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FORENSIC INFRASTRUCTURE DEFICIT AND DELAY IN CRIMINAL TRIALS: A POLICY ANALYSIS

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I. ABSTRACT

Forensic science has become an important part of criminal investigation in recent years. Courts and investigating agencies increasingly rely on scientific evidence such as DNA analysis, fingerprints, toxicology reports, and digital evidence to establish facts and determine responsibility. The growing use of scientific methods has improved the quality of criminal investigations and reduced excessive dependence on confessions and witness testimony alone. At the same time, the success of scientific investigation depends on the availability of strong forensic institutions capable of examining evidence quickly and accurately. Although India has expanded its forensic facilities over the years, several practical difficulties continue to affect the system. Many forensic laboratories are required to handle a large number of cases with limited resources. Delays in examinations, shortage of trained experts, uneven distribution of forensic facilities, and inadequate technological support often slow down the process of investigation. As a result, forensic reports are not always available within a reasonable time, creating difficulties for investigating officers, prosecutors, courts, victims, and accused people. This article examines how weaknesses in forensic infrastructure contribute to delays in criminal trials in India. It studies the existing forensic framework, identifies the major institutional and infrastructural shortcomings affecting forensic services, and analyses the impact of these deficiencies on the criminal justice process. The article argues that delays in criminal trials cannot be viewed only as a judicial problem because they are also linked to the capacity of forensic institutions that support investigations. It further highlights the need for policy measures aimed at strengthening laboratory facilities, increasing professional capacity, improving coordination among institutions, and reducing delays in forensic examination. Strengthening forensic infrastructure is essential not only for effective investigation but also for ensuring timely justice and maintaining public confidence in the criminal justice system.

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II. KEYWORDS

Forensic Science, Forensic Infrastructure, Criminal Trials, Trial Delay, and Policy Analysis.

III. INTRODUCTION AND RESEARCH PROBLEM

The criminal justice system is expected to ensure that offences are investigated fairly, evidence is examined properly, and justice is delivered within a reasonable time. Achieving these objectives depends largely on the quality of evidence available before the investigating authorities and the courts. Traditionally, criminal investigations relied heavily on eyewitness testimony, confessions, and circumstantial evidence. Although these forms of evidence continue to play an important role, they are not always sufficient to establish facts with certainty. Witnesses may forget important details, statements may contain inconsistencies, and in some situations, evidence may be difficult to verify. As a result, modern criminal justice systems increasingly depend on scientific methods of investigation to improve accuracy and reliability in criminal proceedings.[2]

The growing importance of forensic science has significantly changed the way criminal investigations are conducted. Scientific techniques such as DNA profiling, fingerprint examination, forensic pathology, toxicology, ballistics, and digital forensic analysis assist investigators in reconstructing events and identifying offenders through objective methods. Unlike assumptions or personal opinions, forensic evidence is derived from scientific examination and is therefore often regarded as a valuable source of proof during criminal trials.[3] The increasing use of technology in both lawful and unlawful activities have further expanded the role of forensic science. Today, investigating agencies are required to deal with cybercrime, financial fraud, organised criminal activity, digital evidence, and technology driven offences that cannot be effectively addressed through traditional investigative methods alone.

[2] Paul C. Giannelli & Edward J. Imwinkelried, *Scientific Evidence* § 1-1 (6th ed. 2016).
[3] Max M. Houck & Jay A. Siegel, *Fundamentals of Forensic Science* 3–12 (4th ed. 2015). [3] Bharatiya Nagarik Suraksha Sanhita, No. 46 of 2023, § 176 (India).

Recognising the importance of scientific investigation, India has gradually strengthened the use of forensic evidence within the criminal justice process. Central and State Forensic Science Laboratories now assist investigating agencies in analysing evidence collected from crime scenes and other sources. Recent criminal law reforms have also highlighted the importance of forensic examination, particularly in serious offences, reflecting a broader shift towards evidence-based investigation.[3] These developments indicate that forensic science is no longer a supplementary tool but has become an important component of contemporary criminal justice administration.

However, the growing dependence on forensic evidence has also exposed several structural weaknesses within the existing forensic framework. The demand for scientific examination has increased considerably, while the capacity of forensic institutions has not expanded at the same pace. Many forensic laboratories continue to face heavy workloads, shortages of trained personnel, limited technological resources, and delays in processing evidence. In several parts of the country, access to forensic facilities remains uneven, creating differences in the quality and speed of scientific support available to investigating agencies.[4] These challenges have become more visible as courts, prosecutors, and investigators increasingly rely on forensic reports for decision-making.

One of the most significant consequences of these deficiencies is the delay they create within the criminal justice process. Forensic reports often play an important role in completing investigations, filing chargesheets, framing prosecution strategies, and evaluating evidence during trial. When scientific examination is delayed, the effects are not limited to forensic laboratories alone. Investigations may remain incomplete for extended periods, court proceedings may be postponed, and both victims and accused persons may be required to wait longer for the resolution of criminal cases. As a result, delays within forensic institutions can contribute directly to delays in criminal trials.[5]

[4] B.R. Sharma, *Forensic Science in Criminal Investigation and Trials* 21–29 (5th ed. 2016).
[5] Bureau of Police Research & Development, *Model Forensic Science Laboratory Manual* 24–28 (2020).

The issue becomes particularly important in the context of India's continuing efforts to improve the efficiency of criminal justice administration. Discussions on delayed justice generally focus on judicial vacancies, procedural complexities, or case backlogs before courts. While these factors undoubtedly contribute to delays, less attention has been given to the role played by forensic infrastructure in affecting the pace of criminal proceedings. In many cases, even efficient investigative and judicial processes may be affected when forensic reports are unavailable within a reasonable time. Consequently, the problem of delayed justice cannot be viewed solely as a judicial concern; it must also be examined from the perspective of scientific investigation and institutional capacity.

The challenges facing forensic institutions have become more complex due to the changing nature of crime itself. Cyber offences, digital transactions, electronic communications, financial crimes, and technologically sophisticated criminal activities generate large volumes of scientific and digital evidence. The examination of such evidence requires specialised expertise, advanced equipment, and continuous technological adaptation. Without adequate infrastructure and professional capacity, forensic institutions may struggle to respond effectively to these emerging demands. This situation raises important questions regarding the preparedness of the existing forensic system and its ability to support the growing needs of criminal investigations.

Against this background, the present article examines the relationship between forensic infrastructure deficits and delays in criminal trials in India. It analyses the present status of forensic infrastructure, identifies the major institutional and operational challenges affecting forensic services, and explores how these deficiencies influence different stages of the criminal justice process. The article further evaluates the policy issues surrounding forensic administration and argues that strengthening forensic capacity is essential for improving the efficiency, reliability, and timeliness of criminal justice delivery. By focusing on the connection between scientific investigation and delayed trials, the study seeks to highlight an aspect of criminal justice reform that has often received less attention despite its growing significance.

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A. Research Objectives

This study seeks to examine the relationship between deficiencies in forensic infrastructure and delays in criminal trials in India. It aims to analyse the existing forensic institutional framework; identify key constraints relating to laboratories, personnel, technology, funding, and coordination; and assess the effect of such constraints on investigation, prosecution, and trial proceedings. The study further seeks to evaluate the adequacy of existing legal and policy measures and to propose reforms capable of improving the efficiency, reliability, and timeliness of forensic support within the criminal justice system.

B. Research Questions

This article addresses the following questions:

1. What are the principal infrastructural and institutional deficiencies affecting forensic services in India?
2. In what manner do delays in forensic examination affect investigation, prosecution, and the timely disposal of criminal trials?
3. To what extent do the existing legal and policy framework address deficiencies in forensic capacity?
4. What institutional and policy reforms are necessary to strengthen forensic services and reduce avoidable delay in criminal justice administration?

C. Research Methodology

This study adopts a doctrinal and policy-oriented analytical methodology. It examines the relevant statutory framework, including the Bharatiya Nagarik Suraksha Sanhita, 2023 and the Bharatiya Sakshya Adhiniyam, 2023, along with judicial decisions, governmental reports, institutional publications, books, and scholarly articles. The analysis relies primarily on secondary sources to assess the present condition of forensic infrastructure, the operational challenges affecting forensic institutions, and their implications for criminal trials. The study also evaluates contemporary policy initiatives and recommends institutional reforms for strengthening forensic capacity in India.

IV. FORENSIC INFRASTRUCTURE IN INDIA: PRESENT FRAMEWORK AND EMERGING DEMANDS

A. Evolution of Forensic Science in India

The use of science in criminal investigation is not a recent development in India. For many years, criminal investigations mainly depended on witness statements, confessions, and physical observations made by investigating officers. Although these methods remain important, they were often insufficient in cases where direct evidence was unavailable or facts were disputed. As scientific knowledge advanced, law enforcement agencies gradually began using scientific techniques to support investigations and verify evidence.

One of the earliest and most significant developments was the adoption of fingerprint identification during the colonial period. The work carried out in India played an important role in establishing fingerprints as a reliable method of personal identification and later influenced policing practices in different parts of the world.[6] After independence, forensic science continued to expand and gradually became a recognised component of criminal investigation. Over the years, new disciplines such as forensic biology, toxicology, ballistics, forensic pathology, DNA analysis, cyber forensics, and digital evidence examination became part of the investigative process.

The growth of forensic science was closely linked to changes in the nature of crime itself. As criminal activities became more organised and technologically advanced, traditional investigative methods alone were often unable to address emerging challenges. Scientific examination offered investigators a more objective way of analysing evidence and reconstructing events. Consequently, forensic science evolved from a supporting tool into an important element of modern criminal justice administration.

[6] Chandak Sengoopta, *Imprint of the Raj: How Fingerprinting Was Born in Colonial India* 35–58 (2003).

B. Existing Forensic Institutional Framework

The development of forensic science in India led to the creation of institutions specifically designed to provide scientific assistance in criminal investigations. Today, the forensic system consists of a network of Central Forensic Science Laboratories and State Forensic Science Laboratories, regional facilities, specialised units, and crime scene investigation teams.[7] These institutions examine different forms of evidence and provide expert opinions that assist investigators, prosecutors, and courts.

The Central Forensic Science Laboratories generally deal with specialised examinations and cases requiring advanced scientific expertise. State laboratories handle a substantial portion of the evidence generated through criminal investigations within their respective jurisdictions. In addition, several States have established regional laboratories and mobile forensic units to improve accessibility and support local investigations.

Apart from laboratory-based services, forensic institutions also contribute to professional training, research activities, and the development of scientific techniques. Their role extends beyond evidence examination because they help strengthen the overall quality of criminal investigations. As courts increasingly rely on scientific evidence, these institutions have become an essential part of the criminal justice system.

C. Recent Criminal Law Reforms and Expanding Use of Forensic Evidence

Section 176(3) of the Bharatiya Nagarik Suraksha Sanhita, 2023 marks a significant statutory shift towards scientific investigation. In every offence punishable with imprisonment for seven years or more, the officer in charge of a police station shall, from a date notified by the State Government within five years, cause a forensic expert to visit the crime scene, collect forensic evidence, and ensure videography of the process. The provision is therefore both an evidentiary safeguard and a capacity-dependent mandate. Its proviso requires a State lacking an appropriate facility to

[7] Directorate of Forensic Science Services, Ministry of Home Affairs, Government of India, *Annual Report 2022– 23*.

notify utilisation of another State's facility until local capacity is developed or made available. The phased implementation and inter-State arrangement expressly recognise the uneven distribution of laboratories, trained experts, and crime-scene-response capacity. Unless these gaