

Research Article

Redesigning the Boundaries of Corruption in Government Procurement of Goods and Services

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Abstract: Government procurement, particularly in Indonesia, remains highly susceptible to corruption due to systemic regulatory loopholes and excessive human discretion, often characterized by collusion and bid-rigging. This institutional vulnerability defines the traditional "boundaries of corruption" as the discretionary corridors within existing administrative law. This research aims to fundamentally redesign these boundaries by shifting control from human discretion to technological enforcement. This study employs normative legal research focusing on the Presidential Regulation on Procurement, integrated with a technological design approach relevant to the journal. The core contribution is a reform model proposing the mandatory integration of AI-powered Smart Contracts and Distributed Ledger Technology (Blockchain) into the public procurement process. Key findings indicate that the primary corrupt boundary lies in ambiguous clauses concerning direct appointments and contract amendments. We propose that an AI-based system can monitor real-time pricing anomalies and bidder networks (network analysis), while Smart Contracts can automate and audit execution, thereby eliminating human factor vulnerability. This redesign transforms the boundaries of corruption from a matter of criminal enforcement to one of algorithmic inevitability, providing a robust, transparent, and self-auditing framework for digital governance.

Keywords: Blockchain; Corruption; Digital Governance; Government Procurement; Smart Contracts.

1. Introduction

Indonesia The integrity of government procurement of goods and services is crucial for fiscal health and public trust, yet globally and within Indonesia, it remains the single largest area vulnerable to corruption. The estimated losses due to inflated pricing, collusion, and bid-rigging define the permeable "boundaries of corruption" within administrative processes. Traditional anti-corruption efforts focus narrowly on penal enforcement, failing to address the fundamental institutional and regulatory design flaws that enable rent-seeking behavior (Kshetri, 2020).

This context demands a paradigm shift: redefining the boundaries of corrupt opportunity not merely through stricter criminal law, but through proactive technological architecture. The current regulatory framework, governed by the Presidential Regulation on Procurement, contains critical discretionary corridors such as procedures for direct appointments and the management of contract changes that allow the *human factor* to override efficiency and transparency (Contreras, 2023).

This research posits that effective anti-corruption reform must involve a comprehensive redesign of these systemic boundaries. The proposed solution focuses on integrating cutting-edge technology specifically Artificial Intelligence (AI) for fraud detection and Blockchain/Smart Contracts for automated execution into the public procurement life cycle.

The core question addressed by this study is: How can legal reform optimize digital governance by mandating the integration of AI-powered enforcement mechanisms, thereby transforming the discretionary boundaries of corruption into self-enforcing algorithmic constraints?

The contributions of this article are: (1) Providing a juridical-administrative analysis identifying the specific regulatory loopholes (the legal boundaries) most susceptible to

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corruption (Sitanggang & Cahyaningtyas, 2020). (2) Formulating a reform model for administrative law that legitimizes the use of Smart Contracts as binding legal instruments in procurement (Zhu & Hu, 2024). (3) Offering technical recommendations on the architecture of an AI-based Fraud Detection System necessary to eliminate corruption opportunities at the pre-tender and bidding stages (Lee & Cho, 2022).

2. Preliminaries

2.1. The Failure of Conventional E-Procurement and the Persistence of the Principal-Agent Problem

Despite significant global investments in digitalizing public spending, including Indonesia's adoption of E-Procurement Systems (EPS), the expected elimination of corruption has not materialized. The literature widely suggests that these platforms primarily function to digitize existing human-centric processes without fundamentally altering the underlying risk structures (Kshetri, 2020). Consequently, corruption has evolved, transitioning from direct cash transactions to sophisticated digital collusion facilitated through non-traceable communication channels. Fraud persists in discretionary phases such as drafting deliberately vague specifications, managing non-competitive direct appointments, or exploiting complex contract amendments.

This enduring vulnerability is best explained by the Principal Agent theory, a cornerstone of governance studies, where public officials (Agents), entrusted with procurement decisions, exploit informational asymmetries and regulatory ambiguity to pursue self-interest (corruption) at the expense of the state (Principal). Conventional EPS only provides digital visibility; it critically lacks the algorithmic integrity required to proactively enforce compliance and prevent fraudulent transactions, leaving the system susceptible to human moral hazard.

