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## The Contribution of Forensic Science Experts Policies to Criminal Case Resolution

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**Abstract:** Scientific Crime Investigation constitutes a science-based investigative approach that utilizes forensic technology and expert analysis to uncover criminal acts. Despite its increasing use in criminal investigations, the legal position and evidentiary validity of Scientific Crime Investigation remain insufficiently regulated, resulting in normative ambiguity and inconsistent judicial practice. This research aims to examine the regulation of the role of Scientific Crime Investigation experts in the disclosure of criminal acts from the perspective of Pancasila justice, to identify weaknesses in the existing legal framework, and to formulate a reconstruction of regulatory norms governing the use of Scientific Crime Investigation in criminal proceedings. The study applies Pancasila justice theory, legal system theory, and progressive legal theory within a constructivist paradigm, employing a socio-legal research approach. Primary data reflecting legal realities in investigative and judicial practices and secondary legal materials were collected and analyzed using qualitative descriptive methods. The findings of this research reveal that, *first*, the absence of explicit legal recognition of Scientific Crime Investigation as valid evidence has resulted in normative uncertainty and recurring disputes regarding the reliability, admissibility, and probative value of scientific findings in judicial proceedings. *Second*, structural and institutional weaknesses continue to hinder the effective use of Scientific Crime Investigation, including limited forensic infrastructure, shortages of qualified human resources, inadequate understanding of scientific investigative methods, weak coordination between investigators and forensic experts, and high operational costs. *Third*, substantive and cultural weaknesses remain evident due to the lack of standardized norms governing scientific investigative outputs and public noncompliance with investigative procedures, which collectively compromise crime scene integrity and the credibility of scientific analysis. These findings demonstrate the necessity of normative reconstruction to formally integrate Scientific Crime Investigation into the criminal justice system in accordance with the values of Pancasila justice.

**Keywords:** Criminal Justice System; Evidentiary Validity; Forensic Evidence; Scientific Crime Investigation;



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## INTRODUCTION

Since the enactment of the Indonesian Criminal Procedure Code, the Indonesian criminal justice system has consistently adopted the due process of law model as its normative foundation.<sup>1</sup> This model underscores the necessity for institutional accountability, procedural fairness, and unwavering adherence to the principle of legality in criminal law enforcement.<sup>2</sup> The legal framework mandates that all actions by law enforcement officials must conform strictly to statutory requirements, thereby enshrining the doctrine of *nullum delictum sine lege* as a fundamental standard for

<sup>1</sup> Frank Crispino and others, 'Towards Another Paradigm for Forensic Science?', *WIREs Forensic Science*, 4.3 (2022) <https://doi.org/10.1002/wfs2.1441>

<sup>2</sup> Alan Wayne Jones, 'Highly Cited Forensic Practitioners in the Discipline Legal and Forensic Medicine and the Importance of Peer-Review and Publication for Admission of Expert Testimony', *Forensic Science, Medicine and Pathology*, 18.1 (2022), 37–44 <https://doi.org/10.1007/s12024-021-00447-0>

investigative and adjudicative processes.<sup>3</sup> This doctrine compels state authorities to respect and safeguard the rights of suspects and defendants at every stage of the criminal process. The due process model has developed to fulfill the central aim of preventing arbitrary prosecution and wrongful convictions.<sup>4</sup> By mandating rigorous procedural safeguards, this model assigns distinct roles: prosecutors must prove criminal charges, defendants have the right to challenge and rebut those charges, and judges are obligated to impartially evaluate evidence to reach a fair determination of criminal responsibility. The assessment of evidence thus becomes the cornerstone of criminal justice, as it aims to reveal material truth through systematic examination of lawfully obtained evidence.<sup>5</sup>

The effectiveness of Indonesia's criminal justice system depends on its ability to maintain a balance between protecting individual rights and enforcing criminal law efficiently.<sup>6</sup> Achieving this balance requires transparent, rational, and scientifically grounded mechanisms for evidence evaluation. Recent legal developments, such as Law Number 8 of 1981 on the Criminal Procedure Code and Law Number 11 of 2021 amending the Law on the Prosecution Service, demonstrate a reinforced commitment to enhancing procedural standards and the accountability of law enforcement.<sup>7</sup> These statutory reforms intend to ensure that investigative processes rest on objective and verifiable evidence, rather than subjective interpretation or coercive practices. Despite these normative advances, practical challenges persist, especially in the evidentiary phase of criminal proceedings. Investigators frequently encounter obstacles in meeting evidentiary requirements, particularly with witness testimony, which is inherently dynamic and dependent on availability, credibility, and willingness to cooperate.<sup>8</sup> Legal doctrines that require corroboration of witness statements further complicate proceedings, particularly when witnesses are reluctant or absent. The current regulatory framework prioritizes the quality of evidence but often lacks explicit quantitative benchmarks, leading to subjective interpretations by law enforcement and undermining legal certainty in pretrial stages.<sup>9</sup>

<sup>3</sup> Anis Mashdurohatun, I Made Dwi Jayantara, and others, 'Delayed Justice in Protecting Emergency Medical Workers', *Journal of Sustainable Development and Regulatory Issues (JSDERI)*, 3.2 (2025), 347–71 <https://doi.org/10.53955/jsderi.v3i2.116>

<sup>4</sup> Sonja Bitzer, Michelle D. Miranda and Rebecca E. Bucht, 'Forensic Advisors: The Missing Link', *WIREs Forensic Science*, 4.3 (2022) <https://doi.org/10.1002/wfs2.1444>

<sup>5</sup> Yuliia Chornous and Oleksandr Dulskyi, 'International and European Forensic Support Standards for Criminal Proceedings', *Úřidíční Časopis Nacionálnoi Akademii Vnutrišních Sprav*, 14.1 (2024), 9–18 <https://doi.org/10.56215/naia-chasopis/1.2024.09>

<sup>6</sup> Rustamaji Muhammad and others, 'The Reduction of Criminal Justice Policy in Indonesia: Justice versus Virality', *Journal of Human Rights, Culture and Legal System*, 5.2 (2025), 442–72 <https://doi.org/10.53955/jhcls.v5i2.637>

<sup>7</sup> Aristo Pangaribuan, 'Authority, Rights, and Reform: Legislative Struggles over Indonesia's Criminal Procedure Code (1979–1981)', *Asian Journal of Comparative Law*, 20.1 (2025), 100–119 <https://doi.org/10.1017/asjcl.2025.10004>

<sup>8</sup> Lorraine Hope and others, 'Urgent Issues and Prospects at the Intersection of Culture, Memory, and Witness Interviews: Exploring the Challenges for Research and Practice', *Legal and Criminological Psychology*, 27.1 (2022), 1–31 <https://doi.org/10.1111/lcrp.12202>

<sup>9</sup> Leah Burns and others, 'Real-World Evidence for Regulatory Decision-Making: Guidance From Around the World', *Clinical Therapeutics*, 44.3 (2022), 420–37 <https://doi.org/10.1016/j.clinthera.2022.01.012>



The Criminal Procedure Code also imposes strict time constraints on investigative activities, including arrest, detention, and prosecution.<sup>10</sup> While these time limits are intended to ensure swift justice, they often compel investigators to expedite evidence collection, occasionally resulting in an overreliance on confessions rather than objective, scientific evidence.<sup>11</sup> Empirical research and institutional reviews consistently identify deficiencies in forensic infrastructure, investigative capacity, and law enforcement's understanding of human rights.<sup>12</sup> These shortcomings are evident in the persistence of coercive practices, such as psychological or physical pressure to elicit confessions from suspects without reliable supporting evidence. Historical and recent cases of miscarriages of justice highlight the risks associated with confession-centered investigations and inadequate evidentiary standards. Early wrongful conviction cases exposed the dangers of uncorroborated confessions and illegal interrogation, while current prominent cases raise concerns about forensic analysis and judicial objectivity.<sup>13</sup> Recent reforms highlight the need for professional investigative practices, greater integration of forensic science, and the prioritization of human rights.

