A., & Leonardos, N. (2015). *The Bitcoin Backbone Protocol: Analysis and Applications*, Berlin: Springer. p. 44

1) Every action carried out in the computerized blockchain network will be distributed and known to every user (decentralized).

2) *Block chain* is a system that is difficult to manipulate information data that has been entered into the network, so the blockchain work system relies heavily on the principle of transparency. Blockchain combines several existing technologies, including peer-to-peer networks, public-private key cryptography, and consensus mechanisms to create what can be considered a very robust and tamper-resistant file database where people can store data in a transparent manner.[22]In relation to digital land certificates, blockchain as a security system has a role in changing the paradigm of land archive databases. Electronic land certificates that were initially centralized will become decentralized, so that the public can help monitor changes that occur in the certificate while accessing data information recorded in the land certificate.

3) In general, the application of this system is from the beginning of land data that has been collected, both legal and physical data, then input by the Land Office into the blockchain with the system that has been created.

4) When the data has entered the blockchain, the system will be validated by the node. This node is a system that will validate encryption in cryptography, so that it will produce a secret code that cannot be owned by other users. In this process, duplicate certificates cannot be issued because the code is unique and will be rejected if there is data duplication.

5) Then an encryption code will appear which will be used on the electronic certificate and this encryption code will then be given to the land owner.

The following is an illustration of the scheme for implementing blockchain technology to prevent disputes over duplicate land certificates:

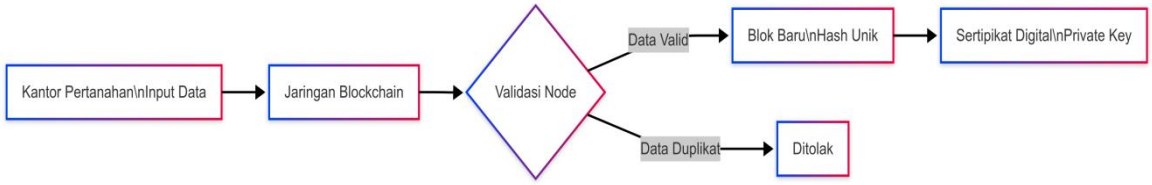

Image of the application of blockchain technology to prevent disputes over duplicate land certificates

In relation to digital land certificates, Blockchain as a security system plays a role in changing the paradigm of land archive databases, namely electronic land certificates which were initially centralized to decentralized. The Blockchain protocol can only have one owner, regardless of its nature in accordance with the

[22]Candya Upavata. (2021). Urgensi Sistem Pengamanan Pada Sertifikat Tanah Digital, *Jurnal Hukum Lex Generalis*, Vol.2. No.9. p. 846

representation of security or rights, and Blockchain technology that allows for new forms of governance, references have been made to combined governance with on-chain and off-chain rules. Thus, the governance file runs parallel to Blockchain governance.[23]

Distribution and decentralization do not mean having anarchic meaning. On the contrary, this system is used to resolve the failures and shortcomings of states and nations in responding to technology in ongoing dialogue. In order to accommodate the concept explained earlier, a normative provision is needed to legitimize Blockchain technology, as well as to regulate a clear distinction between what is legitimate and what constitutes illegitimate exploitation of technology.

Blockchain operational system with all its advantages especially its disintermediation (does not require a third party) and does not recognize national borders, making it considered useful when applied to the development of a security system in digital land certificates. Seeing the great prospects of utilizing Blockchain technology in Indonesia, this technology offers innovations that are not owned by other technologies. Because, from the beginning this technology was designed to run its system autonomously and decentralized.[24]

As a solution, blockchain technology can be implemented in the land system to overcome the problem of duplicate certificates. Blockchain offers transparency, security, and resistance to data forgery with a decentralized system. Each registered certificate will be encrypted and validated by the node, so that no data can be duplicated or manipulated. In addition, the unique code given to the landowner ensures that there is no duplication of certificates. Thus, the implementation of blockchain technology in the land system not only provides a technical solution to the problem of duplicate certificates, but is also in line with the principles of legal certainty put forward by Radbruch.

