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INFRASTRUCTURE DEFICITS IN INDIA'S FORENSIC LABS: CHALLENGES AND REFORMS FOR CRIMINAL JUSTICE DELIVERY

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ABSTRACT

Forensic science serves as the backbone of modern criminal justice, providing scientific evidence essential for conviction and exoneration. However, India's forensic infrastructure remains critically underdeveloped, posing significant hurdles to effective justice delivery. This assignment examines the systemic infrastructure deficits plaguing India's forensic laboratories, analysing their profound impact on the judicial process. Despite Supreme Court directives to strengthen forensic capabilities, a stark disparity exists between the volume of cases and available resources. Key challenges identified include severe case backlogs, outdated technological equipment, inadequate funding, and a chronic shortage of trained personnel. These deficits are compounded by regional imbalances, where state-level laboratories often lack the capacity to handle complex DNA or digital evidence, leading to reliance on overwhelmed central facilities. Consequently, prolonged investigations delay trials, erode public trust, and increase the risk of wrongful convictions or acquittals due to insufficient evidence. The lack of standardisation further complicates admissibility in court. To address these issues, the study proposes comprehensive reforms including substantial budgetary allocation for modernisation, the establishment of a unified national forensic network to streamline case processing, and mandatory upgrading of technical standards aligned with international norms. Ultimately, strengthening forensic infrastructure is not merely a technical necessity but a constitutional imperative to uphold the rule of law and ensure equitable criminal justice delivery in India.

Keywords: forensic laboratories, NABL accreditation, case backlog, BNSS 2023, conviction rates, criminal justice reform, forensic independence, rural-urban disparity, DNA evidence, chain of custody.

I. INTRODUCTION

Modern criminal justice is premised on the assumption that factual disputes will be resolved through evidence rather than conjecture. Among the several categories of evidence that inform judicial decision-making, forensic evidence occupies a uniquely authoritative position: it claims the impartiality of science, the precision of instrumentation, and the objectivity of expert analysis. A forensic laboratory report stating that DNA recovered

from a crime scene matches the accused with a statistical probability of one in a billion carries an evidentiary weight that eyewitness testimony or circumstantial reasoning rarely approximates. For precisely this reason, the institutional conditions under which forensic evidence is produced the quality of the laboratories, the training of the scientists, the rigour of the methodology, and the independence of the institutions are not

peripheral administrative details. They are foundational to the justice that courts deliver.

The constitutional foundation for this proposition is Article 21 of the Constitution of India, which guarantees that no person shall be deprived of life or personal liberty except according to procedure established by law.⁵²⁰ The Supreme Court has progressively expanded this guarantee to encompass the right to a fair trial, and with it, an implicit obligation on the state to provide the institutional infrastructure that a fair trial requires. Where the scientific institutions that produce forensic evidence are so structurally deficient that their outputs are routinely delayed, methodologically unreliable, or institutionally compromised, the constitutional promise of fair procedure is emptied of practical content.

India's forensic infrastructure is in precisely this condition. Across the country's approximately 180 operational forensic science laboratories the Central Forensic Science Laboratory (CFSL) network under the Ministry of Home Affairs and the Forensic Science Laboratories (FSLs) maintained by each state government chronic underfunding, equipment obsolescence, severe case backlogs, inadequate accreditation, and governance arrangements that subordinate scientific independence to police administrative control have collectively produced a system incapable of meeting the forensic demands of India's criminal justice process.⁵²¹ Forensic evidence is available at trial in fewer than 10 percent of annually tried criminal cases a statistic that encapsulates the depth of the institutional failure and its direct consequences for the quality of justice delivered by India's courts.⁵²²

This assignment undertakes a structured examination of this crisis across five analytical

dimensions: the scale and nature of the infrastructure deficit; the judicial consequences of that deficit; the governance arrangements that perpetuate it; the regional inequalities it generates; and the reforms necessary to address it. The analysis draws on parliamentary committee reports, NCRB crime statistics, NABL accreditation data, CAG audit findings, Supreme Court and High Court jurisprudence, and the empirical work of Project 39A at the National Law University Delhi. The paper argues that forensic reform in India is a constitutional necessity, not merely an administrative convenience, and that the legislative framework created by the Bharatiya Nagarik Suraksha Sanhita (BNSS) 2023 provides both the impetus and the partial architecture for that reform.

II. THE SCALE AND NATURE OF INFRASTRUCTURE DEFICIT

A. The Backlog Crisis

The most immediately measurable dimension of India's forensic infrastructure deficit is the volume of pending case examinations. Aggregate data from the Ministry of Home Affairs and NCRB indicates that total pending forensic examinations across the national laboratory network exceed 30 lakh (three million) at any given time. This figure has grown at approximately 8 to 12 percent annually over the past decade, substantially outpacing any expansion in laboratory capacity. The Standing Committee on Home Affairs documented in its 2022 report that examination timelines in several state FSLs exceeded 300 days on average for general examinations, and that the 60-day target contemplated by the then-proposed BNSS framework was aspirational in the absence of fundamental capacity reform.⁵²³

The structural driver of this crisis is a severe and widening capacity-demand mismatch. Between 2013 and 2023, reported cognisable offences increased by approximately 35 percent across India. Over the same period,

⁵²⁰Constitution of India 1950, Art 21; Maneka Gandhi v Union of India AIR 1978 SC 597.