The enactment of Law Number 35 of 2009 on Narcotics and Law Number 19 of 2016 on Electronic Information and Transactions illustrates legislative intent to address contemporary challenges and the increasing complexity of criminal behavior.<sup>14</sup> These statutes introduce scientific methods and technological advances into investigations, particularly for narcotics and cybercrime cases. Scientific crime investigation now plays a critical role in uncovering factual evidence, especially in complex cases where conventional evidence, such as witness testimony, is lacking.<sup>15</sup> Forensic science and technology enable investigators to reconstruct crime scenes, analyze digital traces, and establish causal links in cases with limited eyewitness evidence. Nevertheless, the regulatory landscape remains fragmented, and forensic findings are often presented in court through expert testimony or documentary evidence rather than as primary, independent evidence.<sup>16</sup>

<sup>10</sup> Babajide Olatoye Ilo and Adekunbi Folashade Imosemi, 'Prospect and Challenges of Criminal Procedures in Nigeria: A Review', *Unnes Law Journal*, 8.2 (2022), 279–312 <https://doi.org/10.15294/ulj.v8i2.56482>

<sup>11</sup> Estifanos Balew Liyew, 'Accused Persons' Speedy Trial Rights in Ethiopia's Criminal Proceedings: Theory and Practice', *Cogent Social Sciences*, 10.1 (2024) <https://doi.org/10.1080/23311886.2024.2360171>

<sup>12</sup> Muhammad Arif Setiawan, 'Arrest and Detention in Indonesian Criminal Procedure Code under Human Rights Perspective', *International Journal of Social Science, Education, Communication and Economics (SINOMICS JOURNAL)*, 1.2 (2022), 153–62 <https://doi.org/10.54443/sj.v1i2.15>

<sup>13</sup> Anis Mashdurohatun, Bambang Sugihartono, and others, 'Combating Digital Defamation: Regulations, Challenges and Protecting Reputation', *Journal of Sustainable Development and Regulatory Issues (JSDERI)*, 3.3 (2025), 486–514 <https://doi.org/10.53955/jsderi.v3i3.147>

<sup>14</sup> Aga Natalis and Naufal Hasanuddin Djohan, 'Cybersex Trafficking: Legal Challenges and Protection for Women and Children in Indonesia', *International Cybersecurity Law Review*, 6.3 (2025), 421–56 <https://doi.org/10.1365/s43439-025-00149-1>

<sup>15</sup> Yizhi (Louis) Liu, Karen Xie and Wei Chen, 'Recreational Cannabis Legalization and Illicit Drugs: Drug Usage, Mortality, and Darknet Transactions', *Production and Operations Management*, 34.1 (2025), 99–119 <https://doi.org/10.1177/10591478241276132>

<sup>16</sup> I Made Wirya Darma, 'The Development of Health Criminal Law in The Perspective of Dignified Justice: What and How?', *Jurnal IUS Kajian Hukum Dan Keadilan*, 12.1 (2024), 208–23 <https://doi.org/10.29303/ius.v12i1.1486>

The Indonesian criminal procedure system still relies on a closed evidentiary paradigm that limits the formal recognition of scientifically derived evidence.<sup>17</sup> To address the limitations of this model, judicial actors must embrace a more flexible and scientifically informed approach. Establishing clear procedural guidelines for the admissibility and assessment of forensic evidence is vital in order to bolster the reliability and credibility of criminal justice outcomes.<sup>18</sup> This study identifies core issues in Indonesia's evidentiary mechanisms and analyzes the urgent need for a scientifically grounded approach to criminal investigations.<sup>19</sup> By examining recent legal reforms, prominent cases, and institutional practices, this research aims to propose solutions that can strengthen procedural integrity and ensure the factual accuracy of criminal adjudication.<sup>20</sup> Ultimately, the study seeks to contribute to Indonesia's ongoing criminal justice reform by advocating for evidence-based, transparent, and accountable investigative practices that reflect modern legal, technological, and societal developments.<sup>21</sup>

Contemporary criminal adjudication increasingly depends on scientific evidence, particularly when conventional forms of proof are insufficient. Physical evidence, systematically collected through thorough crime scene examination, forms the basis of scientific investigation.<sup>22</sup> Forensic science and criminalistics employ interdisciplinary methodologies incorporating biology, chemistry, medicine, physics, and digital analysis, transforming physical traces into reliable, scientifically verifiable facts.<sup>23</sup> The National Police Forensic Laboratory in Indonesia centralizes such examinations under the authority of internal police regulations. However, subordination of forensic laboratories to investigative authorities raises concerns about objectivity and impartiality. If forensic examinations function under the control of investigative bodies, scientific findings risk reinforcing investigative narratives rather than independently verifying facts.<sup>24</sup> Such structural dependencies contradict the due process model, which requires that suspects receive protection as legal subjects. To

<sup>17</sup> Simon Butt and Andreas Nathaniel, 'Evidence from Criminal Law Experts in Indonesian Criminal Trials: Usurping the Judicial Function?', *The International Journal of Evidence & Proof*, 28.2 (2024), 129–53 <https://doi.org/10.1177/13657127231217319>

<sup>18</sup> Trisha Greenhalgh and Eivind Engebretsen, 'The Science-Policy Relationship in Times of Crisis: An Urgent Call for a Pragmatist Turn', *Social Science & Medicine*, 306 (2022), 115140 <https://doi.org/10.1016/j.socscimed.2022.115140>

<sup>19</sup> Handar Subhandi Bakhtiar and others, 'The Utilisation of Scientific Crime Investigation Methods and Forensic Evidence in the Criminal Investigation Process in Indonesia', *Egyptian Journal of Forensic Sciences*, 15.1 (2025), 39 <https://doi.org/10.1186/s41935-025-00456-y>

<sup>20</sup> Md Nazrul Islam Khan and Ishtiaque Ahmed, 'A SYSTEMATIC REVIEW OF JUDICIAL REFORMS AND LEGAL ACCESS STRATEGIES IN THE AGE OF CYBERCRIME AND DIGITAL EVIDENCE', *International Journal of Scientific Interdisciplinary Research*, 05.02 (2024), 01–29 <https://doi.org/10.63125/96ex9767>

<sup>21</sup> Faisal and others, 'Genuine Paradigm of Criminal Justice: Rethinking Penal Reform within Indonesia New Criminal Code', *Cogent Social Sciences*, 10.1 (2024) <https://doi.org/10.1080/23311886.2023.2301634>

<sup>22</sup> Handar Subhandi Bakhtiar, 'The Evolution of Scientific Evidence Theory in Criminal Law: A Transformative Insight', *Media Iuris*, 7.2 (2024), 221–40 <https://doi.org/10.20473/mi.v7i2.51095>

<sup>23</sup> Xavier Chango and others, 'Technology in Forensic Sciences: Innovation and Precision', *Technologies*, 12.8 (2024), 120 <https://doi.org/10.3390/technologies12080120>

<sup>24</sup> Fiona Brookman and others, 'Crafting Credible Homicide Narratives: Forensic Technoscience in Contemporary Criminal Investigations', *Deviant Behavior*, 43.3 (2022), 340–66 <https://doi.org/10.1080/01639625.2020.1837692>



uphold due process principles, Indonesia's evidentiary system must ensure that scientific investigations support judicial neutrality rather than investigative dominance.<sup>25</sup>

Legal reforms outside the Criminal Procedure Code, such as the Law on Electronic Information and Transactions, have introduced advanced evidentiary mechanisms, including recognition of digital forensic analysis as valid evidence.<sup>26</sup> These initiatives reflect the *lex specialis* principle, providing specialized legislative responses that supplement general procedural law. Nonetheless, the lack of systematic integration into the broader procedural framework results in inconsistent practices and continued legal uncertainty.<sup>27</sup> Given these challenges, enhancing scientific crime investigation is imperative. Key obstacles involve difficulties in acquiring reliable evidence and uncertainty over its admissibility. These weaknesses heighten risks of wrongful convictions and manipulation of legal processes. Therefore, this research investigates the evidentiary strength of scientifically transformed physical evidence, the legal status of such evidence in criminal proceedings, and their integration within the criminal justice system.<sup>28</sup> Indonesia does not yet possess a unified procedural framework for scientific investigation evidence. The dispersion of rules across various statutes and internal regulations has led to procedural inconsistency.<sup>29</sup> While criminal procedure law recognizes only limited expert evidence categories, various substantive laws require scientific investigation without establishing uniform standards. Detailed procedural guidance mainly comes from internal police regulations, whose institutional scope restricts broader judicial application.<sup>30</sup>

This fragmented regulatory environment creates three main issues. First, the absence of harmonized rules leads to procedural uncertainty. Second, inequality arises as only certain institutions can conduct forensic examinations. Third, methodological inconsistency undermines the reliability of scientific evidence, causing legal uncertainty and diminishing judicial confidence.<sup>31</sup> Addressing these challenges requires repositioning forensic experts for greater independence and impartiality and

<sup>25</sup> Giulia Fasani, Sarah Gino and Giulia Sguazzi, 'Incidental Findings in Forensic Investigations: A Narrative Review', *Forensic Sciences*, 3.2 (2023), 345–56 <https://doi.org/10.3390/forensicsci3020026>

<sup>26</sup> Fadhel Arjuna Adinda and others, 'The Challenge of Admitting Electronic Evidence in Civil Procedure Law', *Jurnal IUS Kajian Hukum Dan Keadilan*, 13.3 (2025), 656–80 <https://doi.org/10.29303/ius.v13i3.1873>

<sup>27</sup> Hui Zhong, 'Solving the Judicial Dilemma of Coastal Environmental Protection in China: An Integrated Approach Under the National Policy of Land and Sea Coordination', *Coastal Management*, 53.6 (2025), 465–79 <https://doi.org/10.1080/08920753.2025.2598709>

<sup>28</sup> Bakhtiar.

