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## Smart Contracts and Notarial Authentication: Redefining Legal Certainty in Indonesia's Digital Civil Law System

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**Abstract:** The expansion of digital transactions and the increasing use of blockchain-based technology pose challenges to the ability of Indonesia's civil law system to provide stable and predictable legal certainty. This article examines the compatibility of smart contracts and digital notary authentication with the principle of legal certainty, particularly within the normative structure of the Civil Code, the Electronic Information and Transactions Law (UU ITE), and the Notary Law (UUJN). The study uses a normative juridical method with statutory, conceptual, and comparative approaches to assess regulatory coherence, test the adequacy of the doctrine of contract formation, and analyze the repositioning of notary functions when projected into a digital system. Data were obtained through a literature review of national regulations, international standards on digital identity and electronic signatures, blockchain-related academic literature, and the practices of civil law countries such as France and Estonia. The analysis was conducted through systematic interpretation and doctrinal mapping to identify normative gaps, conceptual conflicts, and regulatory inconsistencies. The study results indicate that the Indonesian legal framework is unable to provide adequate mechanisms for defining intent in code-based agreements, determining responsibility for algorithmic actions, or establishing standards of proof for immutable ledger data. On the other hand, the formal structure of authentic deeds in the UUJN limits the possibility of recognizing digital deeds without explicit legislative reform. The novelty of this research lies in the formulation of an integrated legal model that aligns smart contract execution, digital authentication, and notary authority within a single framework of legal certainty, and demonstrates that predictability can only be achieved through the codification of technical standards, digital verification procedures, and oversight mechanisms appropriate to the characteristics of distributed ledger technology.

**Keywords:** Digital Deed, Legal Certainty, Electronic Notary, Smart Contract.

## INTRODUCTION

Globalization and digital transformation have revolutionized all aspects of life, including the way people enter into contracts. Advances in information and communication technology have enabled legal transactions and interactions to no longer rely on face-to-face meetings or physical documents. Contracts, agreements, and data exchange can now take place electronically, quickly, and borderlessly (Yulia Yulia, 2024). This change makes the conventional contract format an option, not the only medium for parties seeking to enter into an agreement. Therefore, the old model based on paper and manual signatures is forced to adapt to be relevant in an increasingly digital reality. This reality sparks the need for a critical legal study of how the traditional civil law system responds to the flow of digitalization.

The rate of digital technology adoption in Indonesia demonstrates that the transformation of the transaction space has reached a scale that the legal system can no longer ignore. By 2025, internet penetration is projected to reach 80.66% of the total population, equivalent to approximately 229.4 million people. The largest concentration of users is on the island of Java, followed by Sumatra and Kalimantan, and the distribution is dominated by men.(APJII, 2025)The demographic composition supported by Generation Z, Millennials, and Gen Alpha shows that the productive age group is the main driver of national digital activity, so that transaction, communication, and data exchange patterns are increasingly tied to electronic platforms (Pratama et al., 2025). At the same time, the value of digital banking transactions continues to exceed tens of trillions of rupiah annually, and the volume of transactions through digital payment channels such as QRIS continues to increase, indicating a shift in economic behavior toward a fully connected and data-driven system. This scale of digitalization demands legal certainty commensurate with the risks, complexity, and speed of electronic interactions, as legal instruments that still rely on manual mechanisms are no longer able to meet the needs of a society living in an increasingly digital architecture.

These developments mark the point at which the legal system needs to move beyond simply recognizing electronic transactions and begin to consider digital instruments capable of accommodating fast-paced, complex, and automated interaction patterns. This is where the concepts of smart contracts and electronic notarial authentication gain relevance, as they offer mechanisms that not only adapt to digital architecture but also demand a redesign of the concepts of validity, authenticity, and proof in civil law (Wyda Lusiana, 2024). The shift of transactions to the digital space has created a need for a form of agreement that can run automatically and obtain public legitimacy, so that the integration of blockchain technology with the notary's function as a guardian of authenticity has become an inevitable issue in efforts to build legal certainty amidst changes in the structure of modern interactions (Sisca et al., 2025).

