



## Digital Transformation of Electronic Land Certificates : Solutions and Challenges in Indonesia's Modern Land Registration System

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**Abstract.** Digital transformation in land administration is a strategic step by the Indonesian government to realize a more efficient, transparent, and secure land registration system. One concrete form of this transformation is the implementation of electronic land certificates (e-certificates) regulated in the Ministerial Regulation of ATR/BPN No. 1 of 2021. This article aims to analyze the implementation of electronic land certificates as a legal innovation in the national land registration system and examine the challenges and solutions faced in its implementation. Using a normative juridical approach supported by literature studies and analysis of laws and regulations, this article finds that e-certificates have a strong legal basis and great potential in reducing agrarian conflicts, accelerating the registration process, and strengthening legal protection of land rights. However, its implementation is still faced with structural obstacles, such as limited information technology infrastructure, low digital literacy of the community, and resistance to system changes. Therefore, a strong policy commitment, an inclusive implementation strategy, and strengthening regulations and institutions are needed to ensure the success of the digitalization of the land system in Indonesia. Electronic land certificates are not only an administrative tool, but also a symbol of legal reform and equitable land governance in the digital era. Furthermore, enhancing public awareness and education regarding e-certificates is crucial to foster acceptance and understanding among stakeholders. Engaging various community groups in the digital transformation process can also facilitate smoother transitions and promote a culture of innovation in land administration. Ultimately, the successful implementation of e-certificates can serve as a model for other sectors undergoing digital transformation in Indonesia.

**Keywords:** Electronic land certificates, land registration, land digitization, legal protection, agrarian administration.

### 1. BACKGROUND

Land is one of the resources that has strategic value in national development. The legal status of land is very important because it concerns the ownership, possession, use, and legal use according to the law. In Indonesian law, the guarantee of legal certainty over land is regulated through a registration process that produces a certificate as proof of rights (Nafan, 2022). Land certificates issued by the state are authentic evidence that provides legal protection to the owner (Hulu, 2021).

However, in practice, the conventional land administration system in Indonesia faces various serious challenges, ranging from the length of the bureaucratic process, overlapping ownership, duplicate certificates, to the high rate of land disputes. Data from the Ministry of ATR/BPN shows that as of 2020, more than 30 million land plots in Indonesia have not been officially registered, and most of the certificates that have been issued are still in physical form and have not been digitized (ATR/BPN, 2020). This condition reflects the low efficiency and transparency in the national land system.

To overcome these various problems, the government has issued strategic policies in the form of digitization of land services, one of which is through the implementation of electronic land certificates. This policy has been officially implemented based on the Regulation of the Minister of ATR/BPN No. 1 of 2021 which regulates the electronic land registration system, including the issuance, replacement, and storage of land documents in digital form (Permen of ATR/BPN No. 1 of 2021). Electronic certificates are expected to be a solution to the problem of legality and validity of land documents which are often a source of agrarian conflicts.

This digital transformation in the land sector is in line with the spirit of bureaucratic reform and simplification of public services, as stipulated in Presidential Regulation No. 95 of 2018 concerning Electronic-Based Government Systems (SPBE). Digitalization in the land sector is intended to accelerate services, improve data accuracy, and reduce corruption, collusion, and nepotism practices that have often occurred in the land registration process (Hidmah, 2025). Electronic land certificates are also part of the implementation of e-government to encourage transparency and efficiency in state administrative governance (Susilowati, 2024).

From a legal perspective, the e-land certification policy raises important questions regarding its legality and evidentiary power. Although it has been emphasized in the Minister of ATR/BPN No. 1 of 2021 that electronic certificates have the same status as physical certificates, in litigation practice, not all law enforcement officials and the public understand and accept the validity of digital documents as authentic evidence (Son, 2026). This concern arises due to a lack of understanding of Law Number 11 of 2008 concerning Electronic Information and Transactions (UU ITE) which has stipulated that electronic information and documents can be used as legal evidence.