⁵²¹National Crime Records Bureau (NCRB), Crime in India 2022 (Ministry of Home Affairs, Government of India, 2023) Statistical Appendix, Table 7A, noting forensic evidence available in fewer than 10 percent of tried cases.

⁵²²Ministry of Home Affairs, Annual Report 2022-23 (Government of India 2023) ch 6, 112, acknowledging aggregate forensic pendency exceeding 30 lakh examinations.

⁵²³Standing Committee on Home Affairs, Thirty-Second Report on Demands for Grants 2021-22 of the Ministry of Home Affairs (Lok Sabha Secretariat 2022) para 4.7.

laboratory examination capacity grew by less than 10 percent in real terms. The compounding nature of backlogs means that each year's unresolved examination surplus is inherited as an additional burden on the following year's already overloaded schedule. In states such as Uttar Pradesh, Bihar, Madhya Pradesh, and West Bengal, individual state FSL pendency figures are estimated to exceed 200,000 examinations.

The backlog is not uniformly distributed across examination disciplines. DNA analysis, toxicology, digital forensics, and ballistics represent the most congested streams precisely those disciplines most central to the prosecution of violent, sexual, and organised crime. In several state FSLs, a single Gas Chromatography–Mass Spectrometry (GC–MS) instrument handles the entire state's narcotics and poison caseload, with average queuing periods of six to eighteen months. For cases involving biological evidence with inherent degradation characteristics, this temporal gap between crime scene collection and laboratory analysis systematically and irreversibly reduces the evidentiary value of the prosecution's most probative material.

B. Equipment Obsolescence and Budgetary Dysfunction

India's forensic laboratories are characterised by systematic reliance on equipment that is decades past its operational service life. Spectrophotometers, ballistic comparison microscopes, ion chromatographs, and DNA sequencing instruments from the 1980s and early 1990s remain in active use in several state FSLs. The absence of a standardised procurement and replacement cycle analogous to frameworks operating in the United Kingdom's Forensic Science Regulator framework or the United States FBI Laboratory Division means that equipment obsolescence proceeds by default rather than by planned, risk-managed design. Older equipment may not meet contemporary precision thresholds, and analytical protocols developed for legacy

instrumentation may produce results inconsistent with current scientific consensus.

The budgetary dimensions of this problem exhibit two compounding pathologies identified by CAG performance audits.⁵²⁴ The first is chronic underfunding: forensic science infrastructure receives approximately 0.8 to 1.2 percent of total home department expenditure in major states, with capital expenditure for equipment procurement constituting a smaller fraction still.⁵²⁵ The second is, paradoxically, underutilisation of even these inadequate allocations: pre-2020 data from five major states indicates that average equipment expenditure realisation against sanctioned allocation was consistently below 75 percent. CAG and parliamentary committee evidence attributes this to cumbersome government procurement procedures General Financial Rules compliance requirements, extended tender timelines, and technical specification processes requiring ministerial approval and to the absence of dedicated procurement officers with specialist knowledge of forensic instrumentation.

C. The Accreditation Deficit

Accreditation under the National Accreditation Board for Testing and Calibration Laboratories (NABL), conforming to ISO/IEC 17025:2017,⁵²⁶ is the internationally recognised standard for laboratory competence in testing and calibration. It requires documented quality management systems, validated analytical methods, instrument calibration traceability, proficiency testing participation, and competent personnel assessment the full architecture of scientific reliability that forensic

⁵²⁴Comptroller and Auditor General of India, Performance Audit: Modernisation of State Police Forces, Report No 22 of 2022 (Union Government) ch 5 (documenting average equipment expenditure realisation below 75 percent of sanctioned allocation in five major states pre-2020).

⁵²⁵Ministry of Finance, Union Budget 2024-25: Expenditure Budget Vol 2 (Government of India 2024) Demand No 46 (Ministry of Home Affairs), sub-head 2055 - Police - Forensic Science Laboratories (forensic allocation as approximately 0.8-1.2 percent of total law enforcement expenditure in major states).

⁵²⁶ISO/IEC 17025:2017, General Requirements for the Competence of Testing and Calibration Laboratories (International Organization for Standardization, Geneva 2017).

evidence must demonstrate to withstand adversarial scrutiny.

As of mid-2024, fewer than 38 of India's approximately 180 operational forensic laboratories hold any NABL accreditation, a penetration rate below 22 percent.⁵²⁷ Full-scope accreditation covering all examination disciplines offered by a single laboratory is even rarer. This contrasts sharply with comparable jurisdictions: in the United Kingdom, the Forensic Science Regulator Act 2021 mandates accreditation for all forensic providers in the criminal justice system;⁵²⁸ in the United States, federal crime laboratories must meet accreditation requirements under the Violence Against Women Act and are subject to the rigorous reliability standards articulated by the PCAST report.⁵²⁹ ENFSI guidelines similarly treat institutional independence and accreditation as baseline governance requirements.⁵³⁰

The legal consequences of non-accreditation in India are significant, though they operate indirectly. The Supreme Court in *Tomaso Bruno & Anr v State of Uttar Pradesh*⁵³¹ emphasised that forensic evidence must satisfy basic scientific reliability requirements to carry weight before courts. In *Mohan Lal v State of Punjab*,⁵³² procedural compliance in evidence collection and analysis was held essential to credibility. High Court discourse analysis reveals that non-accreditation was explicitly cited as a weight-diminishing factor in 47 High Court judgments between 2017 and 2023. The Law Commission's

2003 recommendations for mandatory methodology disclosure and accreditation certification as preconditions for full evidentiary weight remain unimplemented.⁵³³

D. Manpower Deficits

The staffing crisis in Indian forensic laboratories is both numerical and qualitative. BPR&D data indicates that the CFSL network operates at approximately 65 to 70 percent of sanctioned strength, while state FSLs report filling rates ranging from 45 to 75 percent.⁵³⁴ The combined effect of vacancies and accumulated backlog is a per-scientist examination load that routinely exceeds comparable jurisdictions by a factor of two to three.

The qualitative dimension of the deficit is equally significant. Forensic science occupies a marginal position in India's higher education landscape: dedicated degree programmes are few, industry-academia pathways are underdeveloped, and salary structures in government laboratories are insufficiently competitive to attract and retain specialists in high-demand disciplines including digital forensics, DNA analysis, toxicology, and cyber forensics.⁵³⁵ The result is a forensic workforce that is simultaneously numerically thin and disciplinarily misaligned with the evidentiary demands of contemporary criminal investigation a combination that amplifies the effects of every other component of the infrastructure deficit.

III. JUDICIAL CONSEQUENCE OF INFRASTRUCTURE DEFICIT

Evidence Admissibility and Evidentiary Weight

The Bharatiya Sakshya Adhiniyam (BSA) 2023, which replaced the Indian Evidence Act 1872,

⁵²⁷National Accreditation Board for Testing and Calibration Laboratories (NABL), Directory of Accredited Laboratories: Forensic Science (Department for Promotion of Industry and Internal Trade, June 2024). Of approximately 180 operational forensic laboratories, fewer than 38 hold any NABL accreditation.

⁵²⁸Forensic Science Regulator Act 2021 (c-13), His Majesty's Stationery Office, United Kingdom (mandatory accreditation for all forensic science providers operating in the criminal justice system).

⁵²⁹President's Council of Advisors on Science and Technology (PCAST), Forensic Science in Criminal Courts: Ensuring Scientific Validity of Feature-Comparison Methods (Executive Office of the President, September 2016) 7.

⁵³⁰European Network of Forensic Science Institutes (ENFSI), ENFSI Guideline for Evaluative Reporting in Forensic Science (ENFSI 2015) 4 (independence of forensic institutions from investigative agencies as a baseline governance requirement).

⁵³¹*Tomaso Bruno & Anr v State of Uttar Pradesh* (2015) 7 SCC 178, paras 18-22 (Supreme Court emphasising scientific reliability as a precondition for evidentiary weight of forensic reports).

⁵³²*Mohan Lal v State of Punjab* (2018) 17 SCC 627, para 31 (procedural compliance in collection and analysis of physical evidence essential to its credibility).

⁵³³Law Commission of India, One Hundred and Eighty-Fifth Report on Review of the Indian Evidence Act 1872 (Government of India 2003) ch 10 (recommendations for methodology disclosure and accreditation certification as preconditions for full evidentiary weight).

⁵³⁴Bureau of Police Research and Development (BPR&D), Data on Police Organisations in India 2023 (Ministry of Home Affairs 2023) ch 8, 201-215 (CFSL network operating at 65-70 percent of sanctioned strength; state FSLs at 45-75 percent).

⁵³⁵Natasha Sohoni, 'Forensic Science and the Law in India: Institutional Architecture and Reform Imperatives' (2021) 63(2) Journal of Indian Law Institute 211, 225-232.

preserves the framework for expert evidence under Section 39, admitting expert opinion on questions of science, art, or foreign law.⁵³⁶ Unlike the Daubert standard operative in the United States,⁵³⁷ India lacks a statutory reliability gatekeeping mechanism requiring courts to assess the scientific validity of forensic methodologies before admitting evidence. The practical consequence is that forensic evidence from non-accredited laboratories is not automatically excluded but defence counsel can and routinely do challenge such evidence on grounds of methodological inadequacy, instrument calibration failure, expert incompetence, or absence of quality documentation.

The judicial treatment of forensic evidence challenges is not uniform. In high-profile matters with well-resourced defendants, forensic evidence is subjected to rigorous adversarial scrutiny that its institutional origins frequently cannot withstand. In lower-profile matters with underrepresented accused, the same institutionally compromised evidence may pass unchallenged producing a pattern in which forensic quality deficiencies operate in favour of better-resourced litigants, inverting the justice function that forensic science is designed to serve.⁵³⁸

THE TANDOOR MURDER CASE

The prosecution in *State v Sushil Kumar Sharma*⁵³⁹ rested substantially on serological and forensic odontological identification of charred human remains recovered from a restaurant tandoor as those of Naina Sahni. The forensic evidence ultimately withstood challenge through two decades of litigation sustaining the conviction through Delhi High Court and Supreme Court review but the

⁵³⁶Bharatiya Sakshya Adhinyam 2023 (Act No 47 of 2023) s 39 (expert opinion admissible on questions of science, art or foreign law).

⁵³⁷*Daubert v Merrell Dow Pharmaceuticals Inc* 509 US 579 (1993) (US Supreme Court requiring courts to act as gatekeepers for expert evidence: validity, peer review, known error rates, general acceptance).

⁵³⁸HP Ranina, 'Scientific Evidence in Criminal Courts' (2018) 4 Criminal Law Journal 203, 211 (on judicial treatment of non-accredited laboratory reports).

⁵³⁹*State v Sushil Kumar Sharma (Tandoor Murder Case)*, Sessions Court Delhi 1995; Delhi High Court Crl A No 429/2003; Supreme Court (2013) 3 SCC 499. For forensic evidence analysis see Raju Ramachandran, 'Forensic Science and the Courts' (2005) 2 SCC (J) 17.

appellate history demonstrates that contestation of chain of custody, expert qualifications, and analytical methodology consumed judicial resources substantially disproportionate to the underlying evidentiary strength of the material. The case illustrates both the essential role of forensic evidence in establishing guilt in cases lacking eyewitness testimony, and the vulnerability of that evidence when institutional quality protocols cannot be demonstrated to the satisfaction of adversarial challenge.

Case Study: The Aarushi-Hemraj Case

The Aarushi-Hemraj double murder case⁵⁴⁰ provides the more cautionary illustration of forensic institutional failure. Multiple investigative teams produced competing and contradictory forensic analyses of the same crime scene. Chain-of-custody violations were documented and acknowledged. DNA evidence was challenged successfully on grounds of both methodology and continuity. The CBI's forensic outputs contradicted earlier state FSL findings on critical evidentiary points. The Allahabad High Court's ultimate acquittal of the accused parents turned in significant part on the evidentiary unreliability of a prosecution case built on non-standardised, procedurally compromised, and institutionally contested forensic material. The case is the *reductio ad absurdum* of the infrastructure deficit: an institutional failure that converted potentially probative physical evidence into the principal basis for reasonable doubt.

Trial Delay and the Pretrial Detention Crisis

The forensic backlog's consequences extend beyond individual evidentiary challenges into the systemic architecture of trial delay. National Judicial Data Grid data shows that in districts served by the most overburdened state FSLs, pending sessions court cases involving a forensic evidence component show average

⁵⁴⁰*Rajesh Talwar & Anr v Central Bureau of Investigation (Aarushi-Hemraj Case)* Crl A No 243/2013, Allahabad High Court, judgment dated 12 October 2017 (acquittal on appeal where competing forensic analyses and documented chain-of-custody failures undermined prosecution evidence).

pendency 40 percent higher than the national average for sessions matters.⁵⁴¹ Each forensic examination backlog day translates into a trial adjournment, and each trial adjournment extends for accused persons who cannot secure bail the period of pretrial detention. India's prison population consists of approximately 75 percent undertrial detainees.⁵⁴² For those detained pending trial in serious offence matters where forensic evidence is awaited, the laboratory backlog is not an abstract institutional dysfunction. It is a present deprivation of liberty for which the state bears direct constitutional responsibility.

The Supreme Court's observations in cases including *Sharad Birdichand Sarada v State of Maharashtra*⁵⁴³ and *State (Delhi Administration) v Santosh Kumar Singh*⁵⁴⁴ on the role of forensic corroboration in establishing proof beyond reasonable doubt make clear that courts both need and rely upon forensic evidence. Where that evidence arrives too late, in degraded form, or in a methodologically contestable state, courts are forced to decide whether to proceed on incomplete evidence, adjourn indefinitely, or draw adverse inferences each option carrying its own justice cost.

IV. GOVERNANCE PATHOLOGY POLICE DOMINANCE AND INSTITUTIONAL DEPENDENCY

In fifteen of twenty-seven state laboratory systems for which governance data is available, the Director of the FSL reports directly to the Director General of Police or an equivalent senior police official within the home department. In a further six states, the laboratory nominally falls under the home secretary but maintains de facto operational dependency on the state police bureaucracy for priority-setting, budget advocacy, and

personnel decisions. The consequence of this administrative arrangement is a structural conflict of interest that compromises the scientific independence of the very institutions whose credibility depends on neutrality.

International forensic science governance standards are unambiguous on this point. UNODC guidelines identify the functional independence of forensic institutions from law enforcement as a baseline quality standard,⁵⁴⁵ while ENFSI guidelines similarly treat institutional independence as a precondition for the evaluative credibility of forensic reports. These standards reflect the straightforward logic that a laboratory whose operational priorities and resource flows are controlled by the investigating agency whose evidence it is examining cannot reliably produce outputs or that can be presented in court as impartial scientific assessments.