Smart contracts can be understood as computer programs or transaction protocols that execute, control, or document events and actions based on contractual clauses automatically on a blockchain network (Asri & Ida Bagus Wyasa Putra, 2025). Meanwhile, electronic notary authentication refers to the process in which a notary official verifies the identity of the parties, validates documents, and creates authentic deeds electronically, including the use of certified digital signatures and the storage of data in encrypted electronic form to produce deeds that have legal force and evidentiary functions like conventional deeds(Indahcantika Mazalio, 2023)This definition is important so that the subsequent discussion on law, regulation, and the integration of digital technology and notarial functions does not proceed in a fog of terms, but rather on a clear conceptual framework.

Indonesia's positive legal framework demonstrates conceptual limitations in addressing blockchain-based transactional architecture. Law No. 19 of 2016, the Law on Amendments to Law No. 11 of 2008 concerning Electronic Information and Transactions (UU ITE), does recognize electronic transactions and electronic signatures, but its definition and scope of

regulation still rely on the digital contract paradigm, which relies on declarations of intent in the form of ordinary electronic statements. Such a model does not adequately address the self-executing, autonomous, and tamper-resistant nature of smart contracts, thus creating a conceptual vacuum regarding how the law assesses intent, responsibility, and the validity of automated execution mechanisms. At the same time, Law No. 2 of 2014 concerning Amendments to Law No. 30 of 2004 concerning the Office of Notaries (UUJN) maintains the design of notarial authority based on authentic deeds that are physical and formal in nature, raising fundamental questions about how notarial authentication can be positioned within a contract ecosystem that no longer relies on paper or physical presence.

These regulatory limitations lead to a number of practical gaps that have the potential to erode legal certainty. The validity of evidence when documents and transactions are on a distributed ledger, the attribution of the parties' will in automated execution, and the compatibility of authentic deeds with immutable data raise serious issues regarding who is responsible in the event of losses or execution errors. The unclear mechanism for enforcing court decisions on transactions "locked" in smart contracts indicates the risk of ineffective procedural law. This situation prevents business actors, particularly those in transactions requiring authentic deeds, from using smart contracts as a reliable instrument without facing a higher risk of disputes. In other words, the digitalization of contractual infrastructure is developing faster than the legal capacity to regulate it.

On the other hand, the integration of smart contracts with notary authentication holds transformational potential for strengthening legal certainty in Indonesia's civil law system (Kinasih, 2024). Contract execution automation can speed up transaction processes, reduce administrative costs, and provide an immutable audit trail, thereby strengthening accountability and reducing the scope for manipulation (Gayatri, 2024). However, these benefits are not without prerequisites. Technical standardization, human control mechanisms (e.g., escape mechanisms or kill switches), and adequate remedial arrangements are required to ensure the principles of prudence, proportionality, and protection of the vulnerable are maintained. Therefore, this technological integration can only serve as an instrument for increasing legal certainty if the state is able to formulate a regulatory framework that links the technical autonomy of smart contracts with the fundamental principles of civil law and the notary office.

The theory of legal certainty provides a fundamental basis for assessing the Indonesian legal system's ability to accommodate smart contracts and notary authentication. Legal certainty requires rules that allow parties to predict the legal consequences of their actions, while smart contracts operate through code that binds parties to automatic execution that is difficult to change once placed on the blockchain (Himami et al., 2025). This situation raises the question of whether the self-executing structure can be equated with an agreement as formulated in Article 1313 of the Civil Code and whether the element of agreement in Article 1320 number 1 can be considered fulfilled when the expression of will is poured into programming logic that runs automatically without human discretion at the implementation stage.

The experience of several civil law countries shows that digitalization of contracts and notaries can be integrated if the regulatory and institutional framework is consistently established. France, through its *acte notarié électronique*, demonstrates that transforming the deed format does not necessarily eliminate the function of perfect proof and the notary's authority as a guardian of authenticity (Hutapea et al., 2023). Estonia, despite having a more advanced digital infrastructure, asserts that distributed ledgers can support civil transactions and public services when the state provides comprehensive technical standards, verification mechanisms, and legal protection (Alamanda & Anindita, 2025). This comparison shows that technological integration depends not only on technical innovation, but also on the ability of positive law to formulate boundaries, procedures, and corrective mechanisms.

