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# REGULATORY HARMONIZATION OF NOTARIAL LAW IN THE ERA OF SMART CONTRACTS: TOWARDS THE LEGALIZATION OF CYBER NOTARY IN INDONESIA

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## ABSTRAK

Perkembangan teknologi blockchain dan *smart contract* telah mengubah mekanisme pembentukan dan pelaksanaan hubungan hukum dalam transaksi digital. Perubahan tersebut menghadirkan tantangan bagi sistem kenotariatan di Indonesia karena regulasi yang berlaku masih bertumpu pada autentikasi konvensional melalui kehadiran fisik, dokumen tertulis, dan verifikasi langsung, sementara pengaturan mengenai *cyber notary* belum memiliki landasan hukum yang memadai. Penelitian ini bertujuan menganalisis urgensi legalisasi *cyber notary* melalui harmonisasi regulasi kenotariatan sebagai respons terhadap perkembangan *smart contract*. Penelitian menggunakan metode hukum normatif dengan pendekatan perundang-undangan, konseptual, dan komparatif yang dianalisis secara preskriptif terhadap ketentuan hukum kenotariatan serta hukum transaksi elektronik. Hasil penelitian menunjukkan adanya disharmoni regulasi terkait pengakuan akta elektronik, verifikasi identitas digital, kehadiran virtual para pihak, dan kewenangan notaris dalam transaksi berbasis *blockchain*, yang berdampak pada munculnya ketidakpastian hukum serta belum optimalnya peran notaris dalam ekosistem digital. Berdasarkan temuan tersebut, penelitian merekomendasikan harmonisasi regulasi melalui pengakuan yuridis *cyber notary*, penguatan mekanisme autentikasi elektronik, pengaturan kehadiran virtual para pihak, pengakuan akta elektronik sebagai alat bukti autentik, serta pemberian kewenangan kepada notaris untuk melakukan verifikasi *smart contract* dalam transaksi berbasis *blockchain*. Rekomendasi tersebut menjadi fondasi bagi penguatan kepastian hukum, perlindungan hukum, dan peningkatan kapasitas kelembagaan kenotariatan dalam menghadapi transformasi hukum di era digital.
**Kata Kunci:** *Cyber Notary, Smart Contract, Harmonisasi Regulasi*

## ABSTRACT

The development of blockchain technology and *smart contracts* has transformed the mechanisms governing the formation and execution of legal relationships in digital transactions. This transformation poses significant challenges to Indonesia's notarial system, as the existing regulatory framework continues to rely on conventional authentication through physical presence, paper-based documentation, and direct verification, while the legal framework governing *cyber notary* remains insufficient. This study aims to analyze the urgency of legalizing *cyber notary* through the harmonization of notarial regulations in response to the advancement of *smart contracts*. The research employs a normative legal method using statutory, conceptual, and comparative approaches, with a prescriptive analysis of notarial law and electronic transaction regulations. The findings reveal regulatory disharmony concerning the recognition of electronic deeds, digital identity verification, virtual appearances of parties, and the authority of notaries in blockchain-based transactions, resulting in legal uncertainty and


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limiting the optimal role of notaries within the digital legal ecosystem. Based on these findings, the study recommends regulatory harmonization through the formal legal recognition of *cyber notary*, the strengthening of electronic authentication mechanisms, the regulation of virtual appearances of parties, the recognition of electronic deeds as authentic legal instruments, and the authorization of notaries to verify *smart contracts* in blockchain-based transactions. These recommendations provide a fundamental basis for strengthening legal certainty, legal protection, and the institutional capacity of the notarial profession in responding to the ongoing transformation of the digital legal landscape.
**Keywords:** *Cyber Notary, Smart Contract, Regulatory Harmonization*

## INTRODUCTION

The acceleration of digital transformation has fundamentally reshaped legal relationships, commercial activities, and the administration of justice in many jurisdictions. The integration of *blockchain* technology into economic transactions has introduced a decentralized mechanism capable of recording, verifying, and executing agreements without relying on conventional intermediaries. One of the most significant innovations resulting from this development is the emergence of *smart contracts*, namely self-executing digital agreements that automatically perform contractual obligations once predetermined conditions are satisfied. Recent studies demonstrate that *smart contracts* have expanded beyond cryptocurrency transactions into financial services, intellectual property management, logistics, mobility systems, and entrepreneurial finance because they improve efficiency, transparency, security, and operational reliability while reducing transaction costs (Khan et al., 2021; Kontos et al., 2024; Robusti et al., 2025; Alqarni, 2025).

