



Transformation of Agrarian Law in the Digital Era: Implementation of Blockchain in Land Certification for Transparency and Prevention Dispute Agrarianism in Indonesia

Sunardi^{1*}, Tuti Nadhifah², Heni Risnawati³

¹⁻³Universitas Muhammadiyah Kudus, Indonesia

*Author correspondence: sunardi@umkudus.ac.id

Abstract. Study This analyze adaptation system law Indonesian agrarian digital transformation, in particular implementation blockchain technology in certification land. Using approach juridical normative, research combining the statute approach with reviewing the UUPA, Regulation of the Minister of ATR/BPN Number 1 of 2021, and the ITE Law, as well as the conceptual approach that examines theory law agrarian, digital transformation, and principles Maqashid Syariah. Secondary data in the form of material primary, secondary, and tertiary law analyzed in a way descriptive qualitative For interpret the relationship between legal norms, theory and digital technology in land. Research results show that harmonization regulations agrarian and digital, blockchain implementation, and integration sharia principles can increase transparency, accountability, and certainty law. Digital transformation accelerates administration, minimizing overlapping overlap ownership, and strengthening governance fair and sustainable land. Research This confirm the need strengthening regulation, digital infrastructure, and literacy apparatus For support legal reform agrarian in the digital era.

Keywords: Accountability; Blockchain; Digital Transformation; Law Agrarian; Maqashid Sharia.

1. INTRODUCTION

Agrarian sector own a very important role in structure social, economic, and legal aspects in Indonesia. As an agricultural country, most of big Indonesian society relies on his life on the ground, good For need place living, farming, and activity economy others. Therefore that, settings and protection right on land become fundamental aspects in realize people's welfare as well mandated in Constitution Number 5 of 1960 concerning Basic Rules of Procedure Agrarian Law (UUPA). However, in in practice, the system administration land national Still face various problem like overlapping overlap ownership, the rise certificate double, practice brokering, weakness land data system, as well as low transparency in the service process public. Conditions the be one of reason main emergence dispute agrarian that continues increase from year to year (Surayya, 2022).

In the current digital era this, the Indonesian government is trying do governance transformation land through digitalization service public. The Ministry of Agrarian Affairs and Spatial Planning/ National Land Agency (ATR/BPN) has launch certificate program land electronic (e-certificate) as part from bureaucratic reform based technology information. Digitalization This expected can increase efficiency, reducing practice corruption, as well as speed up service public in registration and publication certificate land (Sukadi et al., 2023). Although Thus, the implementation system electronic in administration land also gives rise to

challenge new, like problem security cyber, potential data leaks, and legitimacy law document electronic as tool valid evidence (Ernawati, D., Wijayanti, A., & Miarsa).

One of solutions that start reviewed globally for answer challenge the is utilization technology *blockchain* technology This own characteristics decentralization, transparency, and *immutability* (not can changed), which allows certificate data land stored in secure network, can verified, and difficult manipulated. In the context of law agrarian, implementation *blockchain* expected can strengthen trust public to system certification land with minimize potential fraud, speed up the verification process ownership, as well as prevent emergence certificate (Nugraha P Joshua et al., 2022). Several countries such as Georgia, Sweden, and the United Arab Emirates even has apply system land based *blockchain* For ensure security and reliability of ownership data land.

In Indonesia, the discourse implementation technology *blockchain* in certification land start get attention Serious along with publication Regulation of the Minister of ATR/BPN Number 1 of 2021 concerning Electronic Certificate. Regulation This become milestone important in transformation law agrarian to direction digitalization document land. However, regulations the Not yet in a way explicit arrange utilization *blockchain*, okay from side technical and aspect law formally. As a result, it is still there is the absence of norms in implementation digital technology level further in the field agrarian (Widayati, N., Suryawan, IN, & Riorini, 2017). On the other hand, the readiness infrastructure, digital literacy of the community, as well as integration inter-agency the government also becomes challenges that need to be overcome overcome so that the transformation This can walk in a way effective (Nugraha, JP, Wahyuni, 2024).