Despite the breadth of existing scholarship on blockchain adoption, smart contracts, and cyber notary discourse, most of this literature remains descriptive: it documents the technological features of smart contracts and the practices of comparator jurisdictions without systematically explaining why the absence of Indonesian regulation constitutes a legal certainty problem in the technical sense of the term, nor how each unresolved issue should be resolved through concrete regulatory design. This is precisely the gap this research seeks to close. The description of the increasing scale of digital transactions above is not merely contextual background; it demonstrates that the object regulated by law the manifestation of will, the attribution of responsibility, and the standard of proof has changed its material form faster than the normative instruments designed to govern it. Whenever a legal instrument continues to assume a manifestation of will that is verbal, deliberate, and reversible, while the practice being regulated has become automatic, code-based, and irreversible, the resulting condition is not simply a regulatory lag but a structural incapacity of the legal system to fulfil the function of legal certainty, namely the capacity of law to make legal consequences predictable in advance. This is why the absence of specific arrangements for smart contracts and digital notarial authentication cannot be left to voluntary industry practice or case-by-case judicial interpretation; without legislative reform of the Civil Code, the ITE Law, and the UUJN, predictability the core value of legal certainty will continue to erode as digital transaction volumes grow.

With this foundation, this research aims to emphasize how smart contracts and notarial authentication can be combined to redefine legal certainty in Indonesia's digital civil law system. The core questions discussed include the extent to which smart contracts can fulfill the elements of a valid agreement, how authentic deeds and notarial authority can be translated into a ledger structure without eliminating the function of perfect proof, and what regulatory model can guarantee predictability, public protection, and notarial authority amidst digital transformation. This research aims to offer a conceptual framework that can strengthen legal certainty while enabling responsible technology adoption.

## **METHOD**

This study uses a normative juridical research approach with a statutory, conceptual, and comparative approach to examine the compatibility of smart contracts with Indonesian civil law constructions and the position of notary authentication in the digital transaction architecture. The statutory approach is aimed at assessing the consistency of contractual rules, electronic information and transactions, and notaries with the principle of legal certainty in the civil law system. The conceptual approach is used to re-examine the relevance of the concepts of agreement validity, notary authority, and the function of authentic deeds when projected into a distributed ledger structure. As emphasized by Peter Mahmud Marzuki, normative legal research must rely on rational analysis of legal texts to construct logical and systematic arguments. This principle serves as the basis for assessing whether technological integration can be supported by normative consistency. (Peter Mahmud Marzuki, 2005, 2011, 2019).

The research data was obtained through a literature review covering national regulations, international standards on electronic identity and signatures, academic literature related to blockchain and digital notaries, and comparative documents from civil law countries. Data analysis was conducted qualitatively through systematic interpretation and testing of inter-norm coherence, as suggested by Soerjono Soekanto, who suggested that legal analysis must place norms within the entire legal system to assess their effectiveness. (Soekanto & Mamudji, 2001; Soerjono Soekanto, 1986; Soerjono Soekanto & Mamudji, 2004) This analytical model is used to examine the consistency of the legal requirements of agreements, the evidentiary function of authentic deeds, and the scope of notary authority when transformed into the digital realm. The research then constructs an argumentative construction regarding the possibility of

translating notarial authentication into smart contract and ledger structures, while simultaneously formulating a regulatory configuration capable of maintaining predictability and public protection in Indonesia's digital civil law system.

This research is normative juridical (doctrinal) in nature, understood as legal research that treats law as an autonomous system of norms rather than as a social fact to be tested empirically. Three approaches are employed cumulatively. The statutory approach is used to trace the internal consistency of the Civil Code, the ITE Law, and the UUJN as the three principal instruments governing contract formation, electronic transactions, and notarial authority respectively. The conceptual approach is used where positive law provides no explicit rule, so that legal concepts such as party autonomy, the perfect evidentiary power of an authentic deed, and the notion of a code-based expression of will must be reconstructed from doctrine. The comparative approach is used to examine how France and Estonia, as civil law jurisdictions that share Indonesia's codified tradition of notarial authentication, have accommodated digital deeds and distributed ledger technology without abandoning the evidentiary hierarchy of the authentic deed.

The legal materials used consist of primary legal materials, namely the Civil Code, Law No. 19 of 2016 on the ITE Law, and Law No. 2 of 2014 on the UUJN, together with the comparative regulatory instruments of France and Estonia; secondary legal materials in the form of legal doctrine, journal articles, and academic commentary on smart contracts, blockchain, and cyber notary; and tertiary legal materials such as legal dictionaries used to clarify technical terms. These materials were collected through library-based document study and were analyzed qualitatively through three sequential interpretive steps: grammatical interpretation, to establish the literal meaning of the relevant articles of the Civil Code, the ITE Law, and the UUJN; systematic interpretation, to test whether the meaning obtained is consistent when the three instruments are read together as parts of a single legal system, following Soerjono Soekanto's proposition that legal norms must be located within the whole legal system to assess their effectiveness (Soekanto & Mamudji, 2001; Soerjono Soekanto, 1986; Soerjono Soekanto & Mamudji, 2004); and teleological interpretation, to assess whether the existing rules are still capable of achieving the purpose of legal certainty when applied to code-based, self-executing transactions. The result of this three-step interpretive process is used to identify normative gaps and conceptual conflicts, which in turn form the basis for constructing the regulatory model offered in the discussion section.