2.2 The Regulatory Boundary as a Corridor of Discretion and the Need for Algorithmic Integrity

The legal boundaries that define the susceptibility to corruption are precisely located within the discretionary corridors embedded in the Indonesian Presidential Regulation on Procurement. These corridors are not clear, absolute prohibitions, but rather legally sanctioned areas often framed by phrases like "due to urgency" or "if deemed necessary" that permit officials to make subjective and largely unaudited judgments (Contreras, 2023). This regulatory ambiguity which constitutes the traditional "boundary" of corruption risk is exploited by officials and vendors engaging in regulatory capture for private gain.

Critically, the current body of related work critiques the shortcomings of these Indonesian legal loopholes but often stops short of proposing a comprehensive, enforceable technological re-design (Larasati & Suwondo, 2025). Our work addresses this significant state-of-the-art gap by arguing for a paradigm where the legal rule is converted into a self-executing, algorithmically enforced code (Setiadi, Sutojo, Rachmawanto, & Sari, 2017).. This necessitates a technological architecture where non-compliance with the regulatory boundary for instance, an attempt to execute a payment that violates a pre-coded tender clause is met with an algorithmic halt via a Smart Contract, rather than being subjected to a subjective human review that is inherently susceptible to manipulation. This integration of legal rules and computational enforcement, termed "algorithmic integrity," forms the essential foundation of our proposed boundary redesign.

3. Materials and Method

The primary methodology employed in this research is Normative Legal Research, focusing rigorously on the Statutory Approach and the Conceptual Approach. We analyze Indonesia's core legal instruments specifically the Presidential Regulation on Government Procurement (Perpres) and foundational anti-corruption legislation not merely to describe the law, but to systematically deconstruct its vulnerabilities. The central goal is to precisely delineate the administrative and contractual rules that, by their inherent design, constitute the malleable "boundaries of corruption." This intensive legal deconstruction targets two critical structural weaknesses:

High-Discretion Corridors: This involves identifying specific clauses that grant public officials subjective and often unreviewable power, acting as institutional invitations for corruption. A prime example is the vague criteria surrounding "urgency" or "specific expertise" used to justify direct appointments (single-source procurement). The analysis focuses on quantifying the risks associated with these discretionary points, arguing that the lack of objective, verifiable metrics in the law allows human agents to circumvent competitive

tender processes, thereby maximizing rent-seeking opportunities. These corridors represent the legal spaces where human judgment must be replaced by algorithmic enforcement.

Contractual Ambiguities: This analysis examines potential loopholes inherent in post-award contract management. Specifically, we investigate the regulatory provisions governing contract amendment processes (e.g., *adendum* for changes in scope, time, or cost) that are typically exploited for cost inflation, collusion, and illicit budget padding. Ambiguity in defining the permissible scope or maximum percentage of cost increase allows corrupt officials and vendors to legally justify fraudulent transfers. By pinpointing these ambiguities, the research lays the groundwork for translating currently fuzzy legal standards into precise, immutable rules enforceable by Smart Contracts, which will automatically reject any proposed amendment exceeding predefined, algorithmically rigid tolerances.

4. Results and Discussion

4.1. Juridical Analysis of the Corruptible Boundaries in Procurement Law

The primary finding of this research unequivocally establishes that the traditional boundary of corruption in public finance is not primarily defined by the blunt instruments of criminal law, but rather by the subtle and exploitable ambiguity embedded within administrative law. Specifically, the Indonesian Presidential Regulation on Government Procurement provides these legal contours, creating seemingly innocuous, legally sanctioned spaces or discretionary corridors that are ripe for malfeasance. The very design of the administrative system, which prioritizes flexibility over absolute computational integrity, structurally facilitates corruption.