From the perspective Islamic economics, transformation law agrarian through implementation *blockchain* also has relevance important. Land is not only asset economy, but also instruments social must managed based on principle justice, trustworthiness, and sustainability. In the context of this, use *blockchain* can strengthen principle *transparency* and *trustworthiness* in management asset sharia- based, such as waqf land and assets productive people, Meanwhile from side accounting, systems *blockchain* can support recording asset land in a way transparent and accountable, which is in line with principle *good governance* and reporting reliable finance (Anggriani, J., Noviarita, H., & Said).

Based on description said, research This become important For study in a way comprehensive How transformation law agrarian in Indonesia can adapt to development digital technology, in particular through implementation *blockchain* in system certification land.

2. KAJIAN TEORITIS

Agraria Law In Indonesia

Indonesian agrarian law is based on Law Number 5 of 1960 concerning Basic Agrarian Regulations (UUPA). The UUPA became a milestone in reforming the land law system, which previously had colonial roots. The UUPA affirms that all land, water, airspace, and the natural resources contained therein are under the control of the state and are to be used for the greatest prosperity of the people (Article 20 of the UUPA).

According to Boedi Harsono (2003), agrarian law encompasses all legal regulations, both written and unwritten, that govern the relationship between humans and land, water, and airspace. Thus, agrarian law has a strong social function and places the principle of state control as the basis for regulation.

However, in practice, the land administration system in Indonesia still faces various problems such as overlapping certificates, weak data verification systems, and a lack of transparency in the land rights issuance process (Sumardjono, 2001). This condition often triggers agrarian disputes, both between individuals, corporations, and between the community and the government.

Digital Transformation in Land Governance

Digital transformation is a form of public administration modernization that utilizes information technology to improve the efficiency, transparency, and accountability of public services. In the land context, the Ministry of Agrarian Affairs and Spatial Planning, also known as the National Land Agency (ATR or BPN), has initiated an electronic land certificate (e-certificate) program, as stipulated in Ministerial Regulation of ATR/BPN Number 1 of 2021 concerning Electronic Certificates.

According to Kurnia Rheza Randy Adinegoro (2023), digitizing land certificates is a strategic step in agrarian bureaucratic reform to reduce brokering practices, accelerate public services, and prevent corruption in the certification process. However, digitalization also presents new challenges, such as data security, the risk of hacking, and the validity of electronic documents as legal evidence (Arifin Habibi, 2025). Therefore, a digital system with a high level of security and transparency is needed to ensure the validity of land data.

Blockchain Technology and Its Potential in Land Systems

Blockchain is a decentralized, transparent, and immutable digital record-keeping technology. This technology allows every transaction or data to be permanently recorded and verified by the network without the need for a single authority. According to Tapscott &

Tapscott (2014), blockchain can increase trust, security, and efficiency in various sectors, including public administration.

In the land context, blockchain has the potential to address classic problems such as duplicate certificates, data manipulation, and corruption because every data change is recorded in an immutable blockchain. Sigit Sugiardi (2025) also explained in his research that implementing blockchain in land certification systems will strengthen ownership transparency, accelerate legality verification, and reduce the potential for agrarian disputes. Countries such as Georgia, Sweden, and the United Arab Emirates have become pioneers in implementing blockchain-based land systems, which have been proven to improve the security and efficiency of land administration (World Bank, 2018).

A Sharia Economic Perspective on Agrarian Law Transformation

From a sharia economic perspective, land is a trust from Allah SWT that must be managed according to the principles of justice ('adl) (Tuti Nadhifah, Heni Risnawati & Dian Rosita, 2024), sustainability (istidamah), and benefit ('maslahah al-'ammah) (Azharsyah Ibrahim, et al. 2021). The use of digital technology, including blockchain, in the land system can strengthen the principles of trust and transparency in the management of sharia-compliant assets such as land waqf, productive assets for the community, and land-based zakat (Annisa Purnamasari, 2024).