The rapid adoption of digital contractual mechanisms simultaneously presents substantial challenges for legal systems that were originally designed for conventional transactions. Existing legal frameworks generally presume the existence of written documents, direct human interaction, centralized verification, and institutional supervision throughout contractual processes. Conversely, *smart contracts* execute contractual clauses automatically through computer code operating within decentralized digital infrastructures, thereby creating legal questions concerning contract formation, authentication, evidentiary value, accountability, dispute settlement, and regulatory oversight. The expansion of digital legal ecosystems therefore requires legal institutions to develop adaptive regulatory models capable of balancing technological innovation with legal certainty, justice, and effective protection of parties engaging in electronic transactions (Afzal, 2024; Morello, 2025; Kostenko et al., 2025).

Within the Indonesian legal system, notaries occupy a central institutional role as public officials authorized to produce authentic deeds that guarantee legal certainty and evidentiary strength in private legal relationships. The authority and responsibilities of notaries are primarily regulated under Law Number 2 of 2014 concerning the Amendment to Law Number 30 of 2004 on Notary Position, which continues to emphasize physical appearance before the notary, manual signatures, face-to-face verification, and conventional archival systems. Although these regulatory arrangements have long functioned effectively in traditional legal transactions, they are increasingly confronted by the emergence of electronic transactions conducted across digital platforms and national boundaries. Consequently, conventional notarial procedures have become progressively less compatible with the operational characteristics of *blockchain*-based agreements that rely on automation, digital authentication,


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and decentralized verification mechanisms (Akbar et al., 2025; Silalahi & Sudiro, 2025; Bukatova, 2025).

As a response to these developments, the concept of *cyber notary* has emerged as a strategic approach for modernizing notarial services through the utilization of digital communication technologies, electronic authentication, and online verification systems. Comparative studies indicate that several jurisdictions have begun integrating electronic notarization into their legal systems to improve accessibility and administrative efficiency while maintaining legal accountability. In Indonesia, however, the implementation of *cyber notary* remains limited because existing legislation has not comprehensively regulated electronic deeds, virtual appearances, digital identity verification, electronic signatures, or the authentication of *blockchain*-based transactions. This regulatory uncertainty has generated normative fragmentation between the Law on Notary Position and legislation governing electronic information and transactions, thereby creating legal obstacles to the effective implementation of digital notarial services and reducing institutional readiness to respond to the expansion of *smart contracts* within the digital economy (Koos & Koos, 2023; Alkatiri et al., 2023; Catur et al., 2023; Umar et al., 2025; Rizki et al., 2026).

Previous studies have substantially contributed to the discourse on digital transformation within legal services; however, their perspectives remain fragmented across several research streams. The first stream primarily discusses the implementation of *cyber notary* as an instrument for modernizing notarial services through electronic notarization, digital authentication, and comparative legal approaches between Indonesia and other jurisdictions (Koos & Koos, 2023; Alkatiri et al., 2023; Catur et al., 2023). The second stream examines the institutional position of notaries, supervisory mechanisms, and legal certainty in exercising notarial authority amidst technological development, emphasizing the importance of maintaining public trust and the evidentiary value of authentic deeds (Akbar et al., 2025; Silalahi & Sudiro, 2025; Rizki et al., 2026). Meanwhile, the third stream focuses on the application of *blockchain* and *smart contracts* across various sectors, highlighting their ability to automate contractual performance, improve efficiency, and support emerging digital business models, while simultaneously introducing new legal challenges concerning governance and accountability (Khan et al., 2021; Kontos et al., 2024; Robusti et al., 2025; Alqarni, 2025).

Although these studies provide valuable insights, they generally examine *cyber notary* and *smart contracts* as independent legal phenomena rather than interconnected components of a unified digital legal ecosystem. Research concerning *cyber notary* predominantly concentrates on procedural digitalization, electronic deeds, and online authentication without comprehensively addressing the legal implications of *blockchain*-based contractual execution. Conversely, studies on *smart contracts* emphasize technological innovation and contractual automation but rarely consider the institutional role of notaries in ensuring authenticity, legal certainty, and evidentiary legitimacy within decentralized transactions. Furthermore, contemporary legal scholarship has increasingly recognized that the evolution of digital environments, including virtual and decentralized ecosystems, demands a new regulatory paradigm capable of integrating technological innovation with adaptive legal institutions, yet practical regulatory models for achieving such integration remain underdeveloped (Afzal, 2024; Morello, 2025; Kostenko et al., 2025; Bukatova, 2025).