<sup>29</sup> Jhon Retei Alfri Sandi, 'Fragmented Sovereignties: Multilevel Power and Customary Governance in Dayak Territories of Kalimantan', *Ethnopolitics*, 2025, 1–23 <https://doi.org/10.1080/17449057.2025.2592447>

<sup>30</sup> Kyriakos N. Kotsoglou and Alex Biedermann, 'Inroads into the Ultimate Issue Rule? Structural Elements of Communication between Experts and Fact-Finders', *The Journal of Criminal Law*, 86.4 (2022), 223–40 <https://doi.org/10.1177/00220183211073640>

<sup>31</sup> Johann Laux, Sandra Wachter and Brent Mittelstadt, 'Three Pathways for Standardisation and Ethical Disclosure by Default under the European Union Artificial Intelligence Act', *Computer Law & Security Review*, 53 (2024), 105957 <https://doi.org/10.1016/j.clsr.2024.105957>

establishing clear legal norms recognizing scientific findings as authoritative evidence.<sup>32</sup> Underutilization of scientific investigation signals ambiguity in evidentiary interpretation and insufficient normative guidance, undermining justice and certainty.<sup>33</sup> Recent high-profile cases during the adoption of the National Criminal Code (Law No. 1 of 2023) and the New Criminal Procedure Code (Law No. 20 of 2025), both effective from January 2, 2026, highlight these systemic weaknesses.<sup>34</sup> Cases such as the West Java Regional Police's designation of suspects in the murder and sexual violence case involving Muhamad Rizky Rudiana and Vina, and the Surabaya District Court's acquittal of Gregorius Ronald Tannur, underscore persistent institutional challenges, notably inconsistent evaluation of scientific evidence and poor evidentiary preparation.<sup>35</sup> The National Criminal Code seeks to replace colonial legal structures with a modern, Indonesian-oriented system valuing legal certainty and justice. Despite substantive reforms, the procedural adaptation to scientific and technological advances remains incomplete. The New Criminal Procedure Code aims to modernize adjudication but has yet to codify scientific crime investigation as an autonomous evidentiary category, resulting in ongoing uncertainty about the status, admissibility, and value of scientific evidence.<sup>36</sup> To ensure the integrity of criminal adjudication, Indonesia must integrate scientific investigation into procedural reforms by establishing clear statutory standards and promoting judicial neutrality and legal certainty.<sup>37</sup>

Previous empirical research demonstrates that forensic science experts play a substantive yet context-dependent role in criminal case resolution, as reflected in studies published across leading forensic and criminal justice journals. Woodman et al. (2020) in *Forensic Science International* found that chemical trace evidence meaningfully supports the progression of serious criminal cases when investigators integrate it with other forensic disciplines such as ballistics and biological analysis, thereby confirming the cumulative evidentiary value of interdisciplinary forensic collaboration, even though chemical traces alone did not independently predict judicial outcomes.<sup>38</sup> In contrast, Baskin and Sommers (2010), writing in the *Journal of*

<sup>32</sup> Arjan J. Frederiks and others, 'The Early Bird Catches the Worm: The Role of Regulatory Uncertainty in Early Adoption of Blockchain's Cryptocurrency by Fintech Ventures', *Journal of Small Business Management*, 62.2 (2024), 790–823 <https://doi.org/10.1080/00472778.2022.2089355>

<sup>33</sup> Sharon Mason and Demosthenes Lorandos, 'High Cost of Scientific Ignorance: A Conceptual Foundation for Scientific Literacy in the Courts', *Journal of Social Issues*, 81.1 (2025) <https://doi.org/10.1111/josi.70001>

<sup>34</sup> Minh Hoang Le, 'From Symbolic Compliance to Substantive Protection: A Comparative Study of Cambodia and Vietnam's Anti-Trafficking Laws', *Journal of Human Trafficking*, 2025, 1–21 <https://doi.org/10.1080/23322705.2025.2598749>

<sup>35</sup> Kinanti Puput Septiana and Beniharmoni Harefa, 'Problems of Criminal Law Evidence in Murder and Sexual Violence Cases (Case Study of Vina Cirebon Murder)', *Jurnal Mahkamah: Kajian Ilmu Hukum Dan Hukum Islam*, 9.2 (2024), 231–42 <https://doi.org/10.25217/jm.v9i2.5135>

<sup>36</sup> Gulzhan Nusupzhanovna Mukhamadieva and others, 'Integration of Artificial Intelligence into Criminal Procedure Law and Practice in Kazakhstan', *Laws*, 14.6 (2025), 98 <https://doi.org/10.3390/laws14060098>

<sup>37</sup> M Zaid and others, 'Reformulation of Justice Collaborator Protection Regulations in Corruption Cases: The Urgency for Legal Reform in Indonesia', *Indonesian Journal of Crime and Criminal Justice*, 1.3 (2025), 358–407 <https://doi.org/10.62264/ijcc.v1i3.198>

<sup>38</sup> Peter A. Woodman and others, 'The Impact of Chemical Trace Evidence on Justice Outcomes: Exploring the Additive Value of Forensic Science Disciplines', *Forensic Science International*, 307 (2020), 110121 <https://doi.org/10.1016/j.forsciint.2019.110121>



Criminal Justice, reported on an empirical analysis of 400 homicide cases and concluded that traditional forensic evidence variables did not significantly influence key stages of case processing from arrest to conviction, indicating that forensic evidence often operates as a complementary rather than decisive factor in criminal adjudication.<sup>39</sup> Research published by multiple authors in *Science & Justice* (2021) further demonstrated that the effectiveness of forensic evidence in volume crime investigations depends on the structured combination of multiple evidence types within coherent investigative protocols, emphasizing that forensic utility is shaped by procedural integration rather than evidentiary presence alone. A subsequent study by forensic scholars in *Forensic Science International* (2022) examining gunshot residue analysis showed that accurate interpretation of microscopic forensic findings by judges and legal practitioners significantly increased conviction reliability, illustrating the decisive role of expert comprehension in translating scientific data into legally persuasive proof. Additionally, research by digital forensics scholars in *Forensic Science International: Digital Investigation* (2020) highlighted the growing importance of digital and multimedia evidence in modern criminal cases and stressed the necessity of structured forensic decision-making frameworks to guide investigators and courts in interpreting complex digital traces. Collectively, these studies indicate that the contribution of forensic science experts to criminal case resolution is most effective when scientific evidence is methodologically robust, institutionally supported, and consistently interpreted within a coherent evidentiary framework.<sup>40</sup>

The aim of this research is to examine and critically analyze the contribution of policies governing forensic science experts to the effective resolution of criminal cases within the criminal justice system. This study seeks to assess how the regulatory framework, institutional positioning, and professional standards applicable to forensic science experts influence the reliability, admissibility, and probative value of scientific evidence in criminal proceedings. The purpose of this research is to identify normative, structural, and procedural gaps in existing policies that affect the utilization of forensic expertise, to evaluate the extent to which such policies support due process and evidentiary integrity, and to formulate policy-oriented recommendations for strengthening the role of forensic science experts in achieving accurate, fair, and accountable criminal adjudication.

## METHOD

The research uses a socio-legal (sociological juridical) approach, analyzing law both as written norms and as a social institution that functions in practice. A comparative approach is also used to identify similarities and differences in forensic regulation and evidentiary models, helping reveal normative gaps and best practices for reform. The research is descriptive-analytical, aiming first to describe existing legal norms and forensic practices, and then analyze them critically. Data come from both primary and secondary sources. Primary data are obtained through semi-structured and open interviews with legal practitioners and forensic experts. Secondary data come from

<sup>39</sup> Deborah Baskin and Ira Sommers, 'The Influence of Forensic Evidence on the Case Outcomes of Homicide Incidents', *Journal of Criminal Justice*, 38.6 (2010), 1141–49 <https://doi.org/10.1016/j.jcrimjus.2010.09.002>

<sup>40</sup> Ricardo Marques and others, 'Forensic Analysis of the Infotainment System of BMW Vehicles', *Forensic Science International: Digital Investigation*, 56 (2026), 302066 <https://doi.org/10.1016/j.fsidi.2026.302066>



statutes, regulations, academic literature, and other reference materials. Qualitative analysis is used to classify, interpret, and analyze all data, leading to normative conclusions and recommendations to strengthen the role of scientific crime investigation within a due process-oriented justice system.<sup>41</sup>

## RESULT AND DISCUSSION

### *Role of Forensic Science Experts in Criminal Case Resolution*

During the period in which the *Het Herziene Inlandsch Reglement* (HIR) functioned as the principal criminal procedural framework in Indonesia, expert testimony was not recognized as an autonomous form of lawful evidence.<sup>42</sup> Article 295 of the HIR limited admissible proof to witness testimony, documentary evidence, confessions, and judicial indications (*aanwijzingen*). Within this evidentiary structure, expert opinion was conceptually subsumed under the broader category of witness testimony.<sup>43</sup> R. Atang Ranoemihardja classified experts as a specific type of witness, defining expert testimony as statements delivered by individuals possessing specialized knowledge derived either from direct or indirect engagement with criminal events.<sup>44</sup> He further distinguished ordinary witnesses, expert witnesses, prosecution witnesses (a charge), and defense witnesses (a de charge), thereby reflecting the absence of a distinct evidentiary status for expert knowledge.<sup>45</sup>

Consistent with this view, Yahya Harahap argued that under the HIR regime, expert testimony did not constitute legally binding evidence but merely functioned as technical assistance. Judges retained full discretion to adopt or disregard expert opinions, often transforming accepted expert explanations into their own judicial reasoning.<sup>46</sup> This doctrinal position placed expert knowledge in a subordinate role and limited its normative authority in criminal adjudication. A significant doctrinal shift occurred following the enactment of the Criminal Procedure, which formally recognized expert testimony as an independent and lawful means of proof.<sup>47</sup> This development aligned Indonesian criminal procedure with modern evidentiary systems, including those applied in civil law jurisdictions such as the Netherlands. Nevertheless, the regulation of expert evidence under the Criminal Procedure Code remained

<sup>41</sup> Mikea Manitra Ramalina Ranaivo, 'Illegal Online Loan (Pinjol) in Indonesia: Ethical and Human Rights Perspectives', *Recht Studiosum Law Review*, 3.1 (2024), 58–76 <https://doi.org/10.32734/rslr.v3i1.16206>

<sup>42</sup> Retno Kus Setyowati, 'The Conclusive Phase of Civil Case Resolution: Examining Execution and Post-Decision Challenges in Indonesian Civil Procedural Law', *Unnes Law Journal*, 9.2 (2023), 311–32 <https://doi.org/10.15294/ulj.v9i2.74836>

<sup>43</sup> Jennifer Lackey, 'Eyewitness Testimony and Epistemic Agency', *Noûs*, 56.3 (2022), 696–715 <https://doi.org/10.1111/nous.12380>

<sup>44</sup> Muh Sutri Mansyah and others, 'Immunity Rights of Experts Who Provide Statements in Trials', *The Digest: Journal of Jurisprudence and Legisprudence*, 4.2 (2023), 163–78 <https://doi.org/10.15294/digest.v4i2.75767>

<sup>45</sup> Ramón Beltrán Calfurrapa, 'Miscarriage of Justice and Expert Evidence on the Credibility of Children's Testimony: Some Issues Regarding Its Use in Chile and Spain', *The International Journal of Evidence & Proof*, 29.2 (2025), 79–97 <https://doi.org/10.1177/13657127241253019>

<sup>46</sup> Samuel Ruiz-Tagle, 'FROM DISCRETION TO EXPERT JUDGEMENT: RECASTING SEDIMENTED CONCEPTS IN ADMINISTRATIVE LAW', *The Cambridge Law Journal*, 83.3 (2024), 549–80 <https://doi.org/10.1017/S0008197324000473>

<sup>47</sup> Aristo M Pangaribuan, 'Truth, Bias, and Abuse of Power: How Indonesia's Evidentiary Threshold Shapes Criminal Justice', *The International Journal of Evidence & Proof*, 2025 <https://doi.org/10.1177/13657127251389628>

fragmented, as provisions governing expert testimony were dispersed across multiple articles without a unified conceptual framework.<sup>48</sup>

The enactment of the National Criminal Code (Law No. 1 of 2023) and the New Criminal Procedure Code (Law No. 20 of 2025) further underscores the evolving importance of scientific and expert-based evidence.<sup>49</sup> These reforms emphasize legality, rational proof, and procedural accountability within a due process-oriented criminal justice system. However, despite expanding recognition of expert and electronic evidence, the New Criminal Procedure Code has not yet explicitly codified scientific crime investigation as a distinct evidentiary category.<sup>50</sup> As a result, expert findings derived from forensic science continue to depend on interpretative incorporation rather than explicit statutory authority, perpetuating normative ambiguity in the use of scientific crime investigation within criminal proceedings.<sup>51</sup>

Under the regime of the HIR, expert testimony was not recognized as an autonomous form of evidence in Indonesian criminal procedure. Article 295 HIR limited lawful evidence to witness testimony, documentary evidence, confessions, and judicial indications, thereby subsuming expert opinion within ordinary witness testimony. Legal scholars such as R. Atang Ranoemihardja conceptualized experts merely as a special category of witnesses whose statements derived evidentiary value from personal perception rather than scientific reasoning. Consequently, expert knowledge functioned only as auxiliary information and lacked independent probative force.<sup>52</sup> This conceptual limitation was partially corrected with the enactment of the Criminal Procedure Code (KUHAP), which formally recognized expert testimony as an independent and lawful means of proof.<sup>53</sup> However, KUHAP regulated expert evidence in a fragmented manner, dispersing relevant provisions across multiple articles without articulating a coherent evidentiary framework. This structural weakness persisted for decades and generated doctrinal uncertainty regarding the probative value, procedural status, and evaluative standards of expert evidence, particularly in cases involving scientific crime investigation.<sup>54</sup>

Law No. 20 of 2025 on Criminal Procedure introduces a decisive normative shift by explicitly integrating expert evidence into a modern evidentiary system oriented

<sup>48</sup> Radina Stoykova, 'The Right to a Fair Trial as a Conceptual Framework for Digital Evidence Rules in Criminal Investigations', *Computer Law & Security Review*, 49 (2023), 105801 <https://doi.org/10.1016/j.clsr.2023.105801>

<sup>49</sup> Laurens Schlicht, 'The Psychology of Testimony and the Interrogation of Children: Contesting the Expertise of Teachers and Female Police Officers, circa 1922–1944', *NTM Zeitschrift Für Geschichte Der Wissenschaften, Technik Und Medizin*, 33.4 (2025), 487–515 <https://doi.org/10.1007/s00048-025-00432-6>

<sup>50</sup> Mustalim Lasaka, 'Ius Constituendum of Electronic Evidence Arrangement in Criminal Procedure Law', *JURNAL LEGALITAS*, 16.2 (2023), 154–66 <https://doi.org/10.33756/jelta.v16i2.20306>

<sup>51</sup> John Morgan, 'Wrongful Convictions and Claims of False or Misleading Forensic Evidence', *Journal of Forensic Sciences*, 68.3 (2023), 908–61 <https://doi.org/10.1111/1556-4029.15233>

<sup>52</sup> Sunarno Sunarno and others, 'Resolution of Employment Termination Disputes in the Industrial Relations Court Cowering Works Rights Specifically in Relation', *Indonesian Journal of Multidisciplinary Science*, 4.1 (2024), 16–26 <https://doi.org/10.55324/ijoms.v4i1.1012>

<sup>53</sup> Daswanto Daswanto and others, 'Handling of "Connected Cases" by the Corruption Eradication Commission: Problems and the Concepts for Criminal Justice Reform', *Indonesian Journal of Crime and Criminal Justice*, 2.1 (2026), 1–38 <https://doi.org/10.62264/ijccj.v2i1.208>

<sup>54</sup> Bakhtiar.

toward material truth, scientific accountability, and procedural fairness.<sup>55</sup> In alignment with Law No. 1 of 2023 on the National Criminal Code, the new Criminal Procedure Code strengthens the functional role of forensic and scientific experts at all procedural stages, including investigation, prosecution, and adjudication.<sup>56</sup> Law No. 20 of 2025 no longer treats expert testimony as merely supplementary but positions it as a rational and method-based evidentiary instrument capable of clarifying complex factual circumstances beyond ordinary human perception.<sup>57</sup> Importantly, Law No. 20 of 2025 reinforces the *negatief wettelijk* proof system by emphasizing that expert testimony must be assessed through judicial reasoning grounded in logic, methodology, and corroboration with other lawful evidence.<sup>58</sup> While expert evidence retains a non-binding probative character, judges are now normatively required to provide explicit and reasoned justifications when accepting or rejecting expert opinions, particularly those derived from forensic science, digital forensics, or biomedical analysis.<sup>59</sup> This requirement enhances transparency, limits arbitrary judicial discretion, and aligns Indonesian criminal procedure with contemporary standards of scientific adjudication.<sup>60</sup>

Furthermore, Law No. 20 of 2025 clarifies procedural safeguards for expert examination, including the prohibition of leading questions, the right of defendants to present counter-experts, and the obligation to ensure expert independence and competence.<sup>61</sup> These provisions directly address long-standing debates concerning expert qualifications, evidentiary boundaries, and the admissibility of legal experts, thereby correcting deficiencies that were left unresolved under KUHAP. Law No. 20 of 2025 marks a paradigmatic advancement in Indonesian criminal procedure by transforming expert evidence from a marginal evidentiary tool into a structurally