Furthermore, the principles of accountability and data integrity in blockchain align with the Islamic concept of hisbah, a mechanism for monitoring honesty and fairness in economic transactions (Hussein Elasrag, 2019). Thus, the implementation of blockchain not only supports the efficiency of agrarian law administration but also strengthens the values of maqasid al-sharia in the management of national agrarian resources.

3. METHOD

Study This use approach juridical normative which focuses on the analysis of legal norms positive, theory laws and relevant doctrines in context transformation law agrarian in the digital era. Approach This used For study How system law Indonesian agrarian can adapt to implementation blockchain technology in certification land to improve transparency and prevent dispute.

Research methods This combining two approaches main. Fi Constitution Number 5 of 1960 concerning Basic Rules of Procedure Agrarian Law (UUPA), Regulation of the Minister of ATR/BPN Number 1 of 2021 concerning Electronic Certificate, as well as Constitution

Number 11 of 2008 concerning Information and Electronic Transactions Law (ITE Law). Second, the approach conceptual (conceptual approach), with study theory law agrarian, concept digital transformation, as well as principle maqashid sharia which emphasizes justice, trust and benefit in management asset land.

Research data This is secondary data, including material primary law (regulations legislation), materials law secondary (literature) academic, journal scientific, and results research), and material law tertiary (dictionary and encyclopedia law). Analysis done in a way descriptive qualitative, with interpret connection between legal norms, theory and application digital technology in context law agrarian For formulate direction update law LAND IN INDONESIA RST, THE APPROACH STATUTE APPROACH, WITH EXAMINE PROVISION LAW LIKE.

4. RESULT AND DISCUSSION

Analysis to Agrarian Legal Norms and Relevant Regulations

System law agrarian in Indonesia is still face various constraint structural and administrative factors that impact uncertainty law in control and ownership land. Based on results study to material primary law such as Constitution Number 5 of 1960 concerning Basic Rules of Procedure Agrarian Law (UUPA) and Regulation of the Minister of ATR/BPN Number 1 of 2021 concerning Electronic Certificate, found that system law Indonesian agrarian still make an effort balance between principle justice social, certainty law and benefits public. UUPA confirms function social land and rights control the country to as much as possible prosperity of the people. However, in implementation, regulation derivative Not yet fully answer the needs of the digital era, especially related electronic data validity and security information in certification land (Harsono, 2023).

Analysis show that Regulation of the Minister of ATR/BPN No. 1 of 2021 has open room for digitalization certificate land, but Not yet arrange in a way explicit use blockchain technology as instrument recording and verification right ownership. The emptiness of this norm result in existence ambiguity standard technical and procedural in implementation digital system based decentralization. Therefore that, is necessary harmonization between regulations agrarian with digital regulations such as Constitution Number 11 of 2008 concerning Electronic Information and Transactions Law (ITE Law) and Regulations Government Number 71 of 2019 concerning Implementation Electronic Systems and Transactions, to ensure certainty law in management certificate electronic can guaranteed (Sumardjono).

Based on national data, the problem agrarian in Indonesia shows worrying trend. Report Consortium Updates Agrarian Affairs (KPA) noted that throughout in 2024 there were 295 cases conflict agrarian with the total area of the disputed area reach more from 1.1 million hectares, involving around 67,436 heads family. From the event of these, at least 399 people became victims of criminalization, while hundreds other experience action violence committed by the authorities and party private (Kartika, 2024). In the span From 2015 to 2024, KPA also noted more of 3,200 cases similar with impact to more from 1.8 million family. From the whole conflict Of these, as many as 2,841 people were caught case criminalization, 1,054 experienced violence Physically, 88 people were shot, and 79 people lost their lives. life consequence related disputes with land and resources Power natural (Kartika, 2024).

Implementation reform agrarian which is a flagship program the government has not yet fully effective. Although government has distribute certificate land and do redistribution land, lots study show that policy the Not yet touch root problems, such as inequality ownership and weakness enforcement law to violation right land (Nadila, Ghofur, and Fasa). Conflict agrarian can has implications for increasing tension social, disruption stability economy, as well as degradation values culture local, besides disappearance right access public to source Power land. With Thus, the problem agrarian need completed through a just, inclusive and sustainable approach to creating order more social and economic harmonious (Atong).