The foregoing discussion indicates the existence of a significant research gap concerning the harmonization of Indonesian notarial regulations with the governance of *smart*


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*contracts*. Existing scholarship has not adequately explained how the authority of notaries should be reconstructed to accommodate automated contractual relationships while preserving the essential legal principles of authentication, verification, accountability, and legal certainty. Accordingly, the legalization of *cyber notary* should not merely be interpreted as the digitalization of administrative procedures but as a comprehensive legal reform intended to redefine the institutional function of notaries within decentralized digital transactions. The novelty of this study therefore lies in developing an integrated regulatory harmonization framework that bridges the conventional principles of Indonesian notarial law with the operational characteristics of *blockchain*-based *smart contracts*, thereby extending previous studies that discuss these issues separately.

Based on these considerations, this study aims to examine the urgency of harmonizing Indonesian notarial regulations through the legalization of *cyber notary* in response to the rapid development of *smart contracts*. Specifically, the research seeks to identify regulatory inconsistencies between the Law on Notary Position and the legal framework governing electronic transactions, analyze the legal implications arising from the absence of comprehensive regulation concerning digital notarization in *blockchain*-based transactions, and formulate a normative harmonization model capable of strengthening legal certainty, legal protection, and institutional adaptability within the evolving digital legal ecosystem. The findings are expected to enrich contemporary legal scholarship concerning digital governance while providing practical recommendations for future reforms of Indonesian notarial law in accordance with the continuing transformation of technology-driven legal relations.

## RESEARCH METHOD

This study employs normative legal research to examine the harmonization of notarial regulations in response to the development of blockchain technology and *smart contracts*. This method was selected because the research focuses on assessing the consistency of legal norms governing notarial authority in the context of digital transactions. The study applies three complementary approaches, namely the statutory, conceptual, and comparative approaches. The statutory approach analyzes Law Number 2 of 2014 concerning Notary Position, Law Number 11 of 2008 concerning Electronic Information and Electronic Transactions and its subsequent amendments, together with other relevant regulations. The conceptual approach examines legal doctrines and scholarly perspectives concerning *cyber notary*, whereas the comparative approach reviews regulatory frameworks governing electronic notarization and digital authentication in jurisdictions that have implemented advanced digital notarial systems.

The research utilizes primary, secondary, and tertiary legal materials obtained through comprehensive library research. Primary legal materials include legislation, official legal documents, and judicial decisions relevant to notarial law and electronic transactions. Secondary legal materials comprise peer-reviewed journal articles, scholarly books, conference proceedings, and recent scientific publications discussing *cyber notary*, *blockchain*, and *smart contracts*, while tertiary legal materials consist of legal dictionaries, encyclopedias, and other supporting references. All legal materials were selected based on their relevance, credibility, and contribution to the research objectives before being systematically classified according to the legal issues under examination.

The analysis was conducted qualitatively using a descriptive-prescriptive legal analysis. The collected legal materials were first inventoried and classified according to the identified legal issues. Subsequently, the relevant statutory provisions were interpreted and examined


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through conceptual and comparative analyses to identify regulatory inconsistencies, normative gaps, and the compatibility of existing legal norms with *blockchain*-based transactions. The results of each stage were then synthesized to formulate a regulatory harmonization model supporting the legalization of *cyber notary* while strengthening legal certainty, legal protection, and the adaptive capacity of the Indonesian notarial system in the digital era.

## RESULTS AND DISCUSSION

### Result

### 1. The Normative Construction of *Cyber Notary* within the Indonesian Legal System

The analysis of Indonesian legislation indicates that the normative recognition of *cyber notary* remains limited. Existing legal instruments acknowledge the development of electronic transactions, yet no regulation specifically provides operational authority for notaries to perform electronic notarial services. The review of statutory provisions identified inconsistencies regarding electronic deeds, digital authentication, virtual appearance of parties, and electronic verification procedures. These findings demonstrate that the current regulatory framework has not comprehensively accommodated the implementation of *cyber notary* within the Indonesian legal system. The findings summarized in Table 1 present the extent of normative recognition of *cyber notary* across the principal legal instruments governing notarial practice and electronic transactions.

**Table 1. Normative Recognition of *Cyber Notary* in Indonesian Law**

| Legal Instrument | Regulatory Status | Scope of Recognition | Limitation |
|---|---|---|---|
| Law No. 2 of 2014 on Notary Position | Mentioned in the Elucidation of Article 15(3) | Recognition of the *cyber notary* concept | No operational provisions |
| Electronic Information and Transactions Law | Recognition of electronic documents and signatures | Supports digital transactions | No regulation of notarial authority |
| Government Regulations on Electronic Systems | Electronic administration framework | Supports digital governance | No specific *cyber notary* mechanism |
| Notarial Regulations | Conventional notarial procedures | Authentic deed formation | Physical presence requirement |

As presented in Table 1, the legal framework recognizes several elements supporting electronic transactions, while operational provisions governing *cyber notary* remain absent. The identified regulatory limitations mainly concern notarial authority, electronic authentication, and legal procedures for digital notarial services.

### 2. Regulatory Disharmony Between Notarial Law and *Smart Contract* Development

The examination of relevant legislation demonstrates differences between the characteristics of conventional notarial procedures and the operational mechanism of *smart contracts*. Current notarial regulations continue to emphasize direct verification, manual signatures, and physical document management, whereas *smart contracts* operate through digital verification, automated execution, and decentralized technological infrastructure. These differences reveal several regulatory aspects that remain unaccommodated within existing legal


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provisions. Consequently, multiple procedural components of blockchain-based transactions are not explicitly regulated.

The comparison between the conventional notarial system and *smart contract* mechanisms is presented in Table 2.

**Table 2. Regulatory Disharmony Between Conventional Notarial Law and *Smart Contracts***

| Regulatory Aspect | Conventional Notarial System | *Smart Contract* System | Regulatory Conflict |
|---|---|---|---|
| Presence of Parties | Physical appearance required | Virtual participation | Legal incompatibility |
| Authentication | Face-to-face verification | Digital verification | Legal uncertainty |
| Signature | Manual signature | Electronic signature | Normative gap |
| Document Storage | Physical protocol | Blockchain storage | No legal accommodation |
| Contract Execution | Human supervision | Automated execution | Undefined notarial role |

As shown in Table 2, several procedural differences exist between conventional notarial services and blockchain-based contractual mechanisms. These differences primarily concern authentication, signatures, document preservation, and execution procedures.

**3. Limitations of the Conventional Notarial Paradigm in the Blockchain Era**

The comparative review identified variations in the implementation of digital notarial services across several jurisdictions. Countries that have adopted digital legal infrastructures generally regulate electronic authentication, remote notarization, and electronic document management through specific legal frameworks. In contrast, Indonesian regulations continue to recognize *cyber notary* only at a conceptual level. The comparison indicates different levels of regulatory development among the selected jurisdictions.
The comparative findings are summarized in Table 3.

**Table 3. Comparative Development of Digital Notarial Regulation**

| Country | Regulatory Framework | Digital Notarial Services | Remote Authentication | Legal Status |
|---|---|---|---|---|
| Estonia | Digital Government Framework | Integrated *e-Notary* | Permitted | Fully regulated |
| Singapore | Electronic Transactions Act | Limited digital services | Permitted | Partially regulated |
| United States | Remote Online Notarization Laws | Remote notarization | Permitted | Regulated |
| Netherlands | Digitalization policy | Limited electronic functions | Limited | Developing |
| Indonesia | Law No. 2 of 2014 & EIT Law | Conceptual recognition | Not explicitly regulated | Limited recognition |


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As presented in Table 3, the selected jurisdictions demonstrate different regulatory approaches toward digital notarial services. Indonesia currently remains at the stage of limited normative recognition compared with countries that have established operational regulatory frameworks.

**4. The Urgency of *Cyber Notary* Legalization**

The review of legal materials identified four principal dimensions underlying the need for regulatory development concerning *cyber notary*. These dimensions include sociological developments, juridical conditions, philosophical considerations, and economic transformation associated with digital transactions. Each dimension reflects different aspects identified through the analysis of legislation and legal literature. The findings indicate that the issue extends beyond technological development alone.
The identified dimensions are summarized in Table 4.

**Table 4. Foundations for the Legalization of *Cyber Notary***

| Dimension | Current Condition | Legal Implication |
|---|---|---|
| Sociological | Growth of digital transactions | Increasing demand for digital legal services |
| Juridical | Limited regulations | Regulatory uncertainty |
| Philosophical | Legal adaptation | Modernization of legal framework |
| Economic | Expansion of digital economy | Need for efficient legal infrastructure |

As indicated in Table 4, the identified dimensions collectively describe the conditions underlying the development of *cyber notary* regulation. These findings provide an overview of the factors observed during the normative legal analysis.

**5. Proposed Regulatory Harmonization Framework**

The normative analysis identified several regulatory components requiring harmonization to support the implementation of *cyber notary*. The proposed framework covers legal definitions, electronic authentication, digital identity verification, electronic deeds, electronic signatures, blockchain-based document preservation, and verification of *smart contracts*. These components were formulated by comparing the existing legal framework with the requirements of digital transactions. The resulting framework serves as a summary of the regulatory elements identified during the analysis.
The proposed harmonization framework is presented in Table 5.

**Table 5. Proposed Regulatory Harmonization Framework for *Cyber Notary* and *Smart Contract* Governance**

| Regulatory Reform Area | Current Condition | Proposed Reform |
|---|---|---|
| Definition of *Cyber Notary* | Not explicitly regulated | Statutory recognition |
| Virtual Appearance | Not regulated | Legal recognition |
| Digital Identity Verification | Limited framework | National digital identity integration |
| Electronic Deeds | Uncertain status | Recognition as authentic deeds |


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| Regulatory Reform Area | Current Condition | Proposed Reform |
|---|---|---|
| Electronic Signatures | General recognition | Specific notarial regulation |
| Blockchain Storage | Not regulated | Legal framework |
| *Smart Contract* Verification | No authority | Recognition of notarial verification |

As shown in Table 5, the proposed framework consists of seven regulatory components identified during the normative analysis. These components summarize the areas that require harmonization within the Indonesian legal framework concerning *cyber notary* and *smart contract* governance.

**Discussion**

The development of *cyber notary* reflects the necessity for notarial institutions to adapt to the rapid digital transformation of legal services. Conventional notarial procedures that rely on physical presence and paper-based documentation are increasingly challenged by electronic transactions requiring speed, efficiency, and legal certainty. The implementation of *cyber notary* is therefore not merely a technological innovation but also a legal response to changes in the digital economy. Previous studies indicate that digitalization of notarial services can improve accessibility and administrative efficiency, provided it is supported by an adequate regulatory framework (Andriani et al., 2025; Abdillah et al., 2025; Rihhadatul'aisy et al., 2026).

The implementation of *cyber notary* in Indonesia remains constrained by regulatory inconsistencies between the Law on Notary Position and legislation governing electronic transactions. Existing regulations have not comprehensively addressed electronic deeds, digital authentication, and virtual appearances before a notary. Consequently, legal uncertainty persists regarding the validity and evidentiary value of electronically authenticated documents. Similar concerns have been highlighted by Pramudya et al. (2026) and Faisal et al. (2026), who argue that regulatory harmonization is essential to ensure the effective implementation of digital notarial services.

The integration of digital technology into notarial practice also requires stronger protection of electronic documents and personal data. The increasing use of digital identity verification, electronic signatures, and electronic deed storage raises legal risks concerning confidentiality, cybersecurity, and evidentiary integrity. Therefore, harmonization between notarial regulations and personal data protection legislation becomes an important prerequisite for strengthening public trust in digital legal services (Rizqiyah, 2025; Nathawira et al., 2025; Kurniawan & Latumahina, 2025). The legal validity of electronic signatures likewise requires consistent evidentiary standards to prevent future legal disputes (Aziz et al., 2026; Agung & Ayuningtyas, 2026).

The emergence of *smart contracts* further expands the legal responsibilities of notaries within digital transactions. Although *smart contracts* enable automated contractual execution through *blockchain* technology, legal supervision remains necessary to ensure compliance with applicable legal principles, particularly regarding consent, authenticity, and legal accountability. In addition, the growing recognition of digital assets and decentralized legal services requires adaptive notarial regulations capable of supporting technological innovation without reducing legal certainty. This perspective is consistent with recent studies concerning consumer protection, digital assets, electronic legalization, and *blockchain*-based legal services,


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which emphasize the importance of integrating technological development with responsive legal institutions (Nurzaman, 2026; Kristanto & Mahfud, 2026; Anwar et al., 2025; Inayatulloh, 2025; Mahdialthabhawi et al., 2026).