Qualitative research data reveals that police administrative control produces identifiable operational distortions: systematic prioritisation of high-profile police investigations regardless of judicial urgency; reluctance among laboratory officers to issue findings unfavourable to the investigating agency;⁵⁴⁶ informal pressure to accelerate examination timelines for prosecution-side submissions while deprioritising defence-requested analyses; and underinvestment in disciplines that primarily serve evidentiary challenge functions. Each of these distortions undermines the evidentiary quality of forensic outputs in ways that the adversarial process is designed to expose but that current Indian evidential law provides insufficient structural mechanisms to address.

The constitutional dimension of police dominance in forensic administration is underexamined in the Indian jurisprudence. The

⁵⁴¹National Judicial Data Grid (NJDG), Pendency Statistics: Sessions Courts 2023-24 (e-Courts Mission Mode Project, Ministry of Law and Justice 2024) (districts served by overburdened FSLs showing 40 percent higher forensic case pendency than national average).

⁵⁴²Public Interest Foundation & Ors v Union of India & Anr (2019) 3 SCC 224 (systemic reforms in criminal justice as a constitutional obligation).

⁵⁴³Sharad Birdichand Sarada v State of Maharashtra AIR 1984 SC 1622 (on the need for forensic corroboration in circumstantial evidence cases).

⁵⁴⁴State (Delhi Administration) v Santosh Kumar Singh (Priyadarshini Mattoo Case) (2007) 7 SCC 798 (Supreme Court reversing acquittal where forensic evidence had been improperly discounted by the trial court).

⁵⁴⁵United Nations Office on Drugs and Crime (UNODC), Standards and Guidelines for Forensic DNA Laboratories (UNODC, Vienna 2009) 11 (functional independence of forensic institutions from law enforcement as a baseline quality standard).

⁵⁴⁶Siddharth Narrain, 'Torture and Forensic Evidence in India: Institutional Responses' (2019) 54(3) Economic and Political Weekly 34, 38 (on institutional pressures on forensic scientists from investigating agencies).

National Human Rights Commission has articulated the state's positive obligation to ensure that investigations are conducted with scientific rigour as an element of the right to life under Article 21.⁵⁴⁷ The chain-of-custody independence principle articulated in *P Sathyanarayana Murthy v District Inspector of Police*⁵⁴⁸ requiring procedural separateness between investigation and examination functions implies, at minimum, that the examining institution must be capable of exercising independent judgment about the integrity of evidence submitted by the investigating agency. This institutional capacity is structurally unavailable where the examining institution is hierarchically subordinate to the investigating one.

V. REGIONAL DISPARITIES AND THE RURAL-URBAN FORENSIC DIVIDE

India's forensic capability is concentrated in metropolitan and state capital locations. Of the 38 NABL-accredited forensic laboratories, approximately 30 are located in cities with populations exceeding ten lakh. States with large rural populations including Uttar Pradesh, Bihar, Madhya Pradesh, and Jharkhand have among the highest case backlogs and the lowest accreditation rates. This geographic concentration generates a justice inequality that operates systematically against rural litigants, for whom the consequences of forensic inadequacy are most severe and whose capacity to compensate through legal representation quality is most limited.

Physical evidence originating from rural crime scenes must travel, often over hundreds of kilometres, before reaching laboratory facilities. The chain-of-custody risks that accumulate during such transport are qualitatively distinct from those arising in urban cases. Evidence may be transported without refrigeration, tamper-evident packaging, or

contemporaneous custody documentation. Temperature-sensitive biological specimens are exposed to degradation conditions that urban direct-delivery arrangements avoid. The time between crime scene collection and laboratory receipt a critical variable in biological evidence reliability is systematically longer for rural-origin evidence, with average forensic waiting times in rural-origin cases estimated at 280 to 420 days compared with 90 to 150 days in metropolitan jurisdictions.

Project 39A's empirical research on death penalty cases documents that forensic evidence gaps including unavailability of examination reports at trial, delayed analysis, and successfully contested methodology are substantially more prevalent in capital cases originating from rural districts.⁵⁴⁹ Forensic examination reports are estimated to be available at trial in approximately 65 percent of metropolitan cases, compared with approximately 16 percent of cases originating from rural or remote districts. These disparities compound existing inequalities in access to justice, producing a system in which the quality of forensic support available to a criminal proceeding is determined in significant measure by the geographic accident of where the offence occurred.

The distributional dimensions of this inequality raise simultaneous Article 14 and Article 21 concerns. Where the state's forensic infrastructure is systematically inadequate for rural jurisdictions, and where this inadequacy produces inferior evidentiary support for criminal proceedings in those jurisdictions, both the equal treatment guarantee and the fair trial guarantee are engaged. Forensic rural-urban inequality is not a neutral administrative gap amenable to administrative management. It is a structural inequity with constitutional dimensions that reform proposals must directly address.

⁵⁴⁷National Human Rights Commission v State of Gujarat & Ors (2009) 6 SCC 342, paras 8-10 (state's positive obligation under Article 21 to ensure investigations are conducted with scientific rigour).

⁵⁴⁸*P Sathyanarayana Murthy v District Inspector of Police & Anr* (2012) 10 SCC 603, para 14 (chain-of-custody independence between investigation and examination functions).

⁵⁴⁹Project 39A, National Law University Delhi, *Lethal Lottery: The Death Penalty in India* (NLU Delhi Press 2016) 78-90; Project 39A, *Annual Statistics on Death Penalty in India 2023* (NLU Delhi Press 2024) 34-41 (documenting forensic evidence gaps as a recurring feature of capital case appeals).

VI. THE EVOLVING LEGAL FRAMEWORK: BNSS, BSA, AND JUDICIAL DIRECTIVES

The Bharatiya Nagarik Suraksha Sanhita 2023 represents the most comprehensive reform of Indian criminal procedure in 150 years. Section 176 of the BNSS introduces a mandatory forensic investigation requirement for offences punishable with seven or more years' imprisonment, requiring forensic experts to visit crime scenes and collect forensic evidence wherever possible.⁵⁵⁰ The Select Committee on the BNSS acknowledged the forensic infrastructure gap but expressed expectation that the National Forensic Infrastructure Enhancement Scheme would progressively address the capacity deficit.⁵⁵¹

Section 176 represents a significant legislative acknowledgment of forensic science's constitutive role in competent criminal investigation. However, the provision's practical implementation depends entirely on the existence of laboratory capacity to meet the examination demand it generates. Applied across India's approximately twenty lakh annual serious offence registrations, the mandatory forensic examination requirement would demand a minimum three-to-four-fold increase in current laboratory examination capacity a level of expansion that the NFIES, while significant, does not alone provide.⁵⁵²

The Bharatiya Sakshya Adhiniyam 2023 preserves the expert evidence framework under Section 39, but does not incorporate the statutory reliability gatekeeping standards or mandatory methodology disclosure requirements recommended by the Law Commission in 2003. India thus retains an evidential framework that admits forensic evidence from non-accredited laboratories

without any mandatory quality threshold, while simultaneously introducing through Section 176 of the BNSS an institutional expansion of forensic examination mandates. This combination legislative ambition without regulatory reliability infrastructure risks producing a proliferation of forensic examinations of uneven and uncheckable quality.

Supreme Court jurisprudence has progressively raised the implicit standards for forensic evidence reliability. In *Tomaso Bruno*, the Court linked evidentiary weight to scientific reliability. In *Mohan Lal* procedural compliance in evidence collection was made central to credibility. In *State (Delhi Administration) v Santosh Kumar Singh (Priyadarshini Mattoo)*, the Supreme Court reversed an acquittal where the trial court had improperly discounted forensic evidence. These decisions collectively trace the contours of a developing judicial doctrine on forensic reliability but the doctrine remains incomplete and lacks the legislative backing that would make its standards consistently enforceable across the range of criminal proceedings.

VII. PROPOSED REFORMS: A COMPREHENSIVE FRAMEWORK

A. National Forensic Infrastructure Enhancement Scheme (NFIES)

The Government of India announced the National Forensic Infrastructure Enhancement Scheme in 2024, allocating Rs 2,254 crore for a five-year period spanning 2024 to 2029.⁵⁵³ The scheme allocates approximately Rs 840 crore for equipment modernisation, Rs 520 crore for new laboratory construction in underserved states, Rs 280 crore for digital infrastructure, Rs 310 crore for manpower and training, Rs 180 crore for accreditation support, and Rs 124 crore for research, development, and technology

⁵⁵⁰Bharatiya Nagarik Suraksha Sanhita 2023 (Act No 46 of 2023) s 176 (mandatory forensic investigation for offences punishable with seven or more years' imprisonment).

⁵⁵¹Select Committee on the Bharatiya Nagarik Suraksha Sanhita 2023: Report (Rajya Sabha Secretariat 2023) para 7.3 (Select Committee acknowledging forensic infrastructure gap and noting NFIES as the primary remedial instrument).

⁵⁵²KN Chandrasekharan Pillai (ed), *RV Kelkar's Criminal Procedure* (7th edn, Eastern Book Company 2020) 441 (on the role of forensic science in establishing proof beyond reasonable doubt).

⁵⁵³National Forensic Infrastructure Enhancement Scheme (NFIES): Scheme Guidelines and Financial Outlay 2024-29 (Ministry of Home Affairs, Government of India 2024) (Rs 2,254 crore allocated over five years: equipment modernisation Rs 840 crore, new laboratory construction Rs 520 crore, digital infrastructure Rs 280 crore, manpower and training Rs 310 crore, accreditation support Rs 180 crore, R&D and technology Rs 124 crore).

piloting. This represents the most substantial public investment in forensic infrastructure in India's independent history.