Settlement conflict agrarian need existence transparency and accountability from institution government in management and distribution land, as well as involvement active public in the process of taking decision related land (Earlene and Djaja, 2023). Strengthening institutional, renewal system law agrarian, and implementation digital technology in governance land can become step strategic For minimize overlapping overlap ownership land and improve certainty law for all parties. With Thus, it is hoped created system agrarian which is not only fair in a way economical, but also ethical social and sustainable in a way environment (Piantari et al., 2024).

Conceptual Analysis of Implementation Digital Technology in Agrarian Law

Implementation digital transformation in governance land in Indonesia becomes step important in realize service effective, efficient, and transparent public services. The Ministry of Agrarian Affairs and Spatial Planning/ National Land Agency (ATR/BPN) initiated a digital transformation program as a effort increase accessibility service land in order to be able to accessible from anywhere and anytime only. This program is part from implementation System Government Electronic Based (SPBE) which is also supported by the Ministry of

Empowerment State Apparatus and Bureaucratic Reform (PANRB), with objective strengthening data governance, reducing practice bureaucracy convoluted, and increase accountability service public (Ministry of PANRB, 2023).

A number of study about agrarian and use the system carried out by (Adinegoro, 2023), shows that implementation system Electronic *Mortgage Rights (HT- el)* has give impact positive to improvement efficiency and speed service land. Transformation from manual to digital system successful reduce service process time and improve transparency through use online system. Research the identify that variables efficiency and availability system experience significant improvement after implementation service electronically. In addition, research by (Yudiyanto and Pandjaitan) at the Land Office Bandung Regency found that implementation PTP digital system has integrate various aspect service like online registration, digital mapping based spatial, as well as publishing document electronic with code verification (barcode). Innovation This make things easier verification authenticity documents and minimize potential deviation in service.

Approach conceptual show that blockchain implementation is not only functioning as innovation technology, but also as legal reform instruments For creating governance more land accountable. In the system law nationally, blockchain can play a role as tool proof electronic evidence that has strength law if arranged in a way clear in regulation implementation (Arifin habibi).

In a way overall, digital transformation in governance land proven bring change positive to effectiveness service public and transparency administration land. Digitalization service like *HT- el* and PTP based systems electronic speed up the administrative process, reduce burden bureaucracy, and strengthen accountability public (Tapscott, D., & Tapscott. 2018), However, sustainability transformation This need support consistent policies, strengthening infrastructure, as well as collaboration cross agencies so that the system digital land can integrated in a way national. With Thus, the implementation digital transformation in the field land No only just innovation technology, but also a form of bureaucratic reform going to modern, transparent and responsive government to community needs.

Potential Blockchain Technology in Increase Accountability Land

Technology *blockchain* own potential big in increase transparency and accountability system land in Indonesia. System This Work with take notes every transaction in connected and unconnected data blocks can changed, so that minimize risk manipulation or falsification of land data (Sugiardi, 2025). Implementation *blockchain* can assist the National Land Agency (BPN) in create system administration more land efficient, transparent, and accurate, especially

in face problem overlapping overlap certificates and practice corruption that still exists often happened. *Blockchain* inside administration land own role For do recording and monitoring information related land. Other roles is For determine and divert right ownership land on users, as well as spread information land. Third role the become core functions within administration land based *blockchain* (Suratmanto and Emanuel).

Implementation Blockchain technology in system registration land give influence big positive. Technology This ensure data authenticity, security, and openness in every transaction process. Through utilization *smart contract*, transaction can ongoing with level more protection tall Because involving inspector land as the party providing verification (Bank, 2018). Therefore that, Blockchain is capable of overcome various previous problems appear in system registration land conventional, as well as give profit real in matter efficiency and safety management property (Bank, 2018).

In Indonesia still face challenges, such as limitations digital infrastructure, readiness regulations, as well as literacy technology among apparatus. Therefore that, the implementation *blockchain* need done in a way gradually through digitalization of land data, strengthening policy law, and training source Power human. With steps said, *blockchain* potential become solution innovative towards governance transparent, efficient, and accountable land management in Indonesia (Nugraha P Joshua).

Integration of Sharia Values with Policy National Agrarian

Integration of sharia values in policy agrarian national aim align principle justice, benefit and trust with management source Power land in Indonesia. Law Number 5 of 1960 concerning Basic Rules of Procedure Agrarian Law (UUPA) confirms that earth, water, and space space controlled by the state and used as much as possible For prosperity of the people (Article 2 paragraph 3 UUPA), which is in line with with principle *al- milkiyyah al -' ammah* in Islamic law, namely ownership source Power certain as owned by together people. With Thus, integration This emphasize the need management fair, inclusive and responsible land answer, and reject monopoly or utilization detrimental land public wide (Ibrahim, 2021).

Research result show that integration sharia values in policy agrarian can strengthen dimensions accountability and justice social approach This in line with UUPA's vision for realize prosperity of the people based on principle family (Annisa Purnamasari, Murni Ningsih, 2024). In practice, the implementation of system for appropriate results principle *mudharabah* and *musaqah* in the sector agriculture proven increase welfare farmers and strengthen their sense of responsibility answer social (Roiqoh).

From the perspective sharia economics, land is not only an economic asset, but also trustworthy managed in a way productive and sustainable. Implementation of sharia contracts such as *ijarah*, *muzara'ah*, or *musharakah* in land utilization can increase accountability, equality of access and public welfare (Muthalib, Pagar & Harahap). Apart from that, principles of prohibition of speculation in land and management of land in a way that is productive become guidelines for national agrarian policies capable of pushing social justice, maintaining the environment, as well as strengthening the source of sustainable power. Management model of land based on community with the principle of partnership (work) can prevent land monopoly by big corporations. Thus, Islamic economics plays a role as a paradigm balancing ethics between individual rights and collective interests in agrarian law transformation (Elasrag).

5. CONCLUSION

This study shows that the Indonesian agrarian legal system needs to adapt with digital transformation to increase transparency, accountability, and certainty in land management. Application of blockchain technology has the potential to strengthen security, data authenticity, and speed up land certification, at the same time minimizing overlapping ownership. Digital transformation through electronic systems such as HT-el and PTP are proven effective in increasing public service efficiency. Integration of Islamic economics which emphasizes justice, trust and benefit can push equality of access and productive land management as well as sustainability. Therefore, it is recommended to align agrarian regulations and digital, strengthen infrastructure as well as literacy apparatus, implement blockchain gradually, adopt sharia principles in land practice, and involve the public in decision making to create modern, transparent, fair and sustainable land management.

REFERENCES

- Anggriani, J., Noviarita, H., & Said, H. A. (2025). *Digitalization of Land Certification: Legal Perspectives from Islamic, Positive, and Administrative Law*. *Al-Istinbath: Jurnal Hukum Islam*, Vol. 10(2).
- Annisa Purnamasari, Murni Ningsih, Oktaviany & Alamsyah Agit. 2024. DIFUSI TEKNOLOGI DIGITAL DALAM MANAJEMEN KEUANGAN SYARIAH: LITERATURE REVIEW. PROSIDING KONFERENSI INTEGRASI INTERKONEKSI ISLAM DAN SAINS P-ISSN1535697734. Volume 6, 2024, pp 17-24.
- Arifin Habibi1, Ghally Sukma Prambudi, Tuti Trisnawati & Ratna Wulandari. 2025. *Transformasi Digital Administrasi Pertanahan: Implementasi Dan Tantangan*

Sertipikat Elektronik Di Indonesia. Rio Law Jurnal Volume. 1 Nomor. 2. ISSN 2722-9602 DOI: <https://doi.org/10.36355/rlj.v6i1>

