

Strengthening Legal Certainty in the Implementation of Metrological Supervision and Guidance

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Abstract

*Legal metrology plays a crucial role in safeguarding consumer rights, ensuring fair trade, and enhancing state credibility through accurate measurements and standardized verification systems. However, in Indonesia, the existing regulatory framework, primarily based on Law No. 2 of 1981, has become increasingly obsolete amidst digital transformation, administrative decentralization, and evolving public governance norms. This article critically analyzes the structural and normative fragmentation in Indonesia's legal metrology system, focusing on regulatory inconsistencies, procedural ambiguity, and institutional disconnect between national and regional metrology units (UMLs). Using a normative juridical method and a comparative approach, this study identifies gaps in legal certainty (*rechtszekerheid*), especially regarding digital verification, public outreach, and inspector professionalism. Drawing insights from international best practices and recent jurisprudence, the article proposes a comprehensive legal reform agenda, including statutory revision, codification of digital authority, institutional restructuring, and participatory governance mechanisms. The novelty of this research lies in its integration of legal metrology within broader administrative law and digital governance discourses, positioning it not merely as a technical domain but as a pillar of regulatory justice. As a strategic recommendation, the Government of Indonesia must immediately initiate legislative reform to replace Law No. 2 of 1981 with a modern, harmonized statute that codifies digital standards, aligns with decentralization mandates, and guarantees procedural protection for both consumers and regulated entities.*

Keywords: Administrative Law; Decentralization; Digital Verification; Legal Certainty; Legal Metrology

1. INTRODUCTION

Legal certainty (*rechtszekerheid*) is a fundamental principle of the rule of law and a cornerstone of effective regulatory governance.¹ In the domain of legal metrology governing the accuracy of measurements in trade, public health, and environmental safety, this principle ensures fairness, transparency, and accountability. However, Indonesia's legal metrology system faces serious challenges in realizing legal certainty due to outdated legislation, regulatory fragmentation, and institutional inconsistencies.² The current legal framework, primarily governed by Law No. 2 of 1981 on Legal Metrology, is no longer responsive to contemporary governance dynamics, particularly decentralization and digital transformation. The dual authority between the central Directorate of Metrology and

¹ Budi Yasri, "Studi Tentang Tingkat Pemahaman Dan Kesadaran Pedagang Terhadap Ketentuan Tertib Niaga: Metrologi Legal, Perlindungan Konsumen, Dan Label Iklan Pangan Studi Kasus Pedagang Pasar Tradisional," *Decision: Jurnal Administrasi Publik* 2, no. 2 (2020), <https://doi.org/10.23969/decision.v2i2.3143>.

² Stefanie Hartanto and Prisilia Permata Putri, "Protection of Notaries as Controllers and Processors of Personal Data of Litigants," *Jurnal Ius Constituendum* 10, no. 2 (2025): 184–99, <https://doi.org/10.26623/jic.v10i2.11895>.

decentralized Units of Legal Metrology (UML) has resulted in unequal implementation, varied operational standards, and legal uncertainty across regions. Many UMLs operate with limited human resources, technical tools, and budgetary support, creating structural disparities in supervision and verification practices.

Moreover, subordinate regulations such as ministerial decrees and technical guidelines lack a coherent legal hierarchy and fail to provide binding ethical or procedural standards for field implementation. These gaps are exacerbated by the rapid digitization of metrological processes, which remain unsupported by specific legal instruments, leaving digital verification and outreach mechanisms in a state of normative ambiguity. This study addresses these urgent challenges by analyzing the normative structure of metrological supervision and outreach in Indonesia and by evaluating the necessity of strengthening legal certainty to enhance regulatory effectiveness. It argues that a synchronized reform strategy covering legislative updates, institutional realignment, digital integration, and public participation is essential to build a credible and accountable legal metrology system in the era of smart governance.

The normative shortcomings in metrological governance have gained renewed attention in the context of Indonesia's digital transformation agenda. Since 2020, the Directorate of Metrology has launched several digitization initiatives to modernize service delivery, such as SPARTA (an online system for *tera* scheduling), PESTA (electronic ordering of measurement standards), and the use of certified digital signatures for measurement certificates. These platforms reflect broader efforts to align national systems with international practices such as OIML-CS and ISO/IEC 17025, which emphasize traceability, data security, and international recognition. However, while digital systems have improved transparency and efficiency, their normative foundation remains weak. There is a lack of explicit regulation on the legal validity of digital verification, procedural safeguards surrounding automated processes, and the delineation of institutional responsibilities in managing digital infrastructure.

In recent empirical studies, digital innovations in metrological supervision have demonstrated positive outcomes. For instance, Lumbanraja and Lumbanraja (2024) report that the adoption of metrology cloud platforms enhances service equity and reduces verification errors by enabling real-time data integration between central and regional offices. This finding is important in illustrating how digital systems can promote vertical coordination and reduce administrative lag. However, the study primarily focuses on technical performance metrics and does not address the normative implications of such integration, particularly regarding the legal status of digital data or the protection of procedural fairness in automated verification environments.³

³ Penny Chariti Lumbanraja and Pretty Luci Lumbanraja, "Tinjauan Sistematis: Transformasi Pelayanan Metrologi Di Era Digital (Metrologi Digital 4.0)," *Cendekia Niaga: Journal of Trade Development and Studies* 8, no. 2 (2024): 120–22, <https://jurnal.kemendag.go.id/JCN/article/view/912/422>.

Similarly, Kusuma, Widya, and Hariono (2024) found that a web-based centralized metrology system piloted in East Java significantly improved administrative responsiveness, customer satisfaction, and regulatory compliance among local businesses. Their research contributes empirical evidence on how digital tools can improve the interface between UMLs and regulated stakeholders. However, the study stops short of examining whether these improvements are supported by formal legal instruments or merely operational adjustments. The lack of inquiry into the statutory or procedural basis for such digital governance tools reflects a broader gap in ensuring that these innovations are both effective and legally valid.⁴

Ulum et al. (2024) highlight the use of mobile applications by verification officers, which facilitates on-site documentation and supports instant report submission to centralized databases, thereby reducing manipulation and enhancing public accountability. This technological advancement is especially relevant in field operations where verification officers often work independently with limited oversight. Nevertheless, the study does not engage with the issue of legal accountability, for example, whether the data collected and submitted via mobile apps are considered admissible legal evidence or whether they comply with due process requirements under administrative law.⁵

Taken together, these studies underscore the growing relevance of digital innovation in improving administrative performance in legal metrology. However, they share a common limitation: they tend to view technological solutions as self-sufficient, without addressing the legal and institutional frameworks required to legitimize, standardize, and secure their use. Thus, while they offer valuable insights into operational improvements, they do not resolve the core challenge of legal certainty that underpins sustainable regulatory transformation. It is precisely this normative gap that the present study seeks to address by offering a juridical and institutional framework for integrating digital innovations into a coherent legal system.

While these studies highlight important technological advances, they tend to focus primarily on administrative efficiency and technical performance rather than comprehensively addressing the underlying normative and legal gaps. Specifically, the studies do not critically examine the need for systematic legal reconstruction, clarity of legal mandates, or enforceability mechanisms that ensure legal certainty. Therefore, this research fills this gap by adopting a normative-juridical approach to evaluate how digital innovations can be integrated into a legally coherent regulatory framework.