## **RESULTS AND DISCUSSION**

### **The Indonesian Civil Law System in Regulating Contracts and Notarial Deeds in the Digital Era**

The legal structure of contracts in Indonesia is based on civil law, which places codification as the primary source of authority, so that the articles of the Civil Code form a systematic basis for the validity of agreements. The formulation of the elements of a valid agreement in Article 1320 of the Civil Code, namely "agreement of those who bind themselves," "capacity to enter into an agreement," "a certain subject matter," and "a lawful cause," not only serves as an administrative requirement but also determines the logical limits of what can be considered an expression of legal will. (Lestari & Santoso, 2018) These four elements imply that a contract is not simply a representation of a transaction, but rather a normative structure that requires verification of the existence of consent, object, legality of cause, and capacity of the subject. When digital structures introduce automatic execution, this article becomes the starting point for assessing whether a code-based mechanism is capable of representing will as understood in Indonesian positive law. (Azis Putri & Satriawan, 2024).

Article 1338 of the Civil Code emphasizes that "all agreements made legally apply as law for those who make them." This principle of *pacta sunt servanda* has two implications:

first, contracts that comply with Article 1320 must be respected without exception, and second, contracts have the same legitimacy as written norms as long as they do not conflict with law, morality, or public order (Valentia & Faisal Faisal, 2024). The presence of algorithm-based digital contracts challenges this traditional doctrine because the execution of obligations no longer depends on human will after the contract is formed (Fathoni et al., 2024). A critical question arises when an algorithm automatically executes a command under certain conditions: does the action fall within the scope of the parties will as understood at the time of contract formation? It is at this point that the character of Indonesian civil law demonstrates its rigidity, as the validity of an agreement is determined not only by formal requirements but also by its conformity to the construction of the will, understood anthropomorphically or interpreted based on its characteristics.

The Indonesian civil law system also maintains contract formalism for certain types of agreements that require a written form or authentic deed, for example the transfer of land rights, the establishment of legal entities, or high-value legal acts. (Poetra et al., 2024) This formalism is not merely an administrative technique, but rather a mechanism for state control over transactions that have broad legal consequences, particularly those involving third-party interests. At this point, Indonesian contract doctrine is oriented toward long-term legal protection, not just transaction efficiency. As digitalization introduces new ways of forming agreements, the question shifts from "are electronic contracts valid" to "can electronic contracts replace the function of formalism previously maintained through authentic deeds."

The legal character of evidence in the civil law system reinforces the importance of the deed as written evidence with a specific hierarchy. Authentic deeds are placed at the top of the evidentiary hierarchy because they fulfill the requirements of public official authority, formal procedures, and the recording of minutes in notarial protocols (Ahmad Fauziannor et al., 2025). This hierarchy not only regulates the weight of evidence, but reflects the civil law philosophy that legal certainty depends on the stability of documents (Sihaan & Hasanah, 2023). When digital transactions introduce dynamic and distributed electronic evidence, traditional evidentiary systems are forced to interact with new forms of evidence that do not rely on the physical presence of minutes. This normative tension intensifies when distributed ledgers store transaction data permanently but lack the formal attributes required by the Notary Law.

The position and function of an authentic deed is confirmed by Law Number 2 of 2014 concerning Amendments to Law Number 30 of 2004 concerning the Position of Notary (UUJN), specifically Article 1 number 1 in conjunction with Article 15 paragraph (1), which stipulates that a notary as a public official is authorized to make an authentic deed that has full evidentiary power for all contents stated in the deed in accordance with the provisions of Article 1868 of the Civil Code. A notary as a public official is tasked with ensuring the legality, capacity of the subject, object, and conformity between what is desired by the parties and what is stated in the deed (Daffa Fa'adillah, 2025). This function is preventive and repressive in nature, preventing disputes through the orderly preparation of deeds, as well as providing strong evidence when disputes occur (Narestya & Saleh, 2025). The role of a notary is not merely administrative, but also an instrument of legal protection because the state entrusts the authority of authentication to notaries to maintain legal certainty.