- Azharsyah Ibrahim, et., al. 2021. Pengantar Ekonomi Islam. Jakarta : Departemen Ekonomi Dan Keuangan Syariah Bank Indonesia.
- Boedi Harsono. (2003). *Hukum Agraria Indonesia: Sejarah Pembentukan dan Pelaksanaannya*. Jakarta: Djambatan.
- Ernawati, D., Wijayanti, A., & Miarsa, F. R. D. (2025). *Perlindungan Hukum bagi Pemegang Sertipikat Tanah Elektronik*. JIRK Journal of Innovation Research and Knowledge Vol.4, No.9.
- Hussein Elasrag. 2019. Blockchains for Islamic finance: Obstacles & Challenges. MPRA Munich Personal RePEc Archive. Online at <https://mpra.ub.uni-muenchen.de/92676/>
- Kurnia Rheza Randy Adinegoro. 2023. Analisis Transformasi Digital Layanan Publik Pertanahan: Hak Tanggungan Elektronik pada Kementerian Agraria dan Tata Ruang. Jurnal Administrasi Publik. Volume XIX (1). Hal. 26-49. P-ISSN: 1858-2168. Doi: 10.52316/jap.v19i1.135
- Nugraha, J. P., Kurniawan, A. P., Putri, I. D., Wicaksono, R. K., & Tarisa. (2022). *Penerapan Blockchain untuk Pencegahan Sertipikat Tanah Ganda di Kementerian Agraria Dan Tata Ruang/Badan Pertanahan Nasional*. Jurnal Widya Bhumi, Vol. 2(2).
- Nugraha, J. P., Wahyuni, & Kusmiarto. (2024). *Prospek Pemanfaatan Teknologi Blockchain untuk Mengoptimalkan Keamanan Dokumen Pertanahan Elektronik: Sebuah Tinjauan Literatur Secara Sistematis*. Kadaster: Journal of Land Information Technology, Vol. 2(1).
- Peraturan Menteri Agraria dan Tata Ruang/Kepala Badan Pertanahan Nasional Republik Indonesia Nomor 1 Tahun 2021 tentang Sertipikat Elektronik (Berita Negara Republik Indonesia Tahun 2021 Nomor 12).
- Sigit Sugiardi. 2025. PEMANFAATAN TEKNOLOGI BLOCKCHAIN UNTUK RANTAI PASOKAN PERTANIAN YANG TRANSPARAN DAN BERKELANJUTAN. Prosiding Seminar Nasional Indonesia. Vol. 3 No. 2 Juni 2025, hal., 252-261. e-ISSN: 3026-5169.
- Sukadi, I., Harry, M., Setyobudi, T., Sinal, M., & As-Suvi, A. Q. (2023). *Legal Politics Electronic Land Certificate in Indonesia*. Jurnal USM Law Review, Vol. 7(3).
- Sumardjono, M. S. W. (2001). *Kebijakan Pertanahan Antara Regulasi dan Implementasi*. Jakarta : Kompas.
- Surayya, I. (2022). *Pendaftaran Tanah dalam Hukum Agraria (Land Registration in Agrarian Law)*. The Juris, Vol. 6(2).
- Tapscott, D., & Tapscott, A. (2018). *Blockchain Revolution: How the Technology Behind Bitcoin is Changing Money, Business, and the World*. New York: Penguin.
- Undang-Undang No. 5 tahun 1960, Tentang Peraturan Dasar Pokok-Pokok Agraria, Penjelasan Umum II, Dasar-Dasar Dari Hukum Agraria Nasional Pasal 20 Undang-Undang No. 5 Tahun 1960 Tentang Peraturan Dasar Pokok Agraria
- Widayati, N., Suryawan, I. N., & Riorini, S. V. (2017). *Regulations on the Ownership of Land and Buildings in Indonesia*. Jurnal Bisnis dan Akuntansi, Vol. 19(1).
- World Bank. (2018). *Blockchain and the Future of Land Administration*. Washington D.C.