The harmonization of notarial regulations should be directed toward establishing a legal framework capable of accommodating technological developments without diminishing the essential functions of notaries as public officials. Regulatory reform should integrate provisions concerning electronic deeds, digital identity verification, electronic signatures, and *blockchain*-based transactions into a coherent legal system. Such harmonization will strengthen legal certainty while supporting innovation in digital legal services. This approach is consistent with recent studies emphasizing the importance of adaptive legal policies in responding to digital transformation (Faisal et al., 2026; Andriani et al., 2025).

Comparative experiences also demonstrate that jurisdictions implementing *cyber notary* have developed comprehensive regulatory mechanisms combining technological innovation with institutional accountability. These experiences indicate that successful implementation depends not only on digital infrastructure but also on clear legal standards governing authentication, data protection, and professional responsibility. Therefore, Indonesia can adopt comparative best practices while maintaining conformity with its national legal principles. Similar conclusions are presented by Abdillah et al. (2025), Rihhadatul'aisy et al. (2026), and Pramudya et al. (2026).

Another important aspect concerns the protection of legal certainty in *smart contract* transactions involving electronic documents and digital assets. The increasing use of *blockchain* technology requires legal mechanisms capable of ensuring document integrity, protecting personal data, and resolving disputes arising from automated contractual execution. Consequently, the role of notaries should evolve from merely authenticating conventional deeds to providing legal assurance for digital transactions through reliable electronic verification systems. This perspective is supported by Rizqiyah (2025), Kurniawan and Latumahina (2025), Kristanto and Mahfud (2026), and Inayatulloh (2025).

Based on the foregoing analysis, the legalization of *cyber notary* should be viewed as a strategic legal reform rather than solely as technological modernization. Harmonized regulations will enable notaries to perform their public functions effectively within an increasingly digital legal environment while preserving legal certainty, accountability, and public trust. At the same time, clear regulatory standards will provide stronger legal protection for parties engaging in *smart contract* transactions. Accordingly, regulatory harmonization constitutes an essential foundation for ensuring that Indonesian notarial law remains responsive to the continuing evolution of digital legal relations (Nurzaman, 2026; Nathawira et al., 2025; Aziz et al., 2026; Anwar et al., 2025; Mahdialthabhawi et al., 2026).

## CONCLUSION

The findings of this study demonstrate that the increasing adoption of blockchain technology and *smart contracts* has fundamentally reshaped the landscape of legal transactions, requiring corresponding adjustments within Indonesia's notarial legal framework. Rather than merely revealing regulatory fragmentation, this study confirms that the existing legal framework has not yet provided sufficient normative support for implementing *cyber notary* practices capable of accommodating electronic deeds, digital identity verification, virtual appearances, and blockchain-based authentication. These findings indicate that the principal challenge extends beyond technological readiness to the absence of an integrated regulatory


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framework capable of ensuring legal certainty, legal protection, and the authenticity of notarial services within an increasingly digital legal environment. Accordingly, the harmonization of notarial regulations should be viewed as a strategic legal response to technological transformation rather than merely a legislative revision.

This study contributes by proposing a comprehensive regulatory harmonization framework integrating *cyber notary*, electronic authentication, blockchain-based document management, and *smart contract* verification into a coherent legal system while preserving the fundamental principles of the notarial profession. As a priority, the Government of Indonesia should establish a comprehensive legal framework that explicitly recognizes *cyber notary*, regulates electronic deeds and remote appearances, and defines the legal authority of notaries in verifying *smart contracts*. In parallel, the Indonesian Notary Association should develop professional standards, technical guidelines, and competency-based training programs to ensure the consistent and secure implementation of digital notarial services. These measures are expected to strengthen institutional readiness and facilitate the effective implementation of *cyber notary* within Indonesia's evolving digital legal ecosystem. Future research may complement this normative analysis through empirical investigations evaluating the practical implementation and institutional readiness of *cyber notary* in Indonesia and comparative jurisdictions.

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