Analysis of the structure of formal evidence and material evidence shows the complexity of authentic deeds which cannot be reduced to mere electronic documents (Ramadan, 2024). Formal evidentiary power relates to the validity of the deed as a product of a public official, while material evidentiary power concerns the truth of the deed's contents as long as it is not proven otherwise. Smart contracts or other digital documents do not automatically possess these two characteristics because they do not involve a public official as a verifier (Fitri Arianti Saputri, 2024). When a digital contract executes itself, traditional proof structures lose a referential point for identifying the intent at the time the contract was formed (Kamilah et al.,

2025). This condition shows why authentic deeds cannot be mapped directly to an automated contract model without human authority intervention.

The tension between traditional arrangements and digital demands becomes even more apparent when considering the physical requirements of a deed, namely the presence of the parties, the signing of minutes, the filing of protocols, and the physical documentation procedures. Digital transactions operate without physical space, without face-to-face interaction, and often involve parties located in different jurisdictions (Maulia Nurfadillah, 2025). The requirement for manual presence is a structural constraint that makes traditional deeds incompatible with the fluid digital space. Even the concept of wet signatures becomes problematic when transactions demand speed of execution and automated verification. A fundamental question arises: should the definition of "deed" be revised to accommodate its digital nature, or should digital notaries be built as a parallel system that maintains authentication functions but utilizes new technological infrastructure?

In the Electronic Information and Transactions Law (UU ITE), Article 1 number 2 states that "Electronic Transactions are legal acts carried out using computers, computer networks, and/or other electronic media." Article 1 number 12 further defines "Electronic Signatures as signatures consisting of electronic information that is attached, associated, or linked to other electronic information used as a means of verification and authentication." These two provisions indicate that Indonesian law recognizes the legality of electronic documents and contracts. However, this recognition does not explicitly include smart contracts, which are automated, code-based contracts that execute themselves based on certain programming parameters and conditions. Smart contracts do not fall into the category of ordinary electronic contracts because they do not merely represent agreements, but rather execute and enforce agreements without human discretion (Gabriella Mansula, 2023). From the perspective of Article 1320, the issue of how will can be derived from a series of codes that deterministically execute instructions becomes crucial. This normative gap leaves smart contracts operating without a solid doctrinal foundation in Indonesia's civil law system.

The status of e-notaries in Indonesian law remains unclear. The Notary Law does not regulate digital authentication, does not specify the format of electronic deeds, and does not regulate the use of certified electronic signatures for authentic deeds. The concept of cyber-notary is an academic concept that has not yet gained normative legitimacy, so notarial practice still relies entirely on the physicality of the deed.(Baiti & Badriyah, 2023)While technology allows for automatic verification of identity, time, and document integrity, the lack of a legal basis governing the role of notaries in the digital space leaves Indonesia lagging behind other civil law jurisdictions.(Diyah Kun Mariati, 2022)The absence of these norms creates the risk of disharmony between the needs of modern transactions and the authority of public officials who are still bound by the analog paradigm.

Smart contracts present a significant gap with the Indonesian legal system. Automatic execution may conflict with the doctrine of volition, as Indonesian civil law assumes will is a conscious and deliberate expression. When a contract automatically executes conditions triggered by digital events, the scope for judgment, delay, or correction is lost (Farhan Alex Putra Nasution, 2023). Automated execution also raises new liability issues: can losses resulting from incorrect execution be attributed to the code creator, the blockchain platform, or the parties involved? Without technical rules defining liability limits, the implementation of smart contracts has the potential to create new disputes that cannot be addressed through existing regulatory instruments.

The practice of civil law countries like France demonstrates that digital transformation can be achieved without eliminating the function of notaries. The electronic notarial act maintains the notary's role as the center of authentication, while the digitalization process is geared toward efficiency and increased document integrity (ARBEN & SHANDY UTAMA,

2024). This system combines a centralized digital infrastructure with strict technical regulations regarding identity verification, timestamping, and electronic records management (Kinasih, 2024). Estonia demonstrates more advanced integration with the use of distributed ledgers in real estate registration, but retains public officials as verifiers of legality (Zainal Abidin & Saprudin Saprudin, 2025). These two jurisdictions demonstrate that digitalization should not eliminate the inherent legal authority of notaries, but rather expand technical instruments to fit the digital ecosystem.

This comparison confirms that Indonesia faces a significant task in restructuring its legal framework. While other civil law countries have been able to maintain legal certainty by integrating technology into notarial structures, Indonesia remains stuck with an analog system inadequate for the digital ecosystem. This lag is normative, institutional, and technical. Without electronic authentication standards aligned with the characteristics of authentic deeds and regulations regarding smart contracts, the digital space will develop without clear legal direction. This situation demands legislative reform to maintain the notary function and the principle of legal certainty, while also paving the way for technology integration as part of the modernization of Indonesia's civil law system.

Read cumulatively, the weaknesses described above are not isolated technical gaps but point to three interlocking normative problems. First, the Civil Code's conceptual weakness in confronting blockchain lies in its insistence on a manifestation of will that is conscious, communicative, and correctable; a smart contract's execution logic removes precisely this correctability once the code is deployed, so that Article 1320's requirement of agreement risks being satisfied only at the moment of coding, not at the moment of execution a distinction the Code does not anticipate. Second, a conflict of norms exists between the Civil Code and the ITE Law: the Civil Code presumes a single, identifiable declaration of intent, while the ITE Law's recognition of electronic signatures and electronic transactions in Article 1 numbers 2 and 12 was drafted for representational electronic documents, not for autonomous, self-executing code; applying the ITE Law to smart contracts by analogy therefore stretches a definition never designed to carry that function, producing interpretive uncertainty rather than resolving it. Third, cyber notary regulation is internally inconsistent: while the UUJN preserves an exhaustively physical model of authentication presence, wet signature, protocol storage other sectoral regulations on electronic systems and information have already recognized remote and electronic verification for other purposes, so that the Indonesian legal system simultaneously permits and forbids functionally similar acts of authentication depending on which statute is applied. This norm conflict cannot be resolved through interpretation alone; it requires harmonizing amendment so that the Civil Code, the ITE Law, and the UUJN operate under a single, coherent standard for what counts as a valid, attributable, and authenticated digital legal act.

### **Legal Certainty of Smart Contracts and Notary Authentication in Indonesia's Digital Civil Law System**

The principle of legal certainty in the civil law tradition demands clear, stable, and predictable laws so that every legal subject can anticipate the consequences of their actions. Within this framework, the views of Hans Kelsen and Utrecht provide the basis that norms must be formulated in a deterministic manner, without creating ambiguity, and can be applied consistently by all law enforcement agencies (Ismarini Della Purnama et al., 2025). Legal certainty is not only a matter of certainty of text, but also certainty in the operationalization of norms, namely the extent to which rules are able to provide stability to the social and economic interaction processes that apply in society (Mery Herlina, 2024). In the digital world, this principle faces challenges because the nature of technology, particularly smart contracts, tends

to operate automatically and does not require human validation, thus requiring normative formulations that explicitly anticipate new forms of legal relationships.

Applied concretely to smart contracts, Kelsen's requirement that norms be formulated deterministically so that they can be applied consistently by all law enforcers exposes a paradox: a smart contract is itself deterministic arguably more deterministic than any legal text, since its instructions execute without interpretive discretion yet this computational determinism does not automatically translate into legal determinacy, because the legal system has not defined which norm governs the code's behavior, who is answerable when the code's determinism produces an unintended result, and through which forum a party may seek correction. In other words, code-level certainty and legal certainty are not the same thing: the former concerns the predictability of execution, while the latter, following Utrecht, concerns the predictability of legal consequences, including the availability of a remedy when execution and intention diverge. A smart contract can therefore be entirely certain as a computer program while remaining entirely uncertain as a legal instrument, precisely because Indonesian law has not yet supplied the interpretive bridge through statutory presumption, attribution rule, or evidentiary standard that would allow code-level determinism to be recognized as legal determinacy.

In Indonesia, the concept of legal certainty developed through the thoughts of legal experts who emphasized three main elements, namely clarity of norms, consistency of application, and avoidance of multiple interpretations (Agustalita & Yuherawan, 2023). If these three elements are not met, the law becomes a source of uncertainty that confuses the public. In digital contracts, tensions arise because the Civil Code is structured within a conventional agreement paradigm, while the ITE Law only provides a general framework for electronic transactions without detailing how the law addresses automated execution mechanisms. Therefore, an evaluation of the legal certainty of smart contracts must begin with the fundamental question of whether the two regulations are capable of providing predictability for contracts that execute automatically without human intervention when activated by certain technical parameters.