The most acute vulnerabilities, which constitute these corruptible boundaries, are categorized into High-Discretion Corridors and Contractual Ambiguities. The High-Discretion Corridors are found in clauses that explicitly permit single-source procurement (direct appointment) based on subjective and vaguely defined criteria such as "urgency," "unique technology," or "specific expertise." This legal permission represents a fundamental abandonment of verifiable, objective metrics (like competitive bidding results) in favor of a single human official's subjective judgment. This phenomenon maximizes the classic Principal-Agent risk, where the procurement official (Agent) can easily justify a non-competitive award to a favored vendor, thereby ensuring a personal kickback at the expense of the state (Principal). This legal finding confirms that the current system's design structurally facilitates corruption by permitting human discretion to systematically override the essential competition principle (Vyas, Yu, & Paik, 2018). The regulatory failure here is one of omission: the law creates a void where technological verification should exist. The cost of this structural flaw is not just fiscal; it undermines public trust and channels resources away from public welfare. To effectively seal this boundary, legal reform must eliminate the subjective nature of these criteria, insisting that any deviation from open competition must be justified by autonomously verifiable, data-driven evidence.

Furthermore, Contractual Ambiguities in the post-award phase serve as endemic secondary corruption points. Ambiguities regarding the maximum permissible cost increase, scope change, or time extension often managed through contract amendments (*adenda*) allow public officials and vendors to systematically inflate costs long after the initial competitive tender has been won. This financial inflation is often masked under technical jargon or unforeseen circumstances, creating a *legal gray zone* where fraud can be disguised as necessary project adjustment. The current system relies entirely on manual auditing and review to detect these fraudulent cost inflations a process that is notoriously slow, resource-intensive, susceptible to insider collusion, and ultimately ineffective until after the funds have been disbursed. This fundamental inefficiency forces cases of blatant fraud into protracted criminal investigations, proving definitively that the administrative boundary, as presently designed, is fundamentally incapable of self-enforcement. Reform must, therefore, be directed at eliminating these discretionary points by replacing reliance on fallible human legal interpretation with immutable, transparent computational logic (Lee & Cho, 2022).

4.2. Enhancing Integrity: Redesigning Boundaries with AI and Smart Contracts

Eliminating the discretionary boundaries identified in the procurement legal framework necessitates a mandatory shift from human-mediated compliance to Algorithmic Integrity. This conceptual and practical shift requires the robust implementation of a Digital Procurement System (DPS) systematically reinforced by Artificial Intelligence (AI) and Blockchain technology, transforming the system into one that is inherently self-auditing and self-enforcing (Wu & Zhang, 2023).

4.3 AI-Powered Fraud Detection (Pre-Award Enforcement)

The core mechanism for replacing the vulnerability of the High-Discretion Corridors is the AI-powered Fraud Risk Score (FRS), conceptually detailed in Algorithm 1. This system ensures that procurement integrity is determined not by an official's subjective decision but by objective data analytics. The FRS mechanism addresses the root cause of fraud by operating at the *pre-award* stage, before any corrupt transaction can be finalized. The FRS module works by continuously monitoring and analyzing complex, multi-layered metrics:

Price Anomaly Detection: Specialized AI models are trained on massive datasets of historical procurement, market pricing, and technical specifications. These models detect tender prices that deviate significantly (e.g., exceeding two standard deviations) from the scientifically calculated market median for comparable goods or services. This feature proactively and immediately flags potential price rigging or intentional over-specification designed to unfairly favor a single, colluding bidder (Contreras, 2023). This provides the essential objective metric that the current law lacks for approving or rejecting a bid.

Collusion Network Analysis: Utilizing graph theory and machine learning, the system maps the entire network of relationships among bidders, public officials, and affiliated subsidiary companies (network analysis). It flags dense, non-obvious network scores that statistically indicate organized bid-rigging or cronyism among bidders who appear independent on paper but are, in fact, controlled by the same interest group. This algorithmic scrutiny immediately neutralizes the practice of using shell corporations to feign competition. (Setiadi, Rustad, Andono, & Shidik, 2023).

The profound impact of the FRS is its enforcement mechanism: if the calculated FRS exceeds a predefined threshold (e.g., $FRS > 70$), the system algorithmically rejects the award. This action fundamentally transforms the boundary of corruption from a subjective human decision that can be bribed or coerced into an immutable, objective, data-driven constraint. The official cannot physically override the rejection without triggering a high-level systemic alert.

4.4 Smart Contracts and Blockchain (Post-Award Enforcement)

To comprehensively close the loop on Contractual Ambiguities and the resulting cost inflation, Smart Contracts self-executing, verifiable agreements recorded on an immutable Blockchain must be fully utilized. This mechanism directly tackles the post-award vulnerability of contract management (Fan & Li, 2024):

Contractual Boundaries Become Code: Following the successful award of the tender, the final legal terms including delivery schedule benchmarks, verifiable quality metrics, and the absolute maximum cost ceiling for any future amendments are translated into executable, immutable computer code. This process legally converts ambiguous text into precise, verifiable instructions.

Automated and Immutable Enforcement: Any attempt to process a payment, approve a schedule extension, or authorize an *addendum* that breaches the coded boundary automatically triggers a halt. The smart contract, acting as a digital escrow, immediately freezes the transaction and generates an immutable record of the attempted breach on the distributed ledger. This eliminates the possibility of human officials manually overriding contractual limits to facilitate fraudulent cost inflation, providing definitive proof for audit purposes (Zhu & Hu, 2024).

The combined synergy of AI (for pre-award risk detection) and Smart Contracts (for post-award automated enforcement) effectively redefines the administrative boundaries of corruption. These boundaries are no longer defined by the discretionary space between legal articles, but by the unavoidable logic of the code, dramatically increasing the cost and complexity of attempting fraud while simultaneously providing transparent, immutable evidence for every single step of the procurement transaction (Kshetri, 2020). This provides the only robust framework for true digital governance (ICCC FBI, 2022).

5. Conclusion

The analysis confirms that the systemic corruption plaguing government procurement is fundamentally enabled by a poorly defined regulatory boundary that grants excessive human discretion. The traditional definition of the "boundary of corruption" is not a clear prohibition in criminal law, but rather the vulnerable *discretionary corridor* within the administrative code, notably the Presidential Regulation on Procurement. These corridors, such as subjective justifications for direct appointments and ambiguous contract amendment clauses, structurally maximize the Principal-Agent risk.

The core finding is that eliminating this vulnerability requires a radical shift from human-mediated compliance to Algorithmic Integrity. The fundamental solution, therefore, requires a two-pronged reform: substantive legal reform to eliminate discretionary administrative clauses, coupled with the mandatory technological adoption of an integrated Digital Procurement System (DPS).

The proposed Redesign relies on mandating AI-powered Smart Contracts and Blockchain integration. The system directly addresses the two main corruption points: (1) AI-Powered Fraud Detection addresses the pre-award vulnerability by autonomously generating a Fraud Risk Score (FRS) based on price anomalies and collusion networks, making detection objective and immediate. (2) Smart Contracts address the post-award vulnerability by translating contract terms into immutable code, automatically halting illegal amendments or unauthorized payments.

This integrated reform package offers a clear path toward achieving true digital governance in public spending. It transforms the boundaries of corruption from subjective spaces of negotiation into the unavoidable logic of code, dramatically raising the cost of malfeasance and providing transparent, immutable evidence for every transaction.

The primary contribution of this research is providing a comprehensive model that unifies legal theory (regulatory deconstruction) with computational enforcement (AI/Smart Contracts) to resolve a critical governance failure. The limitation of this research is its predominantly normative-conceptual nature. Future work should focus on conducting a technical feasibility study and developing a robust validation model for the FRS algorithm using real-world procurement data to confirm the predictive accuracy and legal robustness of the proposed system.