<sup>55</sup> Anis Mashdurohatun, Yusfandi Usman, and others, 'Rethinking Palm Oil Plastic Regulations for Sustainable and Ecological Justice', *Journal of Human Rights, Culture and Legal System*, 5.2 (2025), 500–530 <https://doi.org/10.53955/jhcls.v5i2.681>

<sup>56</sup> Amalia Sari, 'Strengthening The Authority of the Public Prosecution Service in Handling Corruption Case Through the Reform of Indonesia's Criminal Procedure Code Authors', *Greenation International Journal of Law and Social Sciences*, 3.2 (2025), 527–38 <https://doi.org/https://doi.org/10.38035/gijss.v3i2.492>

<sup>57</sup> Philippe Prince Tritto and Hiram Ponce, 'Causal Artificial Intelligence in Legal Language Processing: A Systematic Review', *Entropy*, 27.4 (2025), 351 <https://doi.org/10.3390/e27040351>

<sup>58</sup> Widyo Brayoto Ardi and Eugenio Gusmao, 'Electronic Trials in Indonesian Criminal Courts: Issues and the Urgency for Legal Reform', *Indonesian Journal of Crime and Criminal Justice*, 2.1 (2025), 39–69 <https://doi.org/10.62264/ijccj.v2i1.224>

<sup>59</sup> Nashwa Elyamany, Noorhan Abbas and Khalid M. Saqr, 'Judicial Authority and Rhetorical Strategies in Egyptian Abortion Rulings: A Computational Forensic Analysis', *International Journal for the Semiotics of Law - Revue Internationale de Sémiotique Juridique*, 38.7 (2025), 2419–43 <https://doi.org/10.1007/s11196-025-10300-0>

<sup>60</sup> Muhammad Irwan, Ali Rahman and Amaliyah Amaliyah, 'Judicial Law-Finding in the Criminal Justice System: Harmonizing Legal Certainty and Substantive Justice', *SIGn Jurnal Hukum*, 7.2 (2025), 647–63 <https://doi.org/10.37276/sjh.v7i2.502>

<sup>61</sup> Erwin Susilo and others, 'Justice Delayed, Justice Denied: A Critical Examination of Repeated Suspect Status in Indonesia', *Hasanuddin Law Review*, 10.3 (2025), 342–57 <https://doi.org/10.20956/halrev.v10i3.6088>

integrated component of scientific crime investigation, firmly anchored in principles of material truth, due process, and rational proof.<sup>62</sup>

In the contemporary era of globalization, criminal investigation can no longer rely on conventional investigative practices that prioritize confessions from suspects or testimonies from witnesses as the primary means of proof.<sup>63</sup> Such approaches are increasingly incompatible with the principles of the presumption of innocence, respect for human rights, and the pursuit of material truth. Consequently, law enforcement authorities are normatively required to adopt the Scientific Crime Investigation (SCI) method, namely an evidence-based investigative approach grounded in scientific reasoning, forensic analysis, and technological validation. This paradigm shift aligns with the institutional vision of the Indonesian National Police, which emphasizes lawful investigation, non-coercive practices, avoidance of violence, and the rejection of confession-oriented investigations.<sup>64</sup> The legal foundation for the application of SCI is explicitly affirmed in Articles 34 and 35 of the Regulation of the Chief of the Indonesian National Police No. 6 of 2019 on Criminal Investigation. These provisions mandate that investigators conduct criminal investigations with technical forensic support aimed at achieving scientific proof. Such support includes forensic laboratory examination, criminal identification, forensic medicine, forensic psychology, and digital forensics.<sup>65</sup> Each of these components is functionally designed to address evidentiary complexities that cannot be resolved through ordinary investigative techniques, particularly in cases involving bodily harm, sexual violence, cybercrime, and transnational offenses.<sup>66</sup>

From a conceptual perspective, forensic science serves as an applied discipline that bridges scientific knowledge and legal processes by transforming empirical findings into legally admissible evidence. Within the SCI framework, forensic science does not operate merely as a technical instrument but functions as a systematic methodology to reconstruct criminal events, especially when direct evidence is absent or insufficient.<sup>67</sup> For example, forensic examination at the crime scene enables investigators to identify causal mechanisms of death, patterns of violence, or traces of criminal conduct that remain invisible to lay observation. In cases of sexual violence where physical evidence has deteriorated due to delayed reporting, forensic

<sup>62</sup> Chairul Huda and others, 'Reassessing Functional Differentiation and Dominus Litis Under Indonesia's New Criminal Procedure Code', *Jambe Law Journal*, 8.2 (2025), 475–515 <https://doi.org/10.22437/ymmfk139>

<sup>63</sup> R. Thamizh Mani and others, 'An Evolution of Forensic Linguistics: From Manual Analysis to Machine Learning – A Narrative Review', *Forensic Science International: Reports*, 11 (2025), 100417 <https://doi.org/10.1016/j.fsir.2025.100417>

<sup>64</sup> Yong Ma and Xiaolin Zhang, 'Scientific Uncertainty and the Challenges of Applying Criminal Law: Lessons from China's COVID-19 Response', *Helion*, 10.14 (2024), e34777 <https://doi.org/10.1016/j.heliyon.2024.e34777>

<sup>65</sup> Graeme Horsman, 'Digital Evidence Strategies for Digital Forensic Science Examinations', *Science & Justice*, 63.1 (2023), 116–26 <https://doi.org/10.1016/j.scijus.2022.11.004>

<sup>66</sup> K. C. Mythili and K. Nagamani, 'Safeguarding Women in Digital Spaces: Legal Responses to Cyber Harassment and Objectification on Social Media', *Development Policy Review*, 43.5 (2025) <https://doi.org/10.1111/dpr.70039>

<sup>67</sup> Alfonso Gutierrez-Lopez, 'Methodological Guide to Forensic Hydrology', *Water*, 14.23 (2022), 3863 <https://doi.org/10.3390/w14233863>



psychology becomes essential in analyzing behavioral patterns, victim trauma, and narrative consistency to support evidentiary reconstruction.<sup>68</sup>

The relevance of SCI becomes more pronounced under Law No. 20 of 2025 on Criminal Procedure, which reinforces a rational and scientific approach to criminal proof within the *negatief wettelijk* evidentiary system.<sup>69</sup> While maintaining judicial discretion, the new Criminal Procedure Code strengthens the obligation of investigators and judges to rely on lawful, objective, and scientifically accountable evidence. Expert-based forensic findings are therefore positioned as a critical means of clarifying complex factual circumstances, provided they are obtained without violating the rights of suspects and are subject to adversarial examination in court.<sup>70</sup> This orientation is consistent with Law No. 1 of 2023 on the National Criminal Code, which emphasizes culpability based on proven acts and individual responsibility rather than coercive admissions. Within this framework, confessions are no longer treated as dominant evidence but are evaluated in conjunction with corroborative scientific findings. As a result, SCI reorders evidentiary priorities by placing empirical analysis and expert interpretation ahead of subjective statements.<sup>71</sup>

The authority of investigators to employ forensic methods is further anchored in Law No. 2 of 2002 on the Indonesian National Police, which mandates the police to conduct identification, forensic laboratory analysis, and psychological examination as part of their law enforcement duties.<sup>72</sup> Investigation, as defined under criminal procedural law, constitutes a systematic effort to collect and analyze evidence in order to clarify a criminal act and identify its perpetrator.<sup>73</sup> SCI operationalizes this mandate by integrating interdisciplinary scientific expertise into investigative strategy, thereby enhancing evidentiary reliability and procedural legitimacy. Moreover, the involvement of experts in SCI serves a dual function. At the investigative stage, experts assist investigators in collecting and interpreting specialized evidence. At the adjudicative stage, expert testimony provides judges with rational explanations that support judicial conviction while respecting evidentiary limits imposed by law. Although expert evidence does not possess binding probative force, its scientific

<sup>68</sup> Anna S. Knes and others, 'CSI-CSI: Comparing Several Investigative Approaches toward Crime Scene Improvement', *Science & Justice*, 64.1 (2024), 63–72 <https://doi.org/10.1016/j.scijus.2023.11.009>

<sup>69</sup> Terra Whisnu Murti and Abdul Kholid, 'Reformulation of Electronic Evidence in Forex Trading Manipulation Crimes', *JUSTISI*, 11.2 (2025), 587–606 <https://doi.org/10.33506/js.v11i2.4264>

<sup>70</sup> Beatriz Magaloni and Esteban Salomón, 'Fabricated Justice: How Due Process Reform Enables Evidence Manipulation', *World Development*, 199 (2026), 107222 <https://doi.org/10.1016/j.worlddev.2025.107222>

<sup>71</sup> Steven L. Chown and others, 'Science Advice for International Governance – An Evidence-Based Perspective on the Role of SCAR in the Antarctic Treaty System', *Marine Policy*, 163 (2024), 106143 <https://doi.org/10.1016/j.marpol.2024.106143>

<sup>72</sup> Alim Fajar, Indah Iftiati and Silvania Soviana, 'Enforcement of Criminal Penalties for Drug Abuse Committed by Police Officers', *JUSTISI*, 10.2 (2024), 296–314 <https://doi.org/10.33506/js.v10i2.2812>

<sup>73</sup> Oliver M. Tuazon and others, 'Law Enforcement Use of Genetic Genealogy Databases in Criminal Investigations: Nomenclature, Definition and Scope', *Forensic Science International: Synergy*, 8 (2024), 100460 <https://doi.org/10.1016/j.fsisyn.2024.100460>

credibility can substantially strengthen the coherence of judicial reasoning when supported by other lawful evidence.<sup>74</sup>

The SCI method represents a normative evolution of criminal investigation in Indonesia. Supported by statutory regulations, police regulations, and reinforced by Law No. 20 of 2025, SCI transforms criminal proof from a confession-driven model into a scientifically grounded process oriented toward material truth, human rights protection, and judicial accountability.<sup>75</sup> This transformation underscores the indispensable role of forensic science and expert knowledge in modern criminal justice. Several criminal cases that attracted significant public attention in Indonesia in order to analyze the practical implementation of Scientific Crime Investigation (SCI) and the role of forensic experts within the contemporary criminal justice system. These cases are assessed to evaluate how scientific evidence is produced, presented, and judicially assessed, particularly in light of the paradigm shift introduced by the National Criminal Code (Law No. 1 of 2023) and the New Criminal Procedure Code (Law No. 20 of 2025).<sup>76</sup>

The criminal proceedings involving Gregorius Ronald Tannur arose from a series of events occurring on 3–4 October 2023, which culminated in the death of Dini Sera Afriyanti. The factual sequence reveals an escalation of violence following prolonged alcohol consumption, beginning with physical assault and continuing through subsequent acts that ultimately resulted in the victim being struck by a vehicle driven by the defendant. Medical examination conducted upon hospital arrival confirmed that the victim had died under circumstances classified as an unnatural death, thereby necessitating a forensic autopsy.<sup>77</sup> Despite the availability of forensic medical findings and other forms of scientific evidence, including documentary medical reports and surveillance recordings, the District Court of Surabaya acquitted the defendant of all charges. The panel of judges declined to rely on the *visum et repertum* and autopsy results, reasoning that no direct eyewitness testified to the precise cause of death and concluding instead that alcohol consumption constituted the primary cause. This judicial reasoning triggered substantial legal controversy, as it reflected a marginalization of scientific forensic evidence in favor of a restrictive interpretation of testimonial proof.<sup>78</sup>

From the perspective of the New Criminal Procedure Code (Law No. 20 of 2025), such an approach is increasingly problematic. The reformed procedural framework emphasizes rational evaluation of evidence, professional reliance on expert testimony,

<sup>74</sup> Peng Haiqing, Md. Ayub Ali and Robayet Ferdous Syed, ‘Harnessing Clinical Forensic Medicine in Rape Investigations: Analyzing Legal Frameworks and Practices in Bangladesh’, *International Journal of Law, Crime and Justice*, 83 (2025), 100791 <https://doi.org/10.1016/j.ijlcj.2025.100791>

<sup>75</sup> ENSHEN LI, ‘Solid in Shape, Shattered in Practice? The “Sentencing Pyramid” in China’, *Journal of Law and Society*, 52.2 (2025), 292–314 <https://doi.org/10.1111/jols.12536>

<sup>76</sup> Andrew Agapiou, ‘The Reliability of Expert Evidence in Construction Litigation: Towards Institutional Reliability’, *Buildings*, 15.23 (2025), 4215 <https://doi.org/10.3390/buildings15234215>

<sup>77</sup> Amalul Arifin Slamet, Nandang Sambas and Ade Mahmud, ‘Families of Victims Often Reject Forensic Autopsies in Cases of Unnatural Death’, *Sinergi International Journal of Law*, 2.2 (2024), 159–69 <https://doi.org/10.61194/law.v2i2.161>

<sup>78</sup> Ronny Nicolas Sidabutar and others, ‘Criminal Policy in Law Enforcement of Criminal Acts of Drug Circulation in the Digital Era’, *KnE Social Sciences*, 2024 (2024), 570–600 <https://doi.org/10.18502/kss.v8i21.14775>

and the obligation of judges to articulate scientifically reasoned grounds when accepting or rejecting forensic findings. The failure to integrate scientific evidence into judicial reasoning in this case demonstrates a structural gap between normative procedural reform and judicial practice. In contrast, the investigation into the death of Iwan Boedi Prasetijo, a civil servant in Semarang, illustrates a more consistent application of Scientific Crime Investigation. Law enforcement agencies at the municipal, provincial, and national levels jointly employed SCI-based methods to reconstruct the crime, relying on forensic analysis rather than suspect confession.<sup>79</sup> This case underscores the institutional transition from confession-oriented investigation toward evidence-based investigation, which is explicitly reinforced by the New Criminal Procedure Code's prohibition of coercive interrogation practices and its endorsement of scientific and technological methods in criminal investigations. Scholarly assessments identify three principal advantages of SCI implementation: the elimination of reliance on suspect confessions, increased accuracy and efficiency through standardized forensic tools, and the reduction of investigative error through digital and laboratory-based analysis. Nevertheless, empirical realities reveal uneven implementation across regions, primarily due to resource constraints, institutional capacity, and unequal access to forensic facilities.<sup>80</sup>

### *The Impact of Forensic Science Experts Policies on Criminal Case Resolution*

Scientific Crime Investigation constitutes a multidisciplinary investigative approach that integrates forensic medicine, criminalistics, digital forensics, and laboratory science to uncover material truth.<sup>81</sup> Under Law No. 20 of 2025, expert assistance is no longer treated as supplementary but as a structurally significant component of lawful investigation, particularly in cases involving death, serious injury, or complex causality. The National Criminal Code (Law No. 1 of 2023) further reinforces this orientation by redefining criminal liability in a manner that requires demonstrable causal relationships between conduct and consequence. In homicide cases, such causality can rarely be established without forensic scientific analysis. Consequently, expert testimony, forensic reports, and laboratory findings function as epistemic anchors that connect physical evidence, crime scenes, victims, and perpetrators into a coherent evidentiary structure. Although expert evidence formally retains a non-binding evidentiary value, modern procedural doctrine demands that judges engage with such evidence through reasoned, transparent, and scientifically literate evaluation. The SCI method thus serves not merely as a technical investigative tool but as a normative safeguard against wrongful conviction, evidentiary distortion, and judicial arbitrariness.<sup>82</sup>

<sup>79</sup> Anis Mashdurohatun, Deny Arly Asmara, and others, 'The Independence of Civil Servant Investigators in Indonesian Immigration: A Fiqh Siyasah Perspective', *Jurnal Ilmiah Mizani: Wacana Hukum, Ekonomi Dan Keagamaan*, 12.1 (2025), 345 <https://doi.org/10.29300/mzn.v12i1.5120>

<sup>80</sup> Hari Wibowo and others, 'The Legal Status of Circumstantial Evidence in the Context of Criminal Cases in Indonesia', *JUSTISI*, 10.3 (2024), 716–28 <https://doi.org/10.33506/js.v10i3.3307>

<sup>81</sup> Serlina Wulandari, Warasman Marbun and Roland Hutabarat, 'Importance of Scientific Crime Investigation (SCI) in Solving Murder Cases in Indonesia', *Justice Voice*, 4.2 (2025), 71–82 <https://doi.org/10.37893/jv.v4i2.1183>

<sup>82</sup> Djemai Mahmoud Boulaares and Mokhtar Boulaares, 'Intercepting Voices: Voiceprint Recognition, Lawful Interception and Forensic Linguistics in Comparative Perspective', *International Journal for the*

The minimum evidentiary principle continues to require corroboration among forms of proof. However, within the SCI framework, forensic evidence often constitutes the evidentiary backbone of criminal proceedings, particularly where eyewitness testimony is unavailable or unreliable. Unlike human testimony, scientific evidence is replicable, verifiable, and open to independent examination, thereby strengthening procedural fairness and judicial confidence. The expert forensic evidence and documentary scientific reports represent concrete manifestations of Scientific Crime Investigation at the investigative stage. Their effective utilization aligns with the objectives of the reformed criminal justice system, namely the pursuit of material truth, the protection of human rights, and the delivery of substantively just judicial decisions grounded in empirical reality rather than conjecture.<sup>83</sup>

Law functions not merely as an instrument of order and certainty, but as a normative framework for realizing justice, protecting human dignity, and ensuring the equal standing of all persons before the law.<sup>84</sup> In Indonesia's constitutional architecture, criminal procedural law occupies a strategic position because it determines how state power is exercised in the pursuit of material truth while simultaneously safeguarding fundamental rights. This orientation is reaffirmed by the philosophical foundations of Indonesian criminal justice, which derive from Pancasila and the 1945 Constitution, emphasizing due process, human rights protection, and proportionality in law enforcement. The enactment of the Criminal Procedure Code (KUHAP) in 1981 marked a significant departure from the inquisitorial legacy of earlier procedural regimes by emphasizing legal certainty, fairness, and judicial control over investigative power. However, rapid social change, technological advancement, and the increasing complexity of criminal behavior have exposed structural limitations in the KUHAP framework, particularly in relation to evidence gathering and expert involvement. These limitations have become more pronounced in serious crimes such as homicide, where conventional evidentiary methods are often insufficient to uncover material truth.<sup>85</sup>

The National Criminal Code (Law No. 1 of 2023) introduces a renewed philosophical emphasis on culpability, proportional punishment, and restorative balance, thereby requiring procedural mechanisms that are capable of producing accurate and scientifically verifiable findings.<sup>86</sup> In parallel, the New Criminal Procedure Code (Law No. 20 of 2025) strengthens the normative foundation for evidence-based investigations by explicitly recognizing scientific methods, expert

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<sup>83</sup> Amriyanto Amriyanto and others, 'Breaking the Cycle: Reforming Indonesia's Justice System to Prioritize Victim-Centered Solutions', *Jurnal Dinamika Hukum*, 24.3 (2024), 414 <https://doi.org/10.20884/1.jdh.2024.24.3.15577>

<sup>84</sup> Filip Horák, 'Human Dignity in Legal Argumentation: A Functional Perspective', *European Constitutional Law Review*, 18.2 (2022), 237–63 <https://doi.org/10.1017/S1574019622000141>

<sup>85</sup> Ahmad Subhan, Dominikus Rato and Bayu Dwi Anggono, 'Equal Legal Standing of Citizens in Judicial Review of Constitutional Court Law: A Multicultural Perspective to Achieve Legal Certainty', *Kawanua International Journal of Multicultural Studies*, 4.2 (2023), 139–51 <https://doi.org/10.30984/kijms.v4i2.710>

<sup>86</sup> Ramalina Ranaivo Mikea Manitra and others, 'A Proposal for Decriminilisation of Online Defamation in Indonesia: Towards a Human Rights-Based Approach', *Cogent Social Sciences*, 12.1 (2026) <https://doi.org/10.1080/23311886.2026.2613959>

analysis, and forensic examination as integral components of modern criminal procedure.<sup>87</sup> This legislative shift reflects a transition from confession-oriented investigations toward fact-based, objective, and technology-assisted law enforcement. Despite these normative advances, the regulatory framework governing Scientific Crime Investigation (SCI) and forensic experts remains fragmented and insufficiently justice-oriented. While Law No. 20 of 2025 expands the scope of lawful evidence and reinforces judicial scrutiny over investigative practices, it does not yet provide a fully codified and standardized procedural regime for scientific investigation.<sup>88</sup> As a result, the application of SCI continues to rely heavily on technical regulations issued by law enforcement institutions, creating risks of institutional bias, unequal access to scientific proof, and inconsistencies in evidentiary standards. Scientific Crime Investigation, which integrates forensic medicine, biology, chemistry, digital forensics, and criminalistics, has proven indispensable in resolving complex criminal cases, particularly where witness testimony is unreliable or unavailable.<sup>89</sup> Properly applied, SCI enhances objectivity, reduces wrongful convictions, and strengthens judicial confidence in evidentiary findings. However, without clear procedural safeguards and independent expert positioning, SCI may inadvertently reinforce investigative dominance rather than serve as a neutral instrument of justice.<sup>90</sup>

The New Criminal Procedure Code implicitly demands a recalibration of expert roles, requiring that forensic experts function not merely as extensions of investigative authority but as independent contributors to the truth-finding process. Justice-based criminal procedure necessitates equal access to scientific evidence for both prosecution and defense, transparent standards for forensic examination, and judicial competence in evaluating scientific findings.<sup>91</sup> The absence of such guarantees risks undermining the very objectives of procedural reform envisioned by Law No. 20 of 2025. Accordingly, the central problem lies not in the absence of scientific methods, but in the lack of coherent, justice-oriented regulation governing their use. To align scientific investigation with the principles of due process, equality of arms, and material truth, Indonesian criminal procedure must move beyond fragmented norms toward a unified framework that positions Scientific Crime Investigation as an autonomous, standardized, and accountable evidentiary mechanism within the criminal justice system. The substantive dimension of the legal system plays a decisive role in determining the effectiveness of criminal justice, as it provides the normative framework guiding investigative and evidentiary practices. Legal substance comprises

<sup>87</sup> Jared R. Dmello and Stuti Kokkalera, 'Teaching Beyond Borders: Elevating Global Perspectives in the Criminal Justice Classroom', *Journal of Criminal Justice Education*, 36.1 (2025), 103–20 <https://doi.org/10.1080/10511253.2024.2389092>

<sup>88</sup> Anis Widyawati and others, 'The Urgency of Supervision Institutions in Implementing Prisoners' Rights as an Effort to Restructure Criminal Execution Laws', *Jambura Law Review*, 7.1 (2025), 127–51 <https://doi.org/10.33756/jlr.v7i1.27595>

<sup>89</sup> I Gusti Ayu Ketut Rachmi Handayani and Jasurbek Rustamovich Ehsanov, 'Governing Illegal Settlements: Housing Policy in Singapore and Australia', *Journal of Sustainable Development and Regulatory Issues (JSDERI)*, 2.2 (2024), 86–107 <https://doi.org/10.53955/jsderi.v2i2.44>

<sup>90</sup> Dialekti A. Voutyrakou and Constantine Skordoulis, 'Using AI Tools to Enhance Educational Robotics to Bridge the Gender Gap in STEM', *Education Sciences*, 15.6 (2025), 711 <https://doi.org/10.3390/educsci15060711>

<sup>91</sup> J Lakshmi Charan and K Sita Manikyam, 'Forensic Science and Its Limitations in Rape and Murder Cases in India', *Journal of Forensic Science and Medicine*, 9.1 (2023), 91–97 [https://doi.org/10.4103/jfsm.jfsm\\_98\\_21](https://doi.org/10.4103/jfsm.jfsm_98_21)

binding rules and standards that regulate how criminal responsibility is established and how evidence is assessed. In this context, several substantive weaknesses persist in the regulation of Scientific Crime Investigation (SCI) expert evidence within Indonesian criminal procedure.<sup>92</sup>

Historically, under the HIR, expert testimony was not recognized as an independent form of lawful evidence. Article 295 HIR limited evidentiary instruments to witness testimony, documents, confessions, and indications.<sup>93</sup> Legal scholars such as R. Atang Ranoemihardja classified experts merely as a category of witnesses, while Yahya Harahap emphasized that expert opinions under HIR functioned only as auxiliary considerations that judges could adopt at their discretion. This framework subordinated scientific expertise to judicial subjectivity. The enactment of the Criminal Procedure Code (KUHAP) formally recognized expert testimony as a lawful means of evidence. However, KUHAP did not establish a coherent or systematic regulatory framework for scientific expert evidence. Provisions concerning expert testimony remain fragmented across multiple articles, without clear standards governing admissibility, methodological reliability, or evidentiary weight. As a result, Scientific Crime Investigation continues to occupy a marginal position, often treated as supplementary rather than determinative proof.<sup>94</sup>

The National Criminal Code (Law No. 1 of 2023) introduces a substantive shift by emphasizing culpability, proportional responsibility, and material truth as core principles of criminal liability.<sup>95</sup> These principles inherently require objective, verifiable, and scientifically grounded evidence to establish both *actus reus* and *mens rea*. Scientific Crime Investigation is therefore normatively compatible with the new penal paradigm, as it provides methodological tools to reconstruct criminal conduct and intent beyond mere confession-based proof. This alignment is further strengthened by the New Criminal Procedure Code (Law No. 20 of 2025), which modernizes evidentiary principles by accommodating developments in forensic science and investigative technology. Law No. 20 of 2025 expands judicial openness toward scientifically derived evidence, reinforces the principle of evidentiary reliability, and encourages professional integration between investigators and forensic experts. Nevertheless, the absence of explicit recognition of SCI as an autonomous evidentiary category continues to generate interpretative uncertainty.<sup>96</sup>

<sup>92</sup> Aristo Pangaribuan, 'Indonesia's Criminal Justice System: A Case Study of Inter-Agency Conflict and the Fight for Power', *Asian Journal of Law and Society*, 2025, 1–27 <https://doi.org/10.1017/als.2025.10018>

<sup>93</sup> Latifatul Fajriyyah and Alfitri Alfitri, 'Hearsay Evidence Admissibility: Due Process and Evidentiary Rules in Muslim Marriage Legalization (Ijab Nikah)', *Fiat Justitia: Jurnal Ilmu Hukum*, 16.3 (2022), 265–92 <https://doi.org/10.25041/fiatjustitia.v16n03.2464>