When analyzed systematically, Indonesian civil law does not yet provide legal certainty for automated contracts. The Civil Code assumes the manifestation of human will at every stage of the formation and implementation of an agreement, while smart contracts operate on computational logic, automatically executing the parties' obligations once pre-programmed conditions are met. The Electronic Information and Transactions Law (ITE Law) does recognize electronic documents and transactions, but it does not address how legal certainty should be applied to mechanisms that cannot be stopped or reinterpreted after deployment. This situation creates legal uncertainty that is inconsistent with the principle of legal certainty in the civil law system (Abdillah & Saputra, 2025).

The most basic element of a valid agreement is the existence of agreement and the will of the parties (Atmoko & Purbowati, 2024). Smart contracts abstract these wills into code instructions, so that the statement of will is no longer present in verbal or textual form as is customary in written contracts (Sari et al., 2024). Problems arise when the parties' will must be derived from technical digital actions, such as clicking an agreement, sending a token, or an automated system trigger. The legal question is whether such a computational system can represent the parties' conscious and free consent, as required by civil law. Without an adequate mechanism for verifying will, the validity of a smart contract as an agreement is questionable, as the subjective element of agreement is not explicitly applied.

In smart contracts, actions that give rise to legal consequences are no longer carried out directly by humans, but by code running on the blockchain network (Wariantio et al., 2024). If an execution failure, code manipulation, or oracle error occurs, the question of who should be held responsible becomes a critical point (Setiawan et al., 2024). The Civil Code does not

provide an attribution framework for algorithmic actions, making it impossible to definitively determine which party is deemed to have "carried out" a legal action. This ambiguity has the potential to create a void in accountability and reduce legal certainty for parties entering into automated contracts.

From a probative perspective, evidence generated by smart contracts, such as hashes, ledgers, and timestamps, has a high level of integrity because it is recorded immutably and verified by the network. However, its evidentiary weight in Indonesia's civil evidence system does not yet have a normative basis that places it as evidence on a par with authentic deeds or conventional written documents. Recognizing that digital evidence can be used in court does not automatically grant ledgers complete evidentiary power (Agustianto & Situmeang, 2025). Without explicit recognition of its status, smart contract evidence will simply be placed as ordinary electronic evidence whose value depends on the judge's interpretation.

Regulatory weaknesses become even more apparent when considering the absence of specific rules regarding automatic execution-based contracts. Indonesia has not yet codified this type of contract as a separate category, requiring all legal analysis to be forced into the framework of conventional agreements (Sudarto, 2025). This situation creates difficulties in determining how default should be assessed, how automated execution can be reversed by human intervention, or how legal protection is provided if code parameters do not meet the parties' expectations. Without specific regulations, smart contracts exist in a legal gray area that is incompatible with the demands of legal certainty (Wahyuni et al., 2023).

An authentic deed is a legal instrument drafted through strict formal procedures in accordance with the Notary Law. The question is whether a digital deed can retain all the normative elements that make it an authentic deed. Elements such as the reading of the deed, joint signing, recording in minutes, and storage in a protocol are integral components that are not merely administrative but serve as a guarantee of validity and legal protection. The integration of a deed into a digital system must not eliminate these characteristics, as the loss of any one element can reduce the deed's evidentiary power from perfect evidence to merely a private deed.

Notaries are not explicitly mandated to perform blockchain-based authentication, verify digital identities through ledgers, or archive minutes in hashed form on a distributed system (Nugraheni et al., 2022). Without a clear basis for authority, any notarial action in the digital space has the potential to be deemed administratively and legally invalid. This uncertainty has resulted in the lack of established standards for digital notarial practices, resulting in any innovative initiatives creating legal risks for notaries themselves and for those requiring authentic deeds.

The greatest tension arises when the concepts of minutes, protocols, and notarial document storage are confronted with the immutable nature of blockchain. In a notarial system, minutes must be retrievable, monitored, checked, and even corrected under certain conditions by authorized officials. Blockchain, on the other hand, does not allow for changes or corrections without creating an irrevocable record (Tsulasi Putri et al., 2023). This structural conflict makes the integration of blockchain into notaries not as simple as changing the storage format (Budi et al., 2023). It is necessary to design regulations and system architecture that are capable of maintaining the integrity of deeds while upholding the basic principles of notarial protocols, which from the outset were intended to guarantee legal accuracy and accountability.