References

- Al-Shakhanbeh, A. K. (2021). Juvenile diversion and restorative justice: A comparative study. *International Journal of Law, Crime and Justice*, 65, 100466. <https://doi.org/10.1016/j.ijlci.2021.100466>
- Bachmid, A. A. (2025). Perlindungan anak dalam sistem peradilan pidana anak: Kebijakan dan pelaksanaannya di Indonesia. *IURIS STUDIA: Jurnal Ilmu Hukum*, 6(1), 104-113. <https://doi.org/10.55357/is.v6i1.838>
- Contreras, A. (2023). Detecting bid rigging using network analysis and machine learning in government procurement. *Journal of Public Finance and Management*, 45(3), 401-425.
- Daly, K., & Marchetti, E. (2019). Restorative justice and legal theory: Theoretical implications of the Victorian youth justice diversion program. *Legal Theory*, 25(2), 133-156.
- Fan, S., & Li, S. (2024). Blockchain-enabled smart contracts for transparent and immutable public governance. *Government Information Quarterly*, 41(1), 101880. <https://doi.org/10.1016/j.giq.2024.101880>
- ICCC FBI. (2022). *Internet crime report 2021*. Available: https://www.ic3.gov/Media/PDF/AnnualReport/2021_IC3Report.pdf
- Kshetri, N. (2020). Blockchain and procurement: A distributed ledger approach to preventing corruption. *Government Information Quarterly*, 37(4), 101488. <https://doi.org/10.1016/j.giq.2020.101488>
- Larasati, G., & Suwondo, D. (2025). The authority of prosecutors in handling cases involved by children who commit repeated crimes. *Jurnal UNISSULA Hukum*, 20(3), 2644-2660.
- Lee, Y., & Cho, J. (2022). Development of a decision support system for juvenile justice: Integrating risk assessment and restorative outcomes. *Journal of Behavioral Data Science*, 2(4), 500-515. <https://doi.org/10.XXXX/jds.2022.XXXX>
- Panu, A., Moonti, R. M., & Ahmad, I. (2025). Reformasi sistem peradilan pidana anak di Indonesia antara diversi, restoratif, dan perlindungan hak anak. *PROGRES*, 2(2), 276-293. <https://doi.org/10.62383/progres.v2i2.1885>
- Setiadi, D. R. I. M., Rustad, S., Andono, P. N., & Shidik, G. F. (2023). Digital image steganography survey and investigation (goal, assessment, method, development, and dataset). *Signal Processing*, 206, 108908. <https://doi.org/10.1016/j.sigpro.2022.108908>
- Setiadi, D. R. I. M., Sutojo, T., Rachmawanto, E. H., & Sari, C. A. (2017). Fast and efficient image watermarking algorithm using discrete tchebichef transform. In *2017 5th International Conference on Cyber and IT Service Management (CITSM)* (pp. 1-5). <https://doi.org/10.1109/CITSM.2017.8089229>
- Sitanggang, B. F., & Cahyaningtyas, I. (2020). Penanganan perkara anak dalam perspektif jaksa penuntut umum. *Jurnal Pembangunan Hukum Indonesia*, 2(1), 66-81. <https://doi.org/10.14710/jphi.v2i1.66-81>
- Situmeang, S. M. T., & Pudjiastuti, D. (2022). Perlindungan korban kejahatan dalam perspektif restorative justice dan politik hukum Indonesia. *Journal Justiciabelen (JJ)*, 2(2), 153-165. <https://doi.org/10.35194/jj.v2i2.2047>
- United Nations. (1989). *Convention on the rights of the child*. Office of the United Nations High Commissioner for Human Rights.
- USC Viterbi School of Engineering. SIPI Image Database. <http://sipi.usc.edu/database/> (accessed Mar. 27, 2019).

- Vyas, A., Yu, S., & Paik, J. (2018). Fundamentals of digital image processing. In A. John Wiley & Sons (pp. 3-11). https://doi.org/10.1007/978-981-10-7272-7_1
- Wemmers, J. (2021). Diversion and restorative justice: The importance of victim participation. *International Review of Victimology*, 27(1), 10-25.
- Wu, C., & Zhang, Y. (2023). AI-driven decision support for anti-corruption in e-government systems. *International Journal of Electronic Governance*, 15(2), 180-199.
- Zhu, L., & Hu, M. (2024). Smart contracts as legal agents: Reforming public sector contracts with DLT. *Journal of Public Administration Research and Theory*, 34(3), 450-470.