In the theory of state administrative law, public policy must be carried out based on the principle **Good Governance**, namely transparency, accountability, and legal certainty. Therefore, the implementation of electronic land certificates must be ensured to be not only technically efficient, but also juridically strong (Tambuno, 2023). Without a solid legal framework and consistent implementation, this digital transformation has the potential to cause confusion and uncertainty in new laws in society.

On the other hand, the use of electronic documents as evidence has also been strengthened by the presence of Law Number 27 of 2022 concerning Personal Data Protection, which emphasizes the importance of security and integrity of personal information in digital systems. Electronic land certificates contain vital information such as the identity of the owner,

land area, and legal status of the land, which if leaked or misused can harm the owner legally and economically (Arrizal & Fauzi, 2023). Therefore, system security is a key factor in realizing public trust in land digital transformation.

Furthermore, social resistance to the use of technology in legal administration is still quite high, especially in areas that are not familiar with the digital system. Many people feel safer and more confident in having a physical certificate than electronic documents that are only stored in a digital system (Rachmadi, 2022). The lack of digital literacy and limited access to the internet are also challenges in the equitable implementation of this policy throughout Indonesia.

Various studies have revealed that the digitization of land certificates has a positive impact on the efficiency and quality of land services. Lestari and Nugroho (2021) noted that in several pilot areas, the issuance of electronic certificates was able to cut the service time from 25 days to less than 10 days. In addition, digital documents stored in centralized systems reduce the risk of document loss, forgery, or manipulation. However, they also emphasized the need for clear SOPs, HR training, and an integrated monitoring system to prevent potential irregularities.

In the context of legal services to the public, the use of technology in the land registration process is a manifestation of the modernization of community-oriented administrative law. However, this must be accompanied by a legal framework that is adaptive and accommodating to technological developments (Ancient, 2025). Electronic certificates should not only be an administrative product, but should be enforceable and maintained in the legal system substantively, including in court evidence.

Taking these matters into account, it is important to conduct an in-depth legal study of the existence and position of electronic land certificates, both in terms of legal basis, strength as evidence, state responsibility for data protection, and the effectiveness of its implementation in the context of agrarian law. This research aims to examine juridical-normative the implementation of electronic certificates as a form of land law innovation in the national administrative system.

## **2. THEORETICAL STUDIES**

### **Legal Certainty Theory**

Legal certainty is a fundamental principle in the Indonesian legal system that places law as a tool to create order and protection of rights. According to Satjipto Rahardjo, legal certainty is not only related to the existence of written rules, but also concerns their implementation

fairly and consistently (in Rahim et al., 2023). In the context of land, legal certainty is important because it concerns economic, social, and legal rights to an object of high value. Land registration, as an instrument of land administration, aims to provide certainty and legal protection of land rights (Rahim et al., 2023). Land certificates as an administrative law product must be able to guarantee rights and avoid disputes.

In recent developments, the concept of legal certainty is faced with the challenge of digitalization, especially when legal documents are no longer physical, but digital. The question that arises is whether electronic documents can meet the principle of legal certainty that has been attached to authentic physical documents. The answer to this question must be traced through the legal recognition of electronic evidence in the national legal system (Son, 2026). Law in electronic systems requires a strong legal infrastructure, clear authentication mechanisms, and data protection guarantees.

### **Land Certificate Concept and Land Registration**

Land registration in Indonesia refers to the Positive right cadastre, namely the registration system that provides Full legal force to the data and information in the certificate. This means that anyone listed in the land certificate as a rights holder, is legally considered the rightful owner (Richard et al., 2024). Land registration as stipulated in Government Regulation No. 24 of 1997 aims to provide certainty and legal protection to rights holders, as well as provide information to interested third parties.

Land certificates issued by BPN serve as authentic evidence. In the context of electronic documents, the change of form from physical to digital requires assurance that the evidentiary strength and legal validity are maintained. The power of digital certificates can be maintained as long as the system and its issuance process follows the principle of prudence, has strict security standards, and is under legitimate authority (Rodli, 2025). Therefore, it is important to regulate the digitalization process rigidly so as not to cause legal uncertainty.

### **Electronic Certificates in a Positive Legal Perspective**

The issuance of electronic certificates is officially regulated in the Minister of ATR/BPN Regulation No. 1 of 2021, which is a new legal basis for the electronic land registration system. In this regulation, it is explained that electronic certificates are issued in digital format stored in the BPN database, and can be accessed by their owners through the national electronic land system. This document has the same legal status as a physical certificate, as affirmed in Article 16 paragraph (1) of the regulation (ATR/BPN, 2021).

In addition, the existence of electronic certificates is also strengthened by ITE Law (Law Number 11 of 2008) who have recognized that electronic documents can be used as valid legal evidence, as long as they meet technical provisions and formal legality. Article 5 paragraph (1) of the ITE Law states that electronic information and/or electronic documents and their printed results are valid legal evidence. In this case, electronic certificates are a form of application of digital legal principles in the land administration sector (Natama, 2019).

However, the validity and acceptance of electronic documents as evidence must also be supported by a uniform understanding and application by law enforcement officials, including judges and land deed-making officials (PPAT). Without this unity of understanding, digital certificates can be at risk of being rejected or doubting their legal force in legal proceedings (Marcella Santoso, 2024). Therefore, legal counseling and training to relevant officials are very necessary in this transition period.

### **Theory of Administrative Law and Good Governance**

In the theory of state administrative law, every government action or policy must be based on the principle of Legality and principles due process of law. Electronic land certificates as a product of state administration must be born from a legal process and implemented by the competent authority, and must provide protection for the rights of the community (Tjandra, 2021). In addition, the principle Good Governance also underlines the importance of transparency, accountability, efficiency, and community participation in every public service process.

The implementation of electronic-based land services is the state's effort to carry out good governance in the agrarian sector. However, the implementation of this system must be supported by clear procedures, standard operating standards, and an effective monitoring system. If not, then the risk of data misuse and legal losses for the public remains high even though the system has been digitized (Adiyanti & Pidada, 2024).

In that framework, digital transformation in the land sector is not enough only with technological changes, but also requires adjustments to the legal structure, institutions, and legal culture of the community. The implementation of electronic certificates must still guarantee the constitutional rights of citizens, including the right to land protected in Article 28H of the 1945 Constitution.

### **Protection of Personal Data in Electronic Land Certificates**

Electronic land certificates store important information about the identity of the owner, land area, type of rights, and the location of the land. Therefore, the data protection aspect is crucial in this system. Based on Law No. 27 of 2022 concerning Personal Data Protection,

every data controller is obliged to ensure the security and integrity of personal data collected, used, and stored. Violations of this protection may be subject to administrative or criminal sanctions.

The potential for land data leakage, both due to cyber attacks and misuse by individuals, can have implications for economic and legal losses for landowners. Therefore, electronic systems used in land registration must have a high-standard layer of security, including encryption, two-factor authentication, and regular data backups. Without adequate protections, electronic certificate systems can create public distrust of land law services (Ramadhani, 2020).

### **3. RESEARCH METHODS**

This study uses a normative juridical method that aims to analyze the applicable legal norms related to the implementation of electronic land certificates in Indonesia. This approach is very relevant in legal studies because it focuses on literature research that examines primary, secondary, and tertiary legal materials in order to gain a comprehensive understanding of the substance of law (Firmanto et al., 2024).

In the normative juridical approach, law is positioned as a written norm that functions as a guideline and reference in resolving legal problems. The main focus of this study is to analyze the national land law system as stipulated in Law Number 5 of 1960 concerning Basic Regulations on Agrarian Principles, Government Regulation Number 24 of 1997 concerning Land Registration, and Regulation of the Minister of ATR/BPN Number 1 of 2021 concerning Electronic Certificates. This study also examines the applicability of electronic documents as evidence in the Indonesian legal system through Law Number 11 of 2008 concerning Electronic Information and Transactions and its amendments and derivative rules (Son, 2026).

The normative approach used in this study includes several legal approaches, such as a legislative approach and a conceptual approach. The legislative approach is carried out by examining various regulations that are directly or indirectly related to the electronic land certificate policy. The goal is to assess the suitability of these norms in forming a legal system that is complete, harmonious, and does not contradict the principles of administrative law and agrarian law (Tambuno, 2023). Meanwhile, a conceptual approach is used to understand the meaning, scope, and legal implications of concepts such as electronic documents, personal data protection, legal certainty, and authenticity of electronic evidence (Son, 2026).

The sources of legal materials used in this study include primary legal materials, secondary legal materials, and tertiary legal materials. Primary legal material consists of laws and regulations that are the legal basis for the issuance and recognition of electronic certificates.

Secondary legal materials are obtained from legal literature such as books, scientific journals, the results of previous legal research, and the opinions of relevant legal experts. Tertiary legal materials are used to help clarify the definitions and legal terms used in discussions, such as legal dictionaries and legal encyclopedias (Saragih, 2020).

The technique of collecting legal materials is carried out through library research by tracing legal documents, both printed and digital. Laws and regulations are accessed through official websites such as [peraturan.bpk.go.id](http://peraturan.bpk.go.id) and [jdih.atrbpn.go.id](http://jdih.atrbpn.go.id), while scientific literature and journals are obtained from national journal databases and university repositories. This collection is carried out systematically to ensure the accuracy and completeness of the information used as the basis for legal analysis.

After the legal material is collected, the analysis technique used is descriptive-analytical. The author systematically describes the content of laws and regulations, legal principles, and relevant theories, then critically analyzes them to find the relationship between legal norms and the problem of implementing electronic land certificates in the field. Using a deductive mindset, the author reduces the legal argument from general principles to specific cases, such as how electronic certificates stand in the system of proving land rights and the extent to which their protection is regulated in the Indonesian legal system (Murtadho, 2022).

This method was chosen because it is considered to be able to provide a comprehensive understanding of the legality, effectiveness, and normative challenges faced in the implementation of electronic land certificates. In addition, this approach also provides space for normative analysis of information technology-based land policy formulation as part of public service reform and protection of people's land rights. The normative juridical approach allows the author to evaluate the extent to which the law has been able to answer the challenges of digitizing land registration and provide legal solutions to the problems that arise (Susilowati, 2024).

To complement the normative analysis, this study also considers a case approach to some of the initial implementations of electronic land certificates that have been carried out by the Ministry of ATR/BPN in several regions such as Jakarta, Surabaya, and Bandung. Although still limited, this study provides an initial overview of potential legal issues that can arise, such as data mismatches, digital system errors, and public concerns about the security of electronic documents. By examining these cases, the author can compile a more contextual analysis of the legal norms that have been in force (Yunardi, 2025).

Overall, this research method is designed to provide an in-depth and objective legal assessment regarding the transformation of the land registration system into digital form through electronic land certificates. This research is not only descriptive, but also normative evaluative, namely evaluating whether existing regulations are in accordance with the principles of the rule of law and are able to ensure the protection of land ownership rights of the Indonesian people in the digital era.

#### **4. RESULTS AND DISCUSSION**

##### **Paradigm Shift in Land Registration**

The implementation of electronic land certificates (e-certificates) has brought a paradigm shift in the land registration system in Indonesia. If previously the land registration process was manual and based on physical documents, now it has shifted to a more efficient and integrated digital system. Through the Regulation of the Minister of ATR/BPN Number 1 of 2021, the Ministry of Agrarian Affairs and Spatial Planning/National Land Agency (ATR/BPN) officially enforced electronic certificates as a substitute for physical certificates in the land registration process (Nugroho et al., 2023). This implementation is a concrete step in digitizing public services, including land services, which have been known to be slow, bureaucratic, and vulnerable to corrupt practices.

This transformation is also expected to be able to reduce administrative burdens and speed up the land registration process. If previously the process of submitting and issuing certificates could take months, now the process can be shortened to days or even hours, depending on the readiness of infrastructure and data. With an integrated system, land data verification can be carried out automatically, and the recording of changes in land rights becomes more accurate and real-time (Yanti et al., 2024).

In addition to the efficiency aspect, the digitalization of the land system also provides advantages in terms of transparency. The electronic system allows direct supervision of the land registration process by the authorities. Thus, the potential for irregularities and bribery in the land bureaucracy can be minimized. This is in line with the bureaucratic reform agenda that the government has been pushing since the last decade (Noer et al., 2024).

However, this paradigm shift also brings its own challenges. Not all parties are ready to accept the change towards digitalization. Some people, especially in rural areas or groups who are not familiar with technology, have difficulty accessing electronic services. Therefore, digital transformation in land needs to be accompanied by an inclusive and educational approach so as not to create a gap in access to land rights.

## **Legality of Electronic Land Certificates**

The legality aspect of e-certificates is an important concern in the development of this system. In Indonesian law, the legality of electronic documents has been recognized since the enactment of Law Number 11 of 2008 concerning Electronic Information and Transactions (ITE), which was strengthened by amendments in Law Number 19 of 2016. Article 5 of the ITE Law explicitly states that information or electronic documents are considered valid as legal evidence as long as they meet certain requirements (Hartono & Yuliantini, 2020).

In legal practice, electronic documents must meet the principles of authenticity, integrity, and suitability in order to be legally recognized. In the context of electronic land certificates, this validity is strengthened through layered safeguards, such as digital signatures authorized by authorized authorities, as well as data encryption systems. The Regulation of the Minister of ATR/BPN Number 1 of 2021 has given full legitimacy to the use of e-certificates as official documents that have legal status equivalent to physical certificates (Son, 2026)

However, challenges arise when this system is faced with land disputes. The existence of physical documents, which has been the basis of evidence in the trial, is now replaced by digital files that cannot be touched or viewed directly. This is where it is important to socialize law enforcement officials, lawyers, and notaries to understand the procedure for examining and validating electronic certificates as legal evidence (Tambuno, 2023).

In some cases, there is a dualism of understanding between land officials and law enforcement regarding the power of e-certificate proof. Therefore, strengthening regulations and harmonization between law enforcement agencies is a strategic step so that the implementation of electronic certificates can run effectively and not cause legal uncertainty.

## **Security Systems and Technical Risks**

Despite having advantages in speed and efficiency, the implementation of e-certificates is inseparable from technical risks and data security. The electronic certificate system relies entirely on strong digital infrastructure and cybersecurity. This dependence presents potential risks such as hacking, system failure, and data misuse by unauthorized parties (Samsumar et al., 2025).

Cyberattacks on land systems can have serious consequences, including theft of ownership data, document forgery, and manipulation of land information. Therefore, digital land information systems must be equipped with firewalls, double authentication systems, and periodic system audits. In addition, a data backup system and disaster recovery plan must be prepared so that services can be restored immediately in the event of an outage (Aliya & Saragih, 2020).

Data security in the digital land system is also closely related to the protection of personal data of landowners. The data recorded in the e-certificate is not only information on the location and area of the land, but also the identity of the owner, transaction history, and land value. Therefore, the implementation of Law Number 27 of 2022 concerning Personal Data Protection is very relevant in protecting the rights of individuals from misuse of information.

Nevertheless, legal protection will not be effective without technical readiness and user awareness. There are still many people who use unsecured networks, or share personal data carelessly, thus opening security gaps. Therefore, socialization and digital literacy must be part of the national strategy in implementing e-certificates.

### **Legal Certainty and Protection of Land Rights**

One of the main objectives of the land registration system is to create legal certainty and protection of land rights. In this context, electronic certificates are considered to be able to increase legal certainty because the system is based on integrated data and minimizes gaps in document manipulation (Nitiyudo, 2023). E-certificates provide a clear track record of ownership history, transfer of rights, and imposition of dependents.

Unlike physical certificates that are prone to loss, damage, or forgery, e-certificates have an internal security system that can track all changes in ownership status automatically. This provides certainty not only for landowners, but also for third parties such as buyers, banks, and notaries involved in land transactions (Justiansah, 2025).

However, legal certainty also depends on the acceptance of the public and law enforcement to this new system. There are still many people who doubt the legal status of electronic certificates, especially in the process of buying and selling land, transferring inheritance, or resolving disputes. In some cases, the e-certificate validation process still requires manual intervention due to the limitations of the system or old data that has not been integrated.

For this reason, the government needs to conduct massive legal education to the community, village officials, and financial institutions to understand the legality and benefits of e-certificates. On the other hand, formal legal systems such as courts and arbitration bodies should also be directed to accept e-certificates as the primary evidence in land cases, without the need to rely on printed documents.

## **Implementation in Multiple Regions and Practical Challenges**

Until now, the implementation of e-certificates has only been carried out in stages in several pilot project areas such as Jakarta, Surabaya, and Medan. Based on the report of the Ministry of ATR/BPN, the main obstacles in the initial implementation include the integration of legacy data, network limitations in remote areas, and internal resistance from employees and service users (Sani et al., 2025).

The integration of old data is a serious challenge because much of the land data in the past is still stored in manual, unstructured, and even physically damaged. This kind of data conversion requires a lengthy verification and validation process, as well as cross-agency coordination. If not handled appropriately, this process risks creating overlapping ownership conflicts.

The next challenge is infrastructure readiness, especially in areas that do not have stable internet access. Without adequate connectivity, people cannot access the electronic registration system optimally. This hinders the spirit of digitalization which basically wants to create an equal distribution of land services throughout Indonesia (A&Sh, 2024).

Social and cultural resistance is also a challenge in itself. For most people, physical documents are still considered more legitimate and convincing than digital documents. Therefore, this digital transformation needs to be accompanied by a persuasive, participatory, and sustainable communication approach.

## **Strategic Solutions and Recommendations**

In order to optimize the implementation of the electronic certificate system, several strategies need to be implemented. First, there needs to be an even improvement of digital infrastructure throughout Indonesia. Without adequate infrastructure, this system will be difficult to access for people in remote and disadvantaged areas (October, 2025).

Second, training and capacity building of human resources, both within land institutions and the general public, are important steps to reduce resistance and technical errors in the digitalization process. The government needs to involve universities, training institutions, and civil society organizations in providing legal and digital education to the public.

Third, the government needs to adopt the principles of transparency and accountability in the management of land data, including opening safe access to information to the public regarding the status and history of land rights. With transparency, public trust in the digital land system will increase (Yusman et al., 2024). A public monitoring system can also help prevent irregularities and strengthen social surveillance.

Finally, it is necessary to periodically evaluate the policies and technology systems used to remain relevant and responsive to legal and technological dynamics. This evaluation can be carried out through independent audits, trials of new systems, and the drafting of complementary regulations that are more adaptive. Thus, electronic land certificates can truly be an effective and sustainable solution in land system reform in Indonesia.

## **5. CONCLUSION**

Electronic land certificates are an important innovation in the land registration system in Indonesia, which is expected to be able to solve various classic problems such as land overlap, slow bureaucracy, and rampant cases of document forgery. The implementation of this policy brings a paradigm shift from the conventional land administration system to an integrated and information technology-based digital system. This innovation is also in line with the direction of national policies in realizing clean, effective, and accountable governance through the digitization of public services (Walo et al., 2022).

In terms of legality, the use of electronic land certificates has a strong legal basis, both from the perspective of national law through the ITE Law and sectoral regulations issued by the Ministry of ATR/BPN. Electronic documents have been recognized as legal evidence and have the same status as physical documents. The system also strengthens legal protection of land tenure, by providing data security, digital authentication, and an audit trail of changes in rights.

However, the implementation of e-certificates in Indonesia still faces various challenges, ranging from community resistance, low digital literacy, limited infrastructure in the regions, to the challenge of integrating old land data into electronic systems. Even in urban areas, administrative and technical obstacles were found that had the potential to hinder the success of this program. Therefore, institutional strengthening, human resource training, and comprehensive socialization are important prerequisites for the digital transformation of the land system.

Overall, electronic land certificates are not only an administrative tool, but also a representation of the state's commitment to building a transparent, accountable, and equitable land system. If implemented appropriately and inclusively, this system has great potential to improve the quality of land governance in Indonesia and increase public trust in the country's legal and administrative system (Aprilia & Mubarok, 2024).

## REFERENCE

- Adiyanti, N. K. W. S., & Pidada, I. B. A. (2024). Peran pejabat pembuat akta tanah dalam penerbitan sertifikat tanah elektronik. *Student Research Journal*, 2(4), 382–396. <https://doi.org/10.55606/srjyappi.v2i4.1421>
- Aliya, G. R., & Saragih, R. (2020). Pengaruh work-life balance dan lingkungan kerja terhadap kepuasan kerja karyawan di PT Telkom Divisi Telkom Regional III Jawa Barat. *Jurnal Ilmiah Manajemen, Ekonomi, & Akuntansi (MEA)*, 4(3), 84–95.
- Aprilia, A., & Mubarak, A. (2024). Tinjauan hukum terhadap implementasi sertifikasi tanah elektronik di Indonesia. *Almufi Jurnal Sosial dan Humaniora*, 1(2), 44–51.
- Arrizal, N. Z., & Fauzi, M. A. (2023). Aspek hukum sertipikat elektronik dalam sistem pendaftaran tanah di Indonesia. *YUSTISIA MERDEKA: Jurnal Ilmiah Hukum*, 9(1), 92–99. <https://doi.org/10.33319/yume.v9i1.226>
- AS, Y. S. M., & Sh, M. H. (2024). E-government dalam pelayanan publik. CV. Azka Pustaka.
- Firmanto, T., Sufiarina, S., Reumi, F., & Saleh, I. N. S. (2024). Metodologi penelitian hukum: Panduan komprehensif penulisan ilmiah bidang hukum. PT. Sonpedia Publishing Indonesia.
- Hartono, M. S., & Yuliantini, N. P. R. (2020). Penggunaan bukti elektronik dalam peradilan pidana. *Jurnal Komunikasi Hukum (JKH)*, 6(1), 281–302. <https://doi.org/10.23887/jkh.v6i1.23607>
- Hidmah, S. (2025). Efektivitas administrasi pertanahan secara online dalam pelayanan pendaftaran tanah pada Kantor BPN di Kabupaten Kudus. Universitas Islam Sultan Agung Semarang.
- Hulu, K. I. (2021). Kekuatan alat bukti sertifikat hak milik atas tanah dalam bukti kepemilikan hak. *Jurnal Panah Keadilan*, 1(1), 27–31. <https://doi.org/10.52188/jja.v1i1.314>
- Justiansah, R. S. (2025). Kekuatan hukum akta notaris atas tanah musnah dalam perspektif kepastian hukum dan perlindungan hukum bagi pemilik tanah. *AT-TAKLIM: Jurnal Pendidikan Multidisiplin*, 2(6), 602–617.
- Marcella Santoso, S. (2024). Legalitas dan legitimasi surat keterangan tanah. Yayasan Pustaka Obor Indonesia.
- Murtadho, M. (2022). Analisis yuridis perlindungan hukum bagi kreditur atas objek fidusia yang disita oleh kejaksaan dalam kasus tindak pidana. Universitas Islam Riau.
- Nafan, M. (2022). Kepastian hukum terhadap penerapan sertipikat elektronik sebagai bukti penguasaan hak atas tanah di Indonesia. *Jurnal Pendidikan Tambusai*, 6(1), 3342–3355.
- Natama, R. (2019). Analisis yuridis terhadap legalitas informasi atau dokumen elektronik sebagai alat bukti dalam perspektif hukum acara pidana, menurut UU ITE nomor 11 tahun 2008. Universitas Labuhanbatu.

- Nitiyudo, S. (2023). Regulasi ideal pendaftaran tanah terhadap bukti sertipikat yang berbasis kepastian hukum. Universitas Islam Sultan Agung.
- Noer, R. T., Salsabila, S., Niravita, A., Fikri, M. A. H., & Nugroho, H. (2024). Transformasi digital pendaftaran tanah: Tantangan dan efektivitas implementasi aplikasi Sentuh Tanahku dalam era Society 5.0. *Jurnal Ilmiah Nusantara*, 1(6), 250–261.
- Nugroho, D. H., Sukron, A., & Ismail, Y. (2023). Peran Kementerian Agraria dan Tata Ruang/Badan Pertanahan Nasional (ATR/BPN) dalam penyelesaian sengketa waris tanah secara mediasi. *Yurijaya: Jurnal Ilmiah Hukum*, 5(2), 21–30. <https://doi.org/10.51213/yurijaya.v5i2.102>
- Oktavianto, R. (2025). Optimalisasi pelayanan pertanahan melalui adopsi sertifikat tanah elektronik. Universitas Islam Sultan Agung Semarang.
- Purba, J. D. (2025). Rekonstruksi regulasi digitalisasi akta pertanahan yang dibuat oleh pejabat pembuat akta tanah (PPAT) dalam memberikan layanan publik berbasis nilai keadilan. Universitas Islam Sultan Agung Semarang.
- Putra, R. D. (2026). Pembuktian tanda tangan elektronik dalam sengketa tanah berdasarkan perspektif peraturan perundang-undangan. Indra Giri.
- Rahim, A., Aulia, S., Susanti, S., Arifin, M., & Riyadi, S. (2023). Relevansi asas kepastian hukum dalam sistem penyelenggaraan administrasi negara Indonesia. *JIP-Jurnal Ilmiah Ilmu Pendidikan*, 6(8), 5806–5811. <https://doi.org/10.54371/jiip.v6i8.2575>
- Ramadhani, A. P. (2020). Perlindungan hukum pengguna marketplace dalam hal keamanan data pribadi pengguna.
- Richard, H., SE, S. H., Kn, M., & Agus Sudradjat, M. H. (2024). Teori dan praktik pendaftaran tanah (berikut contoh draft akta). CV Cendekia Press.
- Rodli, A. (2025). Kekuatan hukum akta pejabat pembuat akta tanah yang cacat hukum. Universitas Islam Sultan Agung Semarang.
- Samsumar, L. D., Nasiroh, S., Farizy, S., Anwar, C., Mursyidin, I. H., Rosdiyanto, R., Widiyanto, W. W., Mutiarawan, R. A., Mukin, R., & Yusnanto, T. (2025). Keamanan sistem informasi: Perlindungan data dan privasi di era digital. Hadla Media Informasi.
- Sani, A., Shabrina, F., Dana, W. P., Hardini, I. R., Juansa, A., Zulfikar, Z., Kumara, I. M. S., Budiasto, J., Rianty, E., & Angin, J. T. K. P. (2025). Pengantar teknologi informasi: Dampak dan peluang perkembangan teknologi informasi dalam dunia kerja dan bisnis. Star Digital Publishing.
- Susilowati, I. F. (2024). Tinjauan yuridis sertifikat tanah elektronik sebagai alat bukti kepemilikan tanah di Indonesia. *Novum: Jurnal Hukum*, 1(1), 57–71. <https://doi.org/10.59581/jhsp-widyakarya.v1i1.387>
- Tambuno, A. S. (2023). Rekonstruksi regulasi peralihan hak atas tanah dalam sistem hukum Indonesia berbasis nilai keadilan bermartabat. Universitas Islam Sultan Agung.
- Tjandra, W. R. (2021). Hukum administrasi negara. Sinar Grafika.

- Walo, J., Yanuarko, A., Apriani, T., Riva, A., Faruk, M. S. U. L. A., Palupi, S. P., Sari, N. R., & Kusumaningrum, D. A. (2022). Inovasi digitalisasi pelayanan publik, tata kelola pemerintahan, dan inovasi bentuk lainnya pada daerah terinovatif. Bina Praja Press.
- Yanti, D. F. Y., Mutmainah, D. M., Putrit, R. S. J., Niravita, A., & Fikri, M. A. H. (2024). Optimalisasi pendaftaran tanah melalui inovasi teknologi dalam mewujudkan sistem yang efisien dan transparan. *Jurnal Ilmiah Penelitian Mahasiswa*, 2(6), 123–135.
- Yunardi, N. P. (2025). Pembatalan akta jual beli tanah oleh pengadilan studi putusan nomor 37/PDT.G/2023/PN MRB. Pascasarjana Kenotariatan.
- Yusman, Y., Putra, R. R., & Sinaga, I. (2024). Penerapan sistem informasi untuk meningkatkan tata kelola dan pelayanan publik di era digital. *Serasi Media Teknologi*.