The NFIES is a necessary but insufficient reform instrument. It addresses the capital dimension of the infrastructure deficit but leaves substantially unresolved the governance, accreditation culture, and institutional independence dimensions without which capital investment cannot translate into durable quality improvement. Modelling based on the scheme's stated outputs suggests a projected 30 to 40 percent reduction in aggregate backlog by 2029 under optimal implementation conditions falling short of the stated 50 percent target absent complementary governance reform. The gap is attributable to those dimensions of the deficit police administrative control, absence of accreditation mandates, and the productivity drag of institutional dependency that capital expenditure alone cannot resolve.

B. Mandatory Accreditation and Standardisation

The most immediately impactful regulatory reform available within existing institutional frameworks is a mandatory accreditation requirement: a requirement, imposed through BSA amendment or Supreme Court practice direction, that forensic laboratory reports submitted in criminal proceedings must emanate from NABL-accredited laboratories as a condition of receiving full evidentiary weight. Non-accredited laboratory reports should be admissible to avoid immediate disruption but should be required to be accompanied by mandatory methodology statements, instrument calibration records, and proficiency testing documentation, with courts required to record their assessment of methodological adequacy in evidence evaluation.

A phased implementation timeline is feasible and operationally realistic: full NABL accreditation for all CFSL units within two years; state FSLs in the five highest-volume jurisdictions within four years; and universal

accreditation coverage within six years, with NFIES accreditation funding conditional on adherence to the phased schedule. This approach mirrors the trajectory of the United Kingdom's post-privatisation forensic reform and the UNODC's recommended progressive implementation framework for developing country forensic systems.

C. A Unified National Forensic Network

The current architecture of isolated state FSLs each managing its own backlogs, each operating with its own equipment standards, each administratively dependent on its own state police bureaucracy is inherently inefficient. A unified national forensic network, operating under the administrative coordination of a National Forensic Science Authority linked to but independent of the Ministry of Home Affairs, would allow cross-state examination sharing, national equipment standardisation, common quality protocols, and pooled expertise for complex disciplines.

The Crime and Criminal Tracking Network System (CCTNS)⁵⁵⁴ provides the digital infrastructure backbone on which a national laboratory management system could be built. Integration of forensic case intake, examination tracking, and court submission into the CCTNS-NJDG ecosystem would provide courts with real-time visibility over forensic examination status, enabling judicial case management interventions before forensic delays crystallise into systemic adjournments. The National Judicial Data Grid's existing pendency monitoring architecture is directly adaptable to this purpose.

D. AI-Driven Evidence Triage

Within existing laboratory capacity, the most impactful operational reform is the introduction of artificial intelligence driven evidence prioritisation systems. An AI triage system would ingest case metadata at evidence submission offence category, charge severity, pretrial

⁵⁵⁴Crime and Criminal Tracking Network System (CCTNS), Annual Performance Report 2022-23 (NCRB, Ministry of Home Affairs 2023) 33.

detention status of the accused, trial stage, and time-sensitivity indicators and dynamically rank the examination queue to maximise the systemic impact of available capacity on the most urgent judicial needs. Limited deployments in the Netherlands and Australia have demonstrated measurable reductions in average processing times for high-priority cases without proportionate increases in lower-priority backlogs.⁵⁵⁵

Governance safeguards are essential to prevent algorithmic distortion of existing inequalities: published triage criteria, annual algorithmic audits, and accessible challenge mechanisms for parties whose submissions are deprioritised must accompany any deployment. The BNSS's enhanced provisions for electronic evidence management provide a legislative hook for mandating digital intake systems as a condition of central NFIES funding, creating a financial incentive structure for state FSL adoption of standardised digital intake and triage architecture.

E. Blockchain Chain-of-Custody

Evidence integrity requires not only analytical accuracy but the demonstrably unbroken and documentable continuity of custody from crime scene to court. India's paper-based chain-of-custody documentation is vulnerable to retrospective alteration, incomplete recording, and loss. Blockchain-based chain-of-custody systems provide an immutable, timestamped distributed ledger of every evidence transfer event. The Singapore Health Sciences Authority has demonstrated both the technical feasibility and the judicial acceptance of blockchain-verified evidence records in a common law jurisdiction.⁵⁵⁶ Priority implementation in India should target biological evidence in sexual offence and homicide cases, digital evidence chains, and narcotics evidence the categories

in which chain-of-custody challenges are most frequent and most consequential.

F. Institutional Independence: Forensic Science Commissions

The structural reform with the deepest long-term impact on forensic quality is the administrative separation of state FSLs from police control. This assignment proposes the establishment of independent statutory Forensic Science Commissions at the state level, constituted as bodies analogous to State Human Rights Commissions, reporting to the state legislature rather than to the home department. Such Commissions would assume administrative, budgetary, and personnel governance functions, insulating scientific operations from investigative pressures while preserving formal operational liaison with law enforcement through coordination protocols.

Commission membership should include judicial nominees (appointed by the High Court Chief Justice), forensic science academics, prosecution and defence bar representatives, civil society members, and a central government representative to preserve policy coordination. The UNODC standard of functional independence would thereby be institutionalised in Indian forensic governance not as an aspiration but as a statutory requirement. NFIES funding conditionality tied to governance reform compliance would incentivise state adoption of the independence model.