Countries like France have established a clear legal framework for smart contracts and digital deeds. This regime encompasses technical standards, verification procedures, and oversight mechanisms that ensure the use of technology remains under state oversight. Its notarial system maintains the authority of notaries as public officials, but allows for digital transformation through multi-layered electronic authentication standards (Abo Alil & Melhem, 2022). Thus, digitalization does not reduce the evidentiary power of the deed, because its entire

normative structure has been guaranteed through comprehensive technical and legal regulations.

Estonia implements an even more advanced system through a national digital infrastructure that allows identity verification, document storage and deed recording in an integrated mechanism with high security standards (Semenzin et al., 2022). This system ensures that every digital transaction, whether automated contracts or electronic deeds, is conducted under state supervision and receives full legal recognition. The availability of integrated standards and protocols makes legal certainty an inherent condition in all digital activities.

In comparison, Indonesia lacks comparable verification standards, an institutionalized digital audit mechanism, and official guidelines for notary institutions regarding the use of blockchain technology or smart contracts. This lack of guidance leaves legal actors operating in a climate of uncertainty, preventing digital transformation from proceeding within a formal, orderly framework. This situation clearly demonstrates that Indonesia's level of legal certainty remains far below that of countries that have systematically developed digital legal ecosystems.

Evaluatively, the Indonesian legal system does not yet provide adequate legal certainty for smart contracts or digital notary authentication. Existing positive norms remain fragmentary, fail to define the status of automated contracts, do not determine the evidentiary power of ledger evidence, and do not provide operational standards for notaries to play a role in the digital environment. Consequently, predictability for the public and business actors is low. Therefore, regulatory reform is needed in both the ITE Law and the Notary Law that confirms the status of smart contracts, formulates digital authentication standards, establishes e-notary procedures, and establishes oversight mechanisms capable of ensuring that the technology operates in line with the principles of Indonesian civil law.

## CONCLUSION

This research set out to answer three interrelated questions. First, regarding the extent to which smart contracts fulfil the elements of a valid agreement, the analysis shows that smart contracts satisfy Article 1320 of the Civil Code only partially: the elements of a certain subject matter and a lawful cause can be reproduced in code, but the element of agreement is problematic because a code-based declaration of will removes the discretion and correctability that Indonesian doctrine treats as inherent to a genuine expression of consent, so that a smart contract's validity as an agreement currently rests on an analogical extension of the Civil Code rather than an explicit rule. Second, concerning how authentic deeds and notarial authority can be translated into a ledger structure without eliminating the function of perfect proof, the research finds that this is possible only if notarial intervention is preserved at the point of formation as the French and Estonian experiences demonstrate so that the notary continues to verify identity, capacity, and legality before a transaction is committed to the ledger, while the ledger itself is used solely as an immutable record of an act that a public official has already authenticated, rather than as a substitute for that authentication. Third, as to what regulatory model can guarantee predictability, public protection, and notarial authority amid digital transformation, the analysis indicates that predictability can only be restored through simultaneous, harmonized reform of the Civil Code's doctrine of agreement, the ITE Law's definition of electronic transactions and signatures, and the UUJN's authentication procedures, supported by technical standards for verification, timestamping, and audit that are set by the state rather than left to platform operators.

The contribution of this research lies in showing that the normative gap surrounding smart contracts and digital notarial authentication in Indonesia is not a single deficiency but three interlocking deficiencies in the doctrine of agreement, in the definition of electronic transactions, and in the design of notarial authority that must be reformed together, since

reforming one instrument in isolation would leave the other two as sources of continuing legal uncertainty. On this basis, it is recommended that legislative reform explicitly define the legal status of self-executing, code-based agreements within the Civil Code or a dedicated implementing regulation; that the ITE Law be amended to distinguish smart contracts from representational electronic documents and to establish rules of attribution for algorithmic execution; and that the UUJN be equipped with a cyber notary framework that preserves the notary's preventive and evidentiary function while permitting electronic verification and ledger-based recording, following the general direction shown by the French and Estonian models discussed above. Future research is needed to test how such a regulatory model would operate in specific transaction types such as land registration or corporate formation where the requirement of an authentic deed is most rigid, and to examine the institutional readiness of the Indonesian Notary Association and supervisory bodies to implement electronic authentication standards.

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