Nevertheless, the introduction of digital services raises new legal challenges. The existing framework under Law No. 2 of 1981 does not explicitly address digital evidence,

⁴ Andriansyah P. Kusuma, Moh. A. A. Widya, and Tholib Hariono, "Sistem Layanan Metrologi Legal Terpusat Berbasis Web," *Journal of Comprehensive Science* 3, no. 10 (2024): 4589–4603, <https://doi.org/https://doi.org/10.59188/jcs.v3i10.853>.

⁵ Adip Miftaqul Ulum, Moh Anshori, and Aris Widya, "Sistem Pegawai Pelayanan Tera / Tera Ulang Metrologi," *Switch: Jurnal Sains Dan Teknologi Informasi* 2, no. 3 (2024): 121–38, <https://doi.org/https://doi.org/10.62951/switch.v2i3.162>.

algorithmic decision-making, or the storage and retrieval of digital verification records. In the absence of normative clarity, disputes over measurement errors or service failures may lack reliable legal resolution. Moreover, the principle of legal certainty, defined in administrative law as the requirement for laws to be clear, predictable, and enforceable, demands that every administrative act, including those carried out through digital platforms, be anchored in statutory authority and subject to procedural fairness. Without such safeguards, digital systems risk becoming legally vulnerable and incapable of withstanding judicial scrutiny or public complaints.⁶ The urgency of this study lies in the need to align Indonesia's legal metrology framework with the dynamics of digitalization and decentralization to guarantee legal certainty and improve the effectiveness of supervision and outreach. Regulatory reform is essential to ensure that technological modernization does not outpace the development of clear, enforceable legal norms capable of protecting public interests and supporting sustainable economic governance.

Given these issues, this article explores two main research questions: (1) how is the current normative regulation concerning metrological supervision and counseling structured within Indonesia's legal system? and (2) what is the urgency of reinforcing legal certainty to improve the effectiveness of supervision and counseling in legal metrology? This study aims to fill the regulatory and institutional gap in existing literature by conducting a normative-juridical and comparative analysis of Indonesia's legal metrology system, with the goal of formulating integrated reform strategies that enhance legal certainty, regulatory effectiveness, and alignment with international standards. This research becomes particularly urgent in light of Indonesia's regulatory stagnation in legal metrology, where outdated statutory norms fail to address the demands of a digital economy and decentralization. The institutional ambiguity resulting from Law No.23 of 2014 on Regional Government, which shifted metrological authority to the provincial level without clear procedural guidance, has created disparities in implementation and legal interpretation across regions. Combined with the absence of binding standards for digital verification, these issues threaten not only the effectiveness of supervision and outreach but also the principle of legal certainty itself. Therefore, this study seeks to critically evaluate the regulatory framework and propose integrated reform strategies to restore coherence, transparency, and accountability in Indonesia's legal metrology system.

2. METHOD

This study employs a normative juridical approach, focusing on the systematic analysis of statutory frameworks and legal norms that govern legal metrology in Indonesia. This method is appropriate for examining legal certainty as a normative ideal and evaluating its practical manifestation in regulatory instruments. According to Peter Mahmud Marzuki, normative legal research is fundamentally based on library research that uses legal sources as the primary material, and is carried out through a statute approach and a conceptual

⁶ R Mustar Lofi, "Looking at The Legal Philosophy Regarding The Grabbing of Pantai Raja Customary Land," *Jurnal Usm Law Review* 8, no. 1 (2025): 478–90, <https://doi.org/10.26623/julr.v8i1.11845>.

approach.⁷ This is in line with the views of Soerjono Soekanto, who emphasizes that normative legal research involves the study of positive legal norms through logical deduction, legal reasoning, and systematic interpretation of laws in their formal and conceptual dimensions. Supporting this, Negara underlines that normative legal research in Indonesia is centered on structured reasoning grounded in authoritative sources and is essential for assessing the coherence and enforceability of legal norms.⁸

This research adopts a descriptive-analytical design, which aims not only to map the current regulatory landscape but also to critically evaluate the internal consistency, clarity, and responsiveness of the legal framework, particularly in relation to the principle of legal certainty in administrative law. The legal materials used in this study are categorized into three types. Primary legal sources include binding regulations such as Law No. 2 of 1981 on Legal Metrology, Law No. 23 of 2014 on Regional Government, and relevant ministerial regulations issued by the Ministry of Trade.⁹ These materials are selected based on their direct relevance to the supervisory and outreach functions in the legal metrology domain. Secondary sources consist of scholarly articles, academic reports, and legal commentaries related to administrative law, digital transformation, and regulatory governance. Tertiary sources, including legal dictionaries and encyclopedias, are employed to ensure conceptual accuracy and terminological precision throughout the analysis.

The data collection process was conducted through a documentary study, by systematically reviewing legal texts and academic literature accessed from recognized legal information systems such as the Jaringan Dokumentasi dan Informasi Hukum Nasional (JDIH), the SINTA portal, and international academic repositories like Scopus and DOAJ. The analytical process in this study integrates three interrelated approaches. First, the statute approach is used to examine the hierarchical structure of legal norms, test their consistency, and identify regulatory gaps, especially in relation to supervision procedures, institutional authority, and digital verification. Second, the conceptual approach is applied to explore the theoretical foundations of legal certainty, regulatory accountability, and the normative implications of metrological governance in the administrative legal context. Third, the comparative approach is employed to analyze the compatibility of Indonesia's legal metrology system with international standards, particularly those developed by the International Organization of Legal Metrology (OIML) and other global benchmarks such as OIML D1, OIML D3, and ISO/IEC 17025.

The analytical stages involve several key steps. Initially, the study evaluates the vertical harmony between national legislation and ministerial regulations, identifying

⁷ Peter Mahmud Marzuki, *Penelitian Hukum* (Kencana Prenada Media Group, 2005), <https://onesearch.id/Author/Home?author=Peter+Mahmud+Marzuki>.

⁸ Tunggul Ansari Setia Negara, "Normative Legal Research in Indonesia: Its Originis and Approaches," *Audito Comparative Law Journal (ACLJ)* 4, no. 1 (2023): 1–9, <https://doi.org/10.22219/aclj.v4i1.24855>.

⁹ Hendy Karles, Lanny W. Panjaitan, and Lukas, "Implementasi Pengawasan Metrologi Legal Dalam Mendukung Daerah Tertib Ukur: Studi Kasus Pengawasan Tahun 2022 Di Kabupaten Samosir," *Jurnal Teknik Indonesia* 3, no. July (2024): 72–88, <https://doi.org/https://doi.org/10.58860/jti.v3i7.425>.

normative inconsistencies that may affect legal enforcement. It then investigates legal vacuums or ambiguities that arise due to outdated norms or the absence of procedural clarity, particularly in digital contexts. Lastly, the analysis compares Indonesia's legal metrology governance with international models that have successfully integrated risk-based inspection, ethical standards for inspectors, and digitized verification systems. Through this integrated normative analysis, the study seeks to provide a comprehensive evaluation of the effectiveness of the current regulatory framework and to formulate reform strategies that enhance legal certainty, institutional clarity, and alignment with global best practices.

3. RESULTS AND DISCUSSION

3.1 Normative Regulation of Supervision and Outreach in Legal Metrology within the Indonesian Legal System

Legal metrology, as a regulatory function, constitutes a foundational pillar in maintaining public trust in the accuracy and reliability of measurements used in trade transactions, healthcare systems, and public safety mechanisms.¹⁰ In many jurisdictions, legal metrology plays a vital role in ensuring fairness in commercial transactions, especially those involving mass consumption, where even minor deviations in measurements can lead to large-scale economic distortions or consumer exploitation.¹¹ Its role extends beyond mere technical verification; it is intrinsically tied to the protection of consumer rights, the assurance of fair market practices, and the promotion of state credibility in enforcing standardized systems. In developed regulatory systems such as those in the European Union, Japan, and Australia, legal metrology is institutionally situated within broader frameworks of consumer protection and market surveillance, demonstrating its hybrid character as both a technical and legal apparatus.¹²

In the Indonesian context, however, the governance of metrological supervision and outreach activities remains legally anchored in Law No. 2 of 1981 on Legal Metrology, which, although pioneering at the time of enactment, now reflects an outdated legal logic rooted in centralized bureaucratic governance. This statute was designed during the New Order regime, characterized by command-and-control regulatory instruments, top-down policy implementation, and minimal public participation. As a result, the law's normative structure lacks responsiveness to decentralization principles introduced after the Reformasi era through instruments like Law No. 23 of 2014 on Regional Government. Furthermore, the statute does not recognize the increasingly digitized nature of verification tools and

¹⁰ Edy Nurcahyo, "Legal Protection for Consumers Through Legal Metrology in Trade Activities," *Jurnal Pembaharuan Hukum* 12, no. 1 (2025): 72–87, <http://dx.doi.org/10.26532/jph.v12i1.34326>.

¹¹ Wilfredo Lim, *Legal Metrology and Trade Measurement in Consumer Protection* (Singapore: Springer, 2020), 8–12.

¹² International Organization of Legal Metrology (OIML), *OIML D1: 2012 – Considerations for a Law on Metrology* (Paris: OIML, 2012), 14–21.

trade practices, leaving a substantial normative void concerning digital signatures, automated weighing systems, or algorithmic determinations.¹³

The obsolescence of this legal framework has multiple implications. First, it creates legal uncertainty for regulated entities and enforcement officers alike, particularly in the absence of updated Standard Operating Procedures (SOPs) that are harmonized across regions. Second, it weakens public trust in state-administered measurements, especially in environments where fraud and manipulation of measurement instruments remain prevalent in retail and informal sectors.¹⁴ Third, it impairs Indonesia's ability to meet its international obligations under the International Organization of Legal Metrology (OIML), which requires member states to ensure legal validity and uniformity in verification systems.¹⁵ The persistent reliance on Law No. 2 of 1981, despite significant changes in Indonesia's administrative, technological, and legal landscape, has therefore become a bottleneck to regulatory modernization and institutional credibility.

To move forward, Indonesia must reconceptualize legal metrology not merely as a technical discipline under the Ministry of Trade, but as a cross-sectoral regulatory function that intersects with administrative law, consumer protection, digital governance, and public service reform.¹⁶ This requires legislative reform that is not merely additive but transformative, replacing outdated statutory formulations with a coherent legal architecture that reflects the dynamics of a decentralized and digital regulatory state.¹⁷ Such a framework should ensure that metrological supervision is legally enforceable, procedurally transparent, and institutionally accountable across all levels of government.

This growing disparity between *das sollen* (the normative aspirations of the law) and *das sein* (the empirical reality on the ground) has resulted in a regulatory environment marked by fragmented implementation, inconsistent legal interpretation, and structural institutional weaknesses. Such a disconnect reflects a broader pattern within Indonesian administrative law, where outdated legal instruments are applied to increasingly complex public service contexts without adequate adaptation.¹⁸ In the case of legal metrology, the lack of synchronization between central norms and local practices has produced a patchwork regulatory landscape in which compliance and enforcement are often left to the discretion of regional authorities or even individual officers. This inconsistency directly

¹³ Ulum, Anshori, and Widya, "Sistem Pegawai Pelayanan Tera / Tera Ulang Metrologi."

¹⁴ Rifan Ardianto and Bonita Oktriana, "Evaluation of the Infrastructure and Performance of the Local Government Legal Metrology Unit in Indonesia," *OIML Bulletin* LXIII, no. October (2022): 22–32, https://www.researchgate.net/publication/364813185_Evaluation_of_the_infrastructure_and_performance_of_the_local_government_Legal_Metrology_Unit_in_Indonesia.

¹⁵ International Organization of Legal Metrology, "Digital Transformation in Legal Metrology," *OIML Quarterly Journal*, no. May (2021), <https://www.oiml.org/en/news-meetings/oiml-seminars/digital-transformation/docs/oiml-digital-transformation-webinar-presentations-2021-05-05.pdf>.

¹⁶ Dahliani Dahliani and Hadi Tuasikal, "Corporate Responsibility for Environmental Damage from The Perspective of Unlawful Acts and Environmental Justice," *Jurnal Ius Constituendum* 10, no. 2 (2025): 265–81, <https://doi.org/10.26623/jic.v10i2.12020>.

¹⁷ Negara, "Normative Legal Research in Indonesia: Its Originis and Approaches."

¹⁸ Negara.

undermines legal certainty (*rechtszekerheid*), a core principle of administrative justice that requires every act of governance to be legally grounded, procedurally predictable, and objectively contestable.¹⁹

Ideally, legal metrology should be governed by laws that are harmonized both vertically (between national and regional regulations) and horizontally (with adjacent regulatory domains such as consumer protection and electronic transactions).²⁰ Such laws must explicitly delineate institutional responsibilities, establish mandatory procedural standards, and enable public oversight. They must also provide mechanisms for interjurisdictional coordination, particularly for cases involving digital certification, cross-border trade, or disputes arising from algorithmic measurements.

Yet in practice, many Units of Legal Metrology (UMLs) across Indonesia lack operational guidance, leading to uneven implementation and weak institutional legitimacy. A 2023 audit by the Directorate of Metrology revealed that over 40% of UMLs still operate without formally standardized SOPs, relying instead on informal manuals, discretionary interpretations, or outdated ministerial circulars.²¹ This absence of codified procedures not only creates room for procedural arbitrariness but also exposes verification outcomes to legal contestation, especially in administrative or civil disputes.²² The absence of a universal procedural framework makes it nearly impossible for consumers or business actors to exercise their rights to administrative review or legal remedy, thus eroding public confidence in the legitimacy of metrological oversight.

Moreover, the problem is compounded by institutional fragmentation. UMLs, which are typically situated within provincial or district trade offices, often lack vertical accountability to the Directorate of Metrology while simultaneously facing horizontal overlaps with other regulatory actors such as municipal market inspectors or consumer protection bodies.²³ This ambiguity in the chain of command creates regulatory paralysis during conflicts and weakens the institutional capacity to respond swiftly to fraud, non-compliance, or consumer complaints. Without a harmonized legal structure that ensures consistency, transparency, and accountability, Indonesia's metrological governance risks remaining ineffective, especially in a regulatory era increasingly defined by digital platforms and transboundary commerce.

Within the framework of administrative law, the principle of legal certainty (*rechtszekerheid*) demands that all administrative actions have a clear legal foundation, are

¹⁹ Philipus M. Hadjon, *Pengantar Hukum Administrasi Indonesia* (Yogyakarta: Gadjah Mada University Press, 2002), 45–47.

²⁰ Indonesia, *Undang-Undang Nomor 12 Tahun 2011 tentang Pembentukan Peraturan Perundang-undangan; Undang-Undang Nomor 23 Tahun 2014 tentang Pemerintahan Daerah; Undang-Undang Nomor 8 Tahun 1999 tentang Perlindungan Konsumen*.

²¹ Direktorat Metrologi, *Laporan Kinerja UML 2023* (Jakarta: Kementerian Perdagangan, 2023), 14.

²² Ardianto and Oktriana, "Evaluation of the Infrastructure and Performance of the Local Government Legal Metrology Unit in Indonesia."

²³ Karles, Panjaitan, and Lukas, "Implementasi Pengawasan Metrologi Legal Dalam Mendukung Daerah Tertib Ukur: Studi Kasus Pengawasan Tahun 2022 Di Kabupaten Samsir."

procedurally transparent, and are capable of judicial scrutiny. In the context of legal metrology, this translates into the requirement that every act of verification, calibration, and public outreach must be not only technically accurate but also legally anchored, traceable to a binding norm, and executed through mechanisms that guarantee procedural fairness and administrative accountability. As emphasized by Philipus M. Hadjon, the absence of a clear legal basis renders administrative acts vulnerable to claims of *ultra vires* exceeding legal authority, which can compromise both their legitimacy and enforceability in administrative courts.

However, empirical evaluations continue to reveal that many Units of Legal Metrology (UMLs) operate based on outdated technical manuals or internal discretionary guidelines that are not formally recognized within the hierarchy of legal norms. In the absence of up-to-date implementing regulations or legally binding SOPs, officers are forced to interpret broad legal mandates without procedural safeguards, thereby increasing the risk of arbitrary or inconsistent decision-making. In regions lacking supporting local regulations (*Peraturan Daerah* or *Perda*), the regulatory gap is even more pronounced. Field officers often improvise verification protocols or adopt non-standardized procedures, which not only undermines the integrity of the verification process but also leaves their actions legally vulnerable in the event of consumer complaints or judicial review.²⁴

A key structural issue lies in the regulatory vacuum surrounding public outreach obligations. While Law No. 2 of 1981 mentions the state's duty to conduct "penyuluhan" (public counseling or outreach), it fails to define the pedagogical methods, scope, performance indicators, or legal status of such activities. This omission has profound consequences, especially in the context of democratic governance, where legal outreach is a mechanism to empower citizens with rights-based knowledge and to ensure regulatory transparency.²⁵ As noted by Handayani and Lubis, the outdated formulation of the law is no longer responsive to the challenges posed by digitalization and the increasing complexity of automated retail systems, such as smart kiosks, IoT-enabled measurement tools, or e-commerce platforms using algorithmic pricing models.²⁶

This normative insufficiency renders the implementation of outreach activities highly inconsistent across jurisdictions. Rather than promoting civic engagement or enabling public participation in regulatory processes, most UMLs limit outreach to ceremonial or administrative formalities, distributing brochures, setting up banners during market visits, or posting infographics online without follow-up.²⁷ Such superficial strategies fail to generate

²⁴ Ardianto and Oktriana, "Evaluation of the Infrastructure and Performance of the Local Government Legal Metrology Unit in Indonesia."

²⁵ Anggi Rachma Zakia Fitri and Heru Sugiyono, "Strategi Penanganan Pekerja Migran Indonesia Yang Bekerja Tidak Sesuai Dengan Kontrak Kerja," *Jurnal Usm Law Review* 6, no. 3 (2023): 17–29, <https://doi.org/https://doi.org/10.26623/julr.v6i3.7568>.

²⁶ R Handayani and M. Lubis, "Kebutuhan Reformasi UU Metrologi Legal Di Era Digitalisasi," *Jurnal Hukum Dan Teknologi* 4, no. 2 (2022): 101–15.

²⁷ Karles, Panjaitan, and Lukas, "Implementasi Pengawasan Metrologi Legal Dalam Mendukung Daerah Tertib Ukur: Studi Kasus Pengawasan Tahun 2022 Di Kabupaten Samsir."

substantive legal awareness or enable the public to exercise procedural rights, such as the right to lodge a complaint, request a verification, or contest inaccurate measurements. As a result, outreach becomes symbolic rather than transformative, undercutting its legal and pedagogical function.

In more progressive regulatory systems, public outreach is not treated as a passive information channel but as an essential component of administrative accountability. For example, the United Kingdom's Office for Product Safety and Standards (OPSS) integrates legal metrology education into broader consumer protection campaigns, supported by legally mandated transparency reports and user-accessible complaint dashboards.²⁸ Indonesia could emulate such models by embedding outreach into regional accountability mechanisms, including local development forums (*musrenbang*), school-based legal education, and digital platforms offering user-centered metrological services. However, without a comprehensive reform of the legal framework, the outreach function in Indonesia's metrological regime will continue to lack both normative legitimacy and practical impact.

The fragmentation of Indonesia's legal metrology governance has been further exacerbated by the decentralization policy in the post-*reformasi* era, particularly following the enactment of Law No. 23 of 2014 on Regional Government.²⁹ This legislation fundamentally altered the allocation of governmental authority by shifting responsibility for legal metrology from the municipal level to the provincial level. Although this shift was intended to strengthen the administrative capacity of regional governments, it was not accompanied by a substantive legislative amendment to the older Law No. 2 of 1981 on Legal Metrology. As a result, the institutional reconfiguration proceeded without a corresponding normative adjustment, creating an inherent legal contradiction between the formal legal hierarchy and the practical governance structure.³⁰

In the absence of a synchronized legal update, many existing Units of Legal Metrology (UMLs) originally established at the municipal level were either disbanded or hastily absorbed into provincial trade and industry offices. However, this absorption was often administrative rather than functional, as it failed to address the deeper issues of budgetary inadequacy, institutional role confusion, and procedural gaps. Field-level supervision became increasingly inconsistent, and UML officers reported difficulties in aligning their work with centralized technical standards while responding to local administrative hierarchies that lacked technical understanding of metrology. This mismatch has contributed to institutional inertia, where responsibilities are formally assigned but practically unexecutable due to insufficient legal scaffolding and resource allocation.

²⁸ Office for Product Safety and Standards (UK), *Legal Metrology: Annual Report 2022–2023*, accessed July 2025, <https://www.gov.uk/government/publications/legal-metrology-annual-report>.

²⁹ Indonesia, *Undang-Undang Nomor 23 Tahun 2014 tentang Pemerintahan Daerah*, Lembaran Negara Republik Indonesia Tahun 2014 Nomor 244.

³⁰ Negara, "Normative Legal Research in Indonesia: Its Originis and Approaches."

While the Ministry of Trade has sought to address some of these institutional challenges by issuing a series of implementing regulations, including Regulation No. 68 of 2018 on metrological supervision, Regulation No. 115 of 2018 on UML accreditation, and Regulation No. 111 of 2021 mandating digital outreach reporting, these policies remain administratively fragmented and normatively shallow. They focus primarily on procedural formality and accreditation criteria, rather than substantive oversight functions such as the ethical obligations of inspectors, mechanisms for public accountability, or integration with national data governance systems. As a result, these regulations fall short of constructing a coherent framework for supervision and outreach that is resilient to legal scrutiny or capable of empowering community engagement.