3.2. Challenges Faced in Blockchain Implementation for Preventing Dual Land Certificate Disputes in Indonesia

*Blockchain*certainly has some shortcomings in its use for electronic certificates, but there are shortcomings that can certainly be covered in various ways in order to optimize the existing advantages. These shortcomings will be the impetus to continue moving forward so that people are no longer worried about the existence of duplicate certificates. Some of the challenges of Blockchain are:

1) Absence of a Specific Legal Umbrella

2) Inadequate Technology Infrastructure

[23]*Ibid*., p. 847
[24]*Ibid*., p. 848

3) Human Resources (HR) Readiness

4) Cost

5) Data Security and Privacy Protection

6) Acceptance by Society and Stakeholders

Overcoming the challenges in implementing blockchain technology in the land system in Indonesia requires various strategies involving regulatory aspects, technological infrastructure, human resource (HR) readiness, and acceptance by the community. The following are solutions that can be applied:

1) Developing a Clear and Comprehensive Legal Umbrella

2) Building Adequate Technology Infrastructure

3) Improving Human Resources Readiness and Technology Education

4) Overcoming Implementation Cost Challenges

5) Improving Data Security and Privacy Protection

6) Increasing Community Digital Acceptance and Literacy

Although the challenges in implementing blockchain in the land sector are quite large, the right solution can help overcome these obstacles. With clear regulations, adequate technological infrastructure, human resource readiness, and public education, blockchain can be implemented gradually to improve security, transparency, and efficiency in the Indonesian land system. If implemented properly, this technology can be a major breakthrough in preventing disputes over double land certificates, while strengthening legal certainty in land ownership in Indonesia.

4. Conclusion

The application of blockchain technology can prevent the occurrence of dual land certificate disputes because blockchain technology in the land system offers an innovative solution in preventing dual land certificate disputes by creating a transparent, secure, and non-manipulation recording system. With its decentralized characteristics, this system allows every land transaction to be verified openly by various parties through nodes, which act as validators in ensuring the validity and uniqueness of each data entered into the system. This validation process makes blockchain very difficult to hack or manipulate, eliminating the risk of data duplication and falsification. The nodes in the blockchain network work independently but are interconnected, creating a collective oversight system that is stronger than traditional centralized systems. With the adoption of blockchain, land ownership records will be more accurate,

cannot be changed unilaterally, and can be verified openly. This is in line with the Regulation of the Minister of ATR/Head of BPN No. 3 of 2023 and Law No. 1 of 2024 concerning ITE, which has recognized electronic documents as valid evidence. However, to ensure effective implementation, a more comprehensive legal framework, adequate infrastructure, and education for the community and stakeholders are needed.

The challenges faced in implementing blockchain to prevent dual land certificate disputes in Indonesia face various challenges, especially in terms of regulation, infrastructure readiness, and public acceptance. The absence of a specific legal umbrella hampers legal certainty, while technological infrastructure that has not been fully integrated with the national land system can be an obstacle to effective implementation. In addition, the lack of understanding and readiness of human resources in managing blockchain-based systems is also a challenge that needs to be overcome. Therefore, comprehensive efforts are needed through the formulation of clear regulations, improvement of technological infrastructure, as well as education and training for the community and stakeholders so that blockchain technology can be optimally implemented in the land system in Indonesia.

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Regulation of the Head of the National Land Agency of the Republic of Indonesia Number 3 of 2011 concerning Management of Land Case Studies and Handling.

Regulation of the Minister of Agrarian Affairs and Spatial Planning/Head of the National Land Agency of the Republic of Indonesia Number 3 of 2023

concerning the Issuance of Electronic Documents in Land Registration Activities

Supreme Court Regulation Number 6 of 2018 Concerning Guidelines for Settlement of Governmental Administrative Disputes

The 1945 Constitution of the Republic of Indonesia