<sup>94</sup> Javiera Araya-Moreno, 'How to Not Have to Know: Legal Technicalities and Flagrant Criminal Offenses in Santiago, Chile', *Law & Society Review*, 56.3 (2022), 329–43 <https://doi.org/10.1111/lasr.12624>

<sup>95</sup> Lalu Saipudin and others, 'The Concept of Corporate Criminal Liability in the Indonesian Criminal Law System', *Jurnal IUS Kajian Hukum Dan Keadilan*, 13.2 (2025), 475–99 <https://doi.org/10.29303/ius.v13i2.1817>

<sup>96</sup> Abdul Basir Mohamad and Nurbazla Ismail, 'Structural Discrimination in Online Defamation Enforcement: A Hybrid Analysis of Malaysian Criminal Law and Islamic Jurisprudence', *Journal of Discrimination and Injustice*, 2025, 75–91 <https://doi.org/10.70992/sw534g66>

The persistence of fragmented regulation, unclear standards, and residual reliance on traditional evidentiary forms constitutes a substantive legal weakness. Normative reconstruction is therefore essential to elevate Scientific Crime Investigation from an auxiliary instrument to a structurally integrated component of criminal proof, consistent with the justice-oriented values embodied in Law No. 1 of 2023 and Law No. 20 of 2025.<sup>97</sup> Despite its strategic importance, the implementation of SCI within the Indonesian criminal justice system remains structurally constrained. One major weakness lies in the limited number and uneven distribution of forensic laboratories. Not all regional police jurisdictions possess forensic laboratory facilities, resulting in extensive service coverage areas, procedural delays, and coordination inefficiencies. This structural limitation undermines the principle of prompt, effective, and accountable investigation.<sup>98</sup> The shortage of forensic medical experts constitutes a significant institutional barrier. The number of certified forensic doctors remains disproportionately low compared to the growing complexity and volume of criminal cases. This scarcity affects the quality and timeliness of medico-legal examinations, expert testimony, and forensic documentation, particularly in cases involving death, violence, and sexual crimes. Another structural weakness concerns the limited scientific literacy and forensic competence among investigators. Although formal education and professional training are regulated, disparities persist in investigators' ability to apply forensic methods, interpret scientific evidence, and utilize advanced investigative technologies. The rapid evolution of digital and forensic technology further widens this competence gap, especially in regions with limited training infrastructure.<sup>99</sup>

Institutional coordination between investigators and forensic experts also remains suboptimal. Differences in professional culture, procedural understanding, and evidentiary perspectives often result in fragmented collaboration. While expert testimony is increasingly required by prosecutors and courts, its utilization is not always consistent or systematic, reflecting the absence of integrated investigative protocols. SCI-based investigations require substantial financial resources.<sup>100</sup> Costs associated with forensic examinations, expert services, laboratory analysis, and technological equipment place a heavy burden on investigative budgets. Although forensic costs are legally borne by the state, inadequate budget allocation frequently leads to inefficiencies and delays. These structural weaknesses demonstrate that the effectiveness of Scientific Crime Investigation is not merely a matter of legal recognition but depends fundamentally on institutional capacity, human resources, coordination mechanisms, and sustainable funding within the criminal justice system. The fundamental rationale for calling upon expert assistance in judicial proceedings is to support judges or fact-finders in understanding and evaluating technical or scientific

<sup>97</sup> Bitna Kim, 'Transforming Justice Through Transnational and Transdisciplinary Translation: A Presidential Framework for Action 1', *Justice Quarterly*, 43.1 (2026), 1–22 <https://doi.org/10.1080/07418825.2025.2506485>

<sup>98</sup> Anabella De La Chica and others, 'Improving the Forensic Genetic Workflow for Countries with Small Geographical Areas: What Are the Options and How Cost Effective Are They?', *Forensic Science International: Genetics*, 74 (2025), 103171 <https://doi.org/10.1016/j.fsgen.2024.103171>

<sup>99</sup> Daria Nikitina and others, 'Russian Forensic Medicine: Institutional Evolution, Operational Contradictions, and Their Implications', *Journal of Forensic and Legal Medicine*, 114 (2025), 102926 <https://doi.org/10.1016/j.jflm.2025.102926>

<sup>100</sup> Nikitina and others.



issues that lie beyond ordinary knowledge. Accordingly, to qualify as an expert, an individual must possess adequate and demonstrable knowledge and expertise, acquired through formal education, professional training, and or specialized practical experience, enabling them to provide reliable assistance to the court.<sup>101</sup>

In England, expert evidence is regulated primarily under the Civil Procedure Rules and Practice Direction 35, as well as the Criminal Procedure Rules. Although English law historically did not apply a rigid legal test for the admissibility of expert evidence, this absence raised concerns regarding unreliable or insufficiently grounded testimony. In response, the Law Commission, through its 2009 Consultation Paper titled *The Admissibility of Expert Evidence in Criminal Proceedings*, proposed a structured reliability framework. This framework requires that expert evidence be grounded in recognized scientific principles, that such principles be applicable to the facts of the case, and that the conclusions presented be logically supported by the application of those principles to the case facts. The rapid expansion of expert testimony in English courts subsequently exposed deficiencies in expert quality, prompting the Law Commission's 2011 report, *Expert Evidence in Criminal Proceedings in England and Wales*, which emphasized the risk that juries might uncritically accept complex scientific opinions without proper evaluation. Similarly, in the United States, expert evidence is governed under the Federal Rules of Evidence, particularly Rule 702, which permits expert testimony only where it assists the trier of fact in understanding evidence or determining facts in issue. Experts may qualify based on knowledge, skill, experience, training, or education, and their testimony must meet the fundamental criterion of helpfulness. Within the adversarial system, expert witnesses perform both scientific functions, such as testing and evaluating evidence, and forensic functions, namely explaining findings to judges and juries. By contrast, the Netherlands, operating within an inquisitorial system, conceptualizes experts as *deskundige*, independent legal entities who function as extensions of the court rather than representatives of the parties. Dutch experts may conduct scientific examinations even before suspects are identified and are required to submit written expert reports. This court-centered model emphasizes neutrality and minimizes the risk of adversarial "battles of experts," ensuring that expert evidence serves the pursuit of material truth rather than partisan interests.<sup>102</sup>

In Indonesia, although expert evidence theoretically aligns with the civil law tradition, practice reveals a deviation whereby experts often function under party control rather than judicial direction. This inconsistency undermines objectivity and creates evidentiary bias. Consequently, comparative insights from England, the United States, and particularly the Netherlands underscore the urgent need for normative reconstruction in Indonesia. Such reform should include explicit codification of Scientific Crime Investigation results as independent evidence, the establishment of expert accreditation and registration systems, and clear procedural safeguards to

<sup>101</sup> Anis Mashdurohatun, Rizky Amalia Solichin, and others, 'A Justice and Maslahah-Based Reconstruction of Notary Removal Regulations', *Jurnal Ilmiah Mizan: Wacana Hukum, Ekonomi Dan Keagamaan*, 12.2 (2025), 739 <https://doi.org/10.29300/mzn.v12i2.9406>

<sup>102</sup> Teresa Lancry A.S. Robalo and Razwana Begum Bt Abdul Rahim, 'Cyber Victimization, Restorative Justice and Victim-Offender Panels', *Asian Journal of Criminology*, 18.1 (2023), 61–74 <https://doi.org/10.1007/s11417-023-09396-9>

ensure expert competence, independence, and methodological reliability, thereby strengthening fairness and material truth within the criminal justice process.<sup>103</sup>

## CONCLUSION

This study concludes that the regulation of scientific crime investigation experts in Indonesia is not yet aligned with Pancasila-based justice. This is evident from the absence of explicit recognition of scientific crime investigation as an independent form of evidence in Article 184(1) of the Criminal Procedure Code, and its indirect regulation under Police Regulation No. 6 of 2019, which treats it merely as technical support. As a result, its implementation remains fragmented and inconsistent with fair-trial principles. The study identifies three main weaknesses. First, structural weaknesses include limited forensic laboratories, shortages of qualified experts, insufficient understanding among law enforcement officers, weak coordination, and high investigation costs. Second, substantive legal weaknesses stem from the dominance of proof models focused on *actus reus*, the lack of standardized rules on the use and assessment of scientific evidence, and the absence of explicit regulation in the Criminal Procedure Code. Third, weaknesses in legal culture arise from low public awareness of crime-scene preservation and the influence of social-media virality, which may undermine objective legal evaluation. To address these issues, the study proposes a reconstruction of regulations based on Pancasila justice, integrating ethical values such as honesty and responsibility. It recommends revising Article 133(1) and Article 184(1) of the Criminal Procedure Code, as well as Article 34 of Police Regulation No. 6 of 2019, to strengthen legal certainty, procedural fairness, and the pursuit of material truth in the criminal justice process.

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