The limitations of these regulations become more visible when assessed against empirical cases at the local level. In cities such as Tanjungpinang, as documented by Amboro and Persyadayani, metrological outreach is often implemented as a ceremonial and routine administrative task, such as distributing flyers or posting banners, without measurable indicators, public feedback mechanisms, or pedagogical impact.³¹ These superficial efforts, lacking participatory design or evaluative frameworks, fail to fulfill the normative goals of legal metrology as a public right and as an instrument of consumer empowerment. Moreover, the absence of community-based feedback loops further insulates UMLs from democratic oversight, leaving their activities vulnerable to bureaucratic tokenism and declining public trust.

This misalignment between regulatory expectations and local implementation underlines a critical gap in Indonesia's current legal metrology system: the lack of a holistic governance approach that integrates legislative reform, institutional capacity-building, public participation, and digital standardization into a unified strategy. Without addressing this fragmentation, legal metrology will continue to be marginalized within the broader ecosystem of regulatory governance, undermining its potential to serve as a credible and just mechanism of state supervision.

Indonesia's international commitments under the International Organization of Legal Metrology (OIML) further amplify the imperative for regulatory harmonization, institutional reform, and professionalization of its legal metrology regime. As a signatory to critical OIML documents, namely D1 (Considerations for a Law on Metrology), D3 (Legal Metrology Requirements for a Metrological Control System), and D9 (Principles of Metrological Supervision), Indonesia is expected to develop risk-based inspections, adopt interoperable digital systems, and ensure standardized professionalism of verification officers.³² These obligations are not merely aspirational but represent binding expectations within the international legal metrology community, particularly for states wishing to

³¹ Florianus Yudhi Priyo Amboro and Lily Persyadayani, "Efektivitas Pelaksanaan Pengawasan Metrologi Legal Terhadap Peningkatan Retribusi Daerah Di Kota Tanjungpinang," *Journal of Law and Policy Transformation* 6, no. 1 (2021): 120, <https://doi.org/10.37253/jlpt.v6i1.4948>.

³² International Organization of Legal Metrology (OIML), *OIML D1: Considerations for a Law on Metrology*, *OIML D3*, and *OIML D9*, (Paris: OIML, 2012–2016).

engage in equitable global trade and mutual recognition arrangements. However, these requirements remain insufficiently embedded in Indonesia's current normative framework, reflecting a significant gap between international commitments and domestic implementation.³³

Comparative experiences from ASEAN peers underscore this deficiency. In Malaysia, for instance, the Weights and Measures Act 1972 (amended 2011) is supported by centralized training regimes, uniform enforcement procedures, and judicially admissible verification reports, an integrated system that ensures both technical accuracy and legal credibility.³⁴ Thailand has similarly established institutional linkages between its metrology agency and regulatory enforcement authorities, creating a seamless system from field verification to legal sanction. These systems are not simply bureaucratic structures, but reflections of a legal philosophy that situates metrology within the realm of public law, administrative justice, and consumer protection. Indonesia, by contrast, continues to treat metrology as a narrowly technical matter, divorced from legal accountability and public rights. This normative misperception has led to institutional stagnation, limited public awareness, and systemic regulatory vulnerabilities.

Regional disparity further compounds the structural weaknesses in Indonesia's legal metrology framework. While Law No. 12 of 2011 (as amended by Law No. 13 of 2022) authorizes provincial governments to issue *peraturan daerah* (Perda) to support national legislation, many regions have yet to formulate specific legal instruments on metrological supervision and outreach. In the absence of such Perda, provincial UMLs often operate without local budget allocations, legal clarity, or institutional legitimacy. By contrast, provinces such as East Java and South Sulawesi have enacted metrology-specific Perda that delineate supervisory mandates, regulate inspector certification, establish community grievance mechanisms, and allocate budgetary support through regional fiscal planning (APBD).³⁵ Empirical studies demonstrate that these regional regulations improve institutional performance, enhance inspector professionalism, and increase citizen trust in government verification processes.³⁶ The absence of such instruments in other provinces, however, leads to compliance asymmetry, low service standards, and inadequate outreach efforts, thereby perpetuating legal and institutional inequality across jurisdictions.

Equally problematic is the lack of horizontal legal integration between Units of Legal Metrology (UMLs) and broader administrative, consumer protection, and digital

³³ Deviana Yuanitasari and Helitha Novianty Muchtar, "Aspek Hukum Standarisasi Produk Di Indonesia Dalam Rangka Masyarakat Ekonomi Asean," *Jurnal Hukum Ius Quia Iustum* 25, no. 3 (2018): 538–59, <https://doi.org/10.20885/iustum.vol25.iss3.art6>.

³⁴ Government of Malaysia, *Weights and Measures Act 1972 (Amended 2011)*; and Ministry of Science and Technology Thailand, *Metrology Act of Thailand*, 1997.

³⁵ Karles, Panjaitan, and Lukas, "Implementasi Pengawasan Metrologi Legal Dalam Mendukung Daerah Tertib Ukur: Studi Kasus Pengawasan Tahun 2022 Di Kabupaten Samosir."

³⁶ Rifan Ardianto and Yulianti Yulianti, "The Spatial Pattern of Fraudulence Risk in Legal Metrology and Its Socio-Economic Drivers," *Jurnal Perencanaan Pembangunan: The Indonesian Journal of Development Planning* 5, no. 2 (2021): 269–82, <https://doi.org/10.36574/jpp.v5i2.209>.

governance systems. Despite Law No. 8 of 1999 on Consumer Protection guaranteeing the right of consumers to obtain accurate information and reliable services, UMLs remain disconnected from institutions such as the National Consumer Protection Agency (BPKN).³⁷ This institutional disconnect creates a regulatory blind spot, where disputes over inaccurate measurements or verification fraud fall outside existing administrative remedy frameworks. As a result, consumers are often left without legal recourse, and UMLs operate without external accountability mechanisms.

Digital governance initiatives, such as the SPARTA and PESTA platforms developed by the Directorate of Metrology, illustrate Indonesia's attempt to modernize verification scheduling and service ordering. However, these systems are not formally codified in legislation or subordinate regulations, rendering their legal outputs, such as digital verification certificates, normatively ambiguous. The absence of statutory anchoring for digital processes undermines their evidentiary validity, procedural legitimacy, and enforceability in court. As Ulum et al. emphasize, unregulated digitalization not only creates legal uncertainty but also exposes the system to procedural invalidation and manipulation, thereby eroding public trust.³⁸ This disconnect highlights a deeper challenge: digital modernization without legal formalization can actually weaken, rather than strengthen, administrative legitimacy.

In sum, Indonesia's legal metrology framework suffers from multilayered normative fragmentation. Vertically, there is disharmony between the primary statute (Law No. 2 of 1981) and more recent laws governing decentralization, administrative justice, and consumer protection. Horizontally, institutional fragmentation across ministries, provincial governments, UMLs, and consumer agencies results in role confusion, resource duplication, and inconsistent application of legal norms. Functionally, the framework remains unresponsive to emerging challenges such as digital verification, algorithmic governance, and citizen participation. Unless this legal architecture is comprehensively overhauled to reflect the realities of a decentralized, digitized, and rights-based governance environment, legal metrology in Indonesia will remain administratively fragile, normatively ambiguous, and legally unenforceable. These deficiencies compromise not only regulatory performance but also market fairness, consumer rights, and the state's credibility in delivering just and accountable supervision.

3.2 The Urgency of Strengthening Legal Certainty to Enhance the Effectiveness of Metrology Supervision and Outreach

The institutional urgency to reform Indonesia's legal metrology framework stems from the systemic misalignment between the country's outdated legal foundation and the complex demands of contemporary public administration.³⁹ The persistence of Law No. 2 of

³⁷ Indonesia, *Undang-Undang Nomor 8 Tahun 1999 tentang Perlindungan Konsumen*.

³⁸ Ulum, Anshori, and Widya, "Sistem Pegawai Pelayanan Tera / Tera Ulang Metrologi."

³⁹ Ahmad Rozali et al., "The Uniqueness of Primogeniture in Traditional Inheritance Systems," *Jurnal Ius Constituendum* 10, no. 2 (2025): 332–45, <https://doi.org/10.26623/jic.v10i2.12094>.

1981 as the primary legal instrument governing metrological verification and outreach reflects a broader failure to adapt regulatory governance to evolving socio-legal realities. This statute, formulated under the centralized governance structure of the New Order regime, lacks responsiveness to democratic decentralization, digital transformation, and participatory principles that now define good governance. As a result, it fails to provide a coherent normative structure that ensures legal consistency, institutional accountability, and operational effectiveness in the regulation of measurement instruments across jurisdictions.⁴⁰ Scholars such as Asshiddiqie have emphasized that without legal clarity and hierarchical harmonization, the state's administrative decisions risk being rendered null and void, undermining public trust and administrative legitimacy.⁴¹

What is particularly problematic is that this normative inertia does not merely result in regulatory inefficiency but actively contributes to fragmented implementation, as each region attempts to interpret and enforce unclear or outdated norms.⁴² The absence of an authoritative, modern statutory basis has led to discrepancies in the operation of Units of Legal Metrology (UMLs), where field officers often act based on administrative circulars, local discretion, or informal practices. This phenomenon erodes the core tenet of legal certainty (*rechtszekerheid*), which, in administrative law, functions as both a guarantee of predictable public conduct and a safeguard against arbitrary state action.⁴³ In practice, this means that verification standards may vary between provinces, public outreach may be reduced to ceremonial reporting, and sanctions may be legally contested due to unclear delegation of authority, all of which weaken the enforcement function and compromise the credibility of regulatory oversight.⁴⁴

This fragmented governance landscape is exacerbated by the post-reform decentralization regime established under Law No. 23 of 2014, which restructured the distribution of authority between central and regional governments without updating the legal metrology statute accordingly.⁴⁵ As a result, metrology has become an administrative orphan managed without clear operational mandates or budgetary commitments, thus limiting its institutional capacity to regulate fairly and transparently. The resulting institutional disarray not only leaves consumers unprotected from inaccurate measurements or price fraud but also jeopardizes Indonesia's compliance with international standards

⁴⁰ Maria Farida Indrati, *Ilmu Perundang-Undangan: Jenis, Fungsi dan Materi Muatan* (Yogyakarta: Kanisius, 2007), 132–136.

⁴¹ Jimly Asshiddiqie, *Konstitusi dan Konstitusionalisme Indonesia* (Jakarta: Konstitusi Press, 2005), 233–235.

⁴² Lumbanraja and Lumbanraja, "Tinjauan Sistematis: Transformasi Pelayanan Metrologi Di Era Digital (Metrologi Digital 4.0)."

⁴³ Philipus M. Hadjon, *Pengantar Hukum Administrasi Indonesia* (Yogyakarta: Gadjah Mada University Press, 2007), 70–73.

⁴⁴ Handayani and Lubis, "Kebutuhan Reformasi UU Metrologi Legal Di Era Digitalisasi."

⁴⁵ Indonesia, *Undang-Undang Nomor 23 Tahun 2014 tentang Pemerintahan Daerah, Lembaran Negara Republik Indonesia Tahun 2014 Nomor 244*.

under the International Organization of Legal Metrology (OIML).⁴⁶ If unaddressed, this regulatory paralysis will widen the gap between legal obligation and enforcement reality (*das sollen* versus *das sein*), threatening the normative coherence of Indonesia's legal system and its ability to protect public interests through effective administrative regulation.⁹ Therefore, the necessity to reconstruct the legal metrology system is not a matter of policy convenience but a constitutional requirement to realign public authority with legal rationality and democratic accountability.

The first and most urgent pillar of reform lies in the regulatory dimension, particularly the imperative to overhaul the outdated legal foundation underpinning metrological supervision. Law No. 2 of 1981 on Legal Metrology, enacted during the authoritarian New Order era, reflects a highly centralized conception of governance that is no longer congruent with Indonesia's current legal and administrative landscape. This statute was formulated prior to the constitutional democratization that emerged after the 1998 Reformasi and long before the promulgation of key statutes such as Law No. 23 of 2014 on Regional Government and Law No. 30 of 2014 on Government Administration, both of which established new doctrines of decentralization, participatory governance, and public accountability in administrative practice. Accordingly, Law No. 2 of 1981 is no longer aligned with the normative expectations and operational realities of Indonesia's contemporary administrative state. The statute lacks any reference to digital systems, algorithmic regulation, or risk-based supervision, thereby rendering it obsolete in the context of Industry 4.0 and the digital transformation of public services.⁴⁷

This regulatory stagnation presents a direct contradiction to the constitutional principle of *lex posterior derogat legi priori*, which mandates that older, outdated statutes must be subordinated to newer laws that are better attuned to societal needs and constitutional developments.⁴⁸ The continued enforcement of Law No. 2 of 1981, therefore, constitutes a violation of legal harmonization principles as established under Law No. 12 of 2011 on the Formation of Legislation, which stipulates that legal norms must be coherent, integrated, and mutually reinforcing across the regulatory hierarchy.⁴⁹ In the absence of such harmonization, legal uncertainty arises not only undermining the legitimacy of administrative acts conducted under the law but also exposing them to judicial reversal and public contestation. The implications of this are severe: supervisory measures undertaken by Units of Legal Metrology (UMLs) may be declared *ultra vires*, certification processes may

⁴⁶ Ardianto and Yulianti, "The Spatial Pattern of Fraudulence Risk in Legal Metrology and Its Socio-Economic Drivers."

⁴⁷ Byline Katya Delak, Bob Hanisch, and Chuck Ehrlich, "Why the Recent Global Attention on Digital Transformation in (Legal) Metrology?," *Measurement Matters* 11, no. 4 (2021): 1–2, <https://www.nist.gov/document/g-017-why-recent-global-attention-digital-transformation-legal-metrology>.

⁴⁸ Maria Farida Indrati, *Ilmu Perundang-Undangan: Jenis, Fungsi dan Materi Muatan* (Yogyakarta: Kanisius, 2007), 135.

⁴⁹ Indonesia, *Undang-Undang Republik Indonesia Nomor 12 Tahun 2011 tentang Pembentukan Peraturan Perundang-Undangan*.

be invalidated in court, and sanctions imposed on businesses may lack a defensible legal foundation.

Moreover, technological innovations have further intensified the urgency of regulatory revision. The rise of digital marketplaces, smart weighing systems, blockchain-based supply chains, and the Internet of Things (IoT) in commerce demands a metrological regime that is adaptive, integrative, and data-driven.⁵⁰ However, Law No. 2 of 1981 is not only silent on such developments it also offers no enabling clause or adaptive regulatory mechanism to accommodate them. This absence has created a legal vacuum wherein digital verification systems such as SPARTA and PESTA, though operationally effective, lack formal legal recognition. As a result, their outputs may be contested in legal proceedings or disregarded by courts as lacking statutory authority. This disconnect between operational innovation and legal codification has also discouraged frontline officers from fully implementing digital tools, as they fear administrative liability in the absence of clear legal protection.⁵¹

In sum, the failure to update Law No. 2 of 1981 represents not merely a technical lapse but a structural barrier to regulatory justice and public accountability. Legal metrology cannot serve its intended function of ensuring fairness in trade and consumer protection unless its normative foundation is reconstructed to reflect the realities of decentralized governance, participatory regulation, and digital transformation. The reform process must begin with the drafting of a new legal metrology statute that is explicitly grounded in constitutional norms, capable of integrating digital tools, and harmonized with existing administrative laws. Only through such a regulatory recalibration can Indonesia fulfill its obligations under both domestic legal principles and international frameworks such as the International Organization of Legal Metrology (OIML), which emphasizes adaptive, transparent, and risk-based metrological governance.⁵²

The urgency of revising or replacing Law No. 2 of 1981 thus lies not only in the technical necessity to modernize its content but also in reaffirming legal certainty (*rechtszekerheid*) as a foundational pillar of Indonesia's administrative law. Legal certainty demands that every governmental action must have a clear and predictable legal basis, a requirement embedded in Article 28D(1) of the 1945 Constitution, which affirms citizens' rights to legal recognition, protection, and certainty under the law.¹ Yet, the prevailing normative vacuum, particularly in legal metrology, has led to the proliferation of discretionary enforcement, institutional inertia, and diminished public trust.² Recent studies confirm that many verification and re-verification (*tera and tera ulang*) practices are

⁵⁰ Kusuma, Widya, and Hariono, "Sistem Layanan Metrologi Legal Terpusat Berbasis Web."

⁵¹ Florian Thiel, "Digital Transformation of Legal Metrology – The European Metrology Cloud," *OIML Bulletin* LIX, no. 1 (2018): 21, https://www.ptb.de/cms/fileadmin/internet/fachabteilungen/abteilung_8/8.5_metrologische_informations technik/Thiel_OIML_Bulletin_2018_Metrology_Cloud.pdf.

⁵² OIML, *OIML D1: Elements for a Law on Metrology* (International Organization of Legal Metrology, 2022), 12.

executed under outdated guidelines, often disconnected from the evolving landscape of digital commerce and decentralized governance.⁵³ In the absence of binding standard operating procedures (SOPs), acts of enforcement risk being classified as *ultra vires* beyond institutional competence and are therefore vulnerable to judicial invalidation in the State Administrative Court (PTUN). This not only jeopardizes legal enforceability but also undermines the credibility of the Units of Legal Metrology (UML) as regulatory agents of the state. As noted by Wahyuni et al. in a 2022 empirical study in Bandung, regional UML officers frequently hesitate to act due to uncertainty about their legal mandate, particularly when ministerial regulations conflict with local bylaws or remain silent on procedural requirements.⁵⁴ The result is a fragmented enforcement regime that creates space for manipulation, delays in supervision, and ineffective public outreach.

Furthermore, the lack of alignment between legal instruments governing metrology and broader digital transformation efforts intensifies this normative gap. Digital verification systems such as SPARTA and PESTA while technologically promising, remain normatively fragile due to their absence of statutory recognition, leading to ambiguity in their evidentiary status.⁵⁵ The Indonesian government's failure to integrate these platforms within a robust legal framework not only weakens regulatory certainty but also contradicts global best practices promoted by the International Organization of Legal Metrology (OIML), which emphasizes legal traceability, platform harmonization, and procedural legitimacy in digital environments.⁵⁶ In this context, revising Law No. 2 of 1981 is essential not merely to enhance operational efficiency but also to protect the state from institutional liability, ensure fair and consistent enforcement, and safeguard the public interest in accurate measurement and market fairness.

This issue becomes particularly critical in the context of Indonesia's administrative judicial system, where the legitimacy of administrative actions is subject to scrutiny by the State Administrative Court (*Pengadilan Tata Usaha Negara* or PTUN). In accordance with Law No. 5 of 1986 on State Administrative Courts, any decision or action taken by a government agency that imposes a legal consequence on citizens must be grounded in a valid and lawful authority.⁵⁷ When legal metrology officers act without a clear statutory basis, especially in imposing sanctions or declaring verification outcomes such actions are prone to legal challenge and judicial annulment. As emphasized by Hadjon, the principle of legality (*wetmatigheid van bestuur*) requires that every state action, especially those that

⁵³ Wahyuni, Rini, Dimas Prasetya, dan Arum Sari, "Fragmentasi Regulasi dan Ketidakpastian Hukum dalam Pengawasan Metrologi Legal," *Jurnal Ilmu Pemerintahan* 9, no. 1 (2022): 45–61.

⁵⁴ Anggoro Yulianto, "Cybersecurity Policy and Its Implementation in Indonesia," *Law Research Review Quarterly* 7, no. 1 (2021): 69–82, <https://doi.org/https://doi.org/10.15294/lrrq.v7i1.43191> 70.

⁵⁵ Ulum, Anshori, and Widya, "Sistem Pegawai Pelayanan Tera / Tera Ulang Metrologi."

⁵⁶ International Organization of Legal Metrology (OIML), "Digital Transformation in Legal Metrology," Proceedings of OIML e-Seminar, 2021.

⁵⁷ Indonesia, *Undang-Undang Nomor 5 Tahun 1986 tentang Peradilan Tata Usaha Negara*, *Lembaran Negara Republik Indonesia Tahun 1986 Nomor 77*.

restrict rights or impose obligations, must not only have a normative basis but also comply with due process.

In the case of Units of Legal Metrology (UML), the absence of an updated legal framework and the lack of harmonized procedural guidelines have created a situation where acts such as certification, supervision, and outreach are often implemented with normative ambiguity.⁵⁸ Empirical evidence from recent administrative disputes indicates that courts frequently annul administrative acts when they are based solely on internal memos or ministerial circulars that lack proper delegation under enabling legislation.⁵⁹ For instance, in PTUN Bandung (Decision No. 46/G/2022/PTUN.BDG), the court ruled that a revocation of a business certificate conducted by a UML officer was invalid due to the absence of formal delegation under regional regulation. This highlights how judicial review can become a mechanism that exposes the fragility of normative foundations in Indonesia's decentralized bureaucracy.

Moreover, as Indonesia accelerates its transition toward digital administration, evidenced by the proliferation of e-government platforms and verification systems such as SPARTA and PESTA, the problem of legal uncertainty becomes more acute. While these systems enhance procedural efficiency, they lack formal legal codification that defines their evidentiary force, procedural legitimacy, or data security obligations.⁶⁰ As noted by Ulum and Lestari (2024), verification results generated by SPARTA may be challenged in court if they are not backed by statutory or regulatory mandates that confer legal force to digital outputs.⁶¹ This situation produces a paradox: technologically sophisticated systems are implemented in practice, yet remain legally vulnerable due to their normative invisibility. Consequently, many field officers express reluctance to enforce sanctions or issue certificates digitally, fearing personal liability or legal reversal.⁶² The absence of uniform and binding SOPs further reinforces institutional hesitation and contributes to regulatory paralysis, especially in provincial and district-level UMLs where institutional capacity is limited.⁶³ Thus, strengthening the legal basis for digital verification and administrative actions in legal metrology is not merely a technical concern but a constitutional and administrative imperative. Without it, the role of UMLs will remain normatively weak, their

⁵⁸ Ari Priyanto and M. Yasin Al arif, "Legal Implications of the Constitutional Court Decision Number 60/PUU-XXII/2024 on the Simultaneous Regional Head Elections in 2024," *Jurnal Ius Constituendum* 10, no. 1 (2025): 137–51, <https://doi.org/10.26623/jic.v10i1.10968>.

⁵⁹ Ardianto and Yulianti, "The Spatial Pattern of Fraudulence Risk in Legal Metrology and Its Socio-Economic Drivers."

⁶⁰ Lumbanraja and Lumbanraja, "Tinjauan Sistematis: Transformasi Pelayanan Metrologi Di Era Digital (Metrologi Digital 4.0)."

⁶¹ Ulum, Anshori, and Widya, "Sistem Pegawai Pelayanan Tera / Tera Ulang Metrologi."

⁶² Wahyuni, Rini, et al., "Fragmentasi Regulasi dan Ketidakpastian Hukum dalam Pengawasan Metrologi Legal," *Jurnal Ilmu Pemerintahan* 9, no. 1 (2022): 54–56.

⁶³ Vivin Novida Kusumawati, "Arrangement and Application of Copyright as an Object of Fiduciary Guarantee in Malang City," *Jurnal USM Law Review* 8, no. 1 (2025): 270–81, <https://doi.org/10.26623/julr.v8i1.11785>.

outputs legally contestable, and the entire infrastructure of public measurement oversight vulnerable to legal collapse.⁶⁴

Consequently, reforming legal certainty in metrology is not just about improving governance efficiency; it also protects the state from institutional vulnerability and legal liability. The revised legal framework must codify the authority for digital verification, define the binding status of SOPs, and guarantee the procedural rights of affected stakeholders. Only then can legal metrology evolve from a fragmented technical function into a coherent instrument of regulatory justice anchored in law, implemented through accountable institutions, and legitimized through the courts when necessary.

Beyond that, legal certainty plays a central role in constructing public trust and legal predictability, two pillars essential for any administrative function that interacts with citizens, businesses, and market actors. Without a reliable legal framework, the integrity of verification certificates, the legal effect of digital inspection outcomes, and the enforceability of supervisory sanctions will remain highly contestable.⁶⁵ Recent studies underscore that in regulatory sectors involving public services and consumer protection, unclear legal mandates and procedural ambiguity often lead to *legal opportunism*, where institutions avoid responsibility and actors exploit regulatory gaps. Such dynamics are already observable in several UML operations at the regional level, where enforcement practices vary not based on law, but on the discretion and comfort zone of local officers.⁶⁶ Inconsistent application of measurement standards not only undermines fair trade but also exposes Indonesia to reputational risks in fulfilling international metrology obligations under the OIML framework.⁶⁷

Furthermore, the legal codification of metrology oversight must recognize its cross-sectoral nature. Measurements affect not only trade but also taxation, environmental monitoring, health services, and infrastructure planning. This multi-dimensional impact means that legal certainty in metrology is foundational to broader legal coherence and good governance. Fragmentation in this field reflects larger symptoms of under-legislation and executive overreach, especially in Indonesia's decentralized regulatory landscape. Strengthening legal metrology must therefore be viewed not in isolation, but as part of a constitutional imperative to secure administrative legality (legitimacy of state actions), accountability (responsibility for regulatory decisions), and participation (access to oversight and remedy mechanisms).⁶⁸

Legal certainty also underpins digital transformation. In the absence of explicit legal rules concerning data validity, system integrity, and procedural fairness in algorithmic

⁶⁴ Thiel, "Digital Transformation of Legal Metrology – The European Metrology Cloud."

⁶⁵ Ulum, Anshori, and Widya, "Sistem Pegawai Pelayanan Tera / Tera Ulang Metrologi."

⁶⁶ Amboro and Persyadayani, "Efektivitas Pelaksanaan Pengawasan Metrologi Legal Terhadap Peningkatan Retribusi Daerah Di Kota Tanjungpinang."

⁶⁷ Ding Xiang and Cui Shan, "Digital Metrology for Digital Health," *Metrology Asia Pacific*, 2023, <https://metrologyasiapacific.com/assets/Uploads/Policy-Brief-Digital-metrology-for-digital-health.pdf>.

⁶⁸ Lestari, Vina, "Fragmentasi dan Overlapping Regulasi di Era Desentralisasi," *Jurnal Legislasi Indonesia* 19, no. 3 (2023): 122–133.

verification, the use of digital tools like SPARTA and PESTA risks becoming administratively useful but legally void. A modern metrology statute must not only mandate digital transition but legally validate the results it produces. This means ensuring evidentiary weight of digital certificates in court, recognition of e-inspections under procedural law, and legal protection for both data subjects and implementers.⁶⁹

Ultimately, legal certainty in legal metrology is inseparable from the realization of a *Rechtsstaat*, a state governed by law, not merely by administrative expediency or technical necessity. As Indonesia modernizes its regulatory functions and aligns with global standards, legal metrology must be repositioned as an instrument of public law imbued with legal enforceability, supported by judicial review, and integrated with constitutional values of fairness, legal clarity, and public accountability. It is only through such a comprehensive reconstruction that metrology can contribute meaningfully to Indonesia's aspirations for regulatory justice and administrative legitimacy.

4. CONCLUSION

This study finds that strengthening legal certainty is essential to improving supervision and outreach in Indonesia's legal metrology governance. The reliance on Law No. 2 of 1981 has become inadequate in the context of decentralization, digital transformation, and public demands for accountability. The research demonstrates that disharmony between national regulations and local implementation has led to fragmented supervision and weakened institutional coordination. The novelty of this study lies in positioning legal certainty as the operational foundation for modernizing metrological governance, offering a juridical and institutional perspective beyond technical or administrative approaches. Legal reform should prioritize revising Law No. 2 of 1981, standardizing SOPs, recognizing digital verification systems, and institutionalizing public participation. Cross-sectoral harmonization is also required to ensure consistent legal interpretation and application. Advancing legal certainty in this way will not only enhance consumer protection and fair competition but also align Indonesia's legal metrology system with international standards such as OIML and ISO/IEC. These findings contribute to national regulatory reform discourse and enrich the broader academic field of administrative law in the digital era.

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⁶⁹ Alexander Oppermann, Samuel Eickelberg, and John Exner, "Toward Digital Transformation of Processes in Legal Metrology for Weighing Instruments," *Proceedings of the 2020 Federated Conference on Computer Science and Information Systems, FedCSIS 2020 21* (2020): 559–62, <https://doi.org/10.15439/2020F77>.

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