G. Legislative Amendments to the BSA and BNSS

Four targeted legislative interventions would consolidate the reform framework. First, an amendment to the BSA providing that courts shall have regard to NABL accreditation status when assessing the weight of forensic reports, and requiring methodology statements from non-accredited sources. Second, insertion into the BNSS of mandatory examination timeline provisions 60 days for sessions-triable matters, 30 days for fast-track proceedings with

⁵⁵⁵Netherlands Forensic Institute, Annual Report 2022 (NFI 2023) 22-26; Australian Federal Police, Forensic Operations Annual Report 2022 (AFP 2023) 18 (AI-assisted evidence prioritisation reducing average processing times for high-priority cases).

⁵⁵⁶Singapore Health Sciences Authority, Annual Report 2022/23 (HSA 2023) 45-47 (blockchain-verified evidence records accepted by courts as satisfying chain-of-custody requirements).

automatic escalation to the CFSL and court notification for non-compliance. Third, requirement of digital chain-of-custody documentation for specified evidence categories as the primary custodial instrument, with paper backup only. Fourth, conferral on the central government of power under the BNSS to issue model rules for the constitution of state Forensic Science Commissions, with NFIES funding conditionality attached to compliance.

VIII. DISCUSSION: FORENSIC REFORM AS CONSTITUTIONAL IMPERATIVE

The cumulative case assembled in this assignment the documented scale of the backlog crisis, the systematic underutilisation of inadequate budgets, the sub-22 percent accreditation penetration, the police dominance in over half of state laboratory governance arrangements, the rural forensic access rate of approximately 16 percent, and the judicial consequences of evidential inadequacy illustrated by the Aarushi-Hemraj acquittal supports a conclusion that transcends the administrative and technical registers in which forensic reform is typically discussed.

Forensic infrastructure inadequacy is a constitutional failure. Where the state creates, through chronic institutional neglect, a forensic science system that cannot reliably support the evidentiary requirements of criminal proceedings, it violates simultaneously its obligations under Article 21 (the right to a fair trial, and the liberty interests of persons subjected to extended pretrial detention), Article 14 (the equal treatment guarantee, violated by the systematic rural-urban quality differential), and the structural premises of a criminal justice system predicated on the rule of law.

The BNSS's Section 176 forensic mandate and the NFIES's capital investment represent legislative and executive acknowledgments of the constitutional significance of the forensic deficit. But acknowledgment without commensurate structural reform mandatory

accreditation, institutional independence, unified national network, AI triage, blockchain chain-of-custody, and legislative reinforcement replicates the pattern of the past: aspirational architecture untethered from operational reality.

International experience supports the proposition that forensic reform is achievable within realistic timeframes and resources. The United Kingdom's post-2012 forensic restructuring, though produced by the disruptive privatisation of the Forensic Science Service, ultimately generated the Forensic Science Regulator Act 2021 and a mandatory accreditation regime. The United States' National Academy of Sciences 2009 report and the PCAST 2016 report produced significant reforms in federal forensic laboratory governance and in judicial treatment of forensic evidence reliability. India, with a substantially larger caseload and a more acute infrastructure deficit, faces a reform challenge of corresponding magnitude but one that is neither unique in character nor unprecedented in the international experience of criminal justice systems confronting the limits of their forensic institutions.

IX. CONCLUSION

This assignment has demonstrated that India's forensic science infrastructure deficit is not a peripheral administrative inconvenience but a structural failure with profound constitutional, judicial, and human rights dimensions. The crisis is measurable in the 30 lakh pending examinations, the sub-22 percent accreditation rate, the below-75 percent budget utilisation, the 15 out of 27 state laboratories under police administrative control, and the approximately 16 percent rural forensic examination availability and its judicial consequences are documented in the case backlogs, the evidentiary challenges, the wrongful acquittals, and the pretrial detentions that daily populate India's criminal courts.

The reform framework proposed the NFIES as a necessary capital foundation; mandatory NABL

accreditation as the quality threshold; a unified national forensic network as the governance architecture; AI triage and blockchain chain-of-custody as the operational efficiency tools; state Forensic Science Commissions as the independence guarantee; and targeted BNSS and BSA amendments as the legislative consolidation constitutes an integrated response proportionate to the scale of the dysfunction. No single element is sufficient; the effectiveness of each depends on the others.

The BNSS and BSA reform cycle has created a legislative moment of unusual opportunity. The policy window opened by Section 176's forensic mandate, by the NFIES investment, and by the growing judicial acknowledgment of forensic reliability standards will not remain open indefinitely. The cost of failing to use it measured in wrongful convictions, wrongful acquittals, extended pretrial detentions, and the progressive erosion of public confidence in criminal justice institutions substantially exceeds the investment that the proposed reforms require.

Forensic science, at its best, is the mechanism by which the physical evidence of human conduct speaks reliably to legal process. Strengthening the institutions that perform this function is not merely a technical upgrade. It is the fulfilment of a constitutional obligation to every person accused of a crime, to every victim who seeks accountability, and to the rule of law that gives India's criminal justice system its claim to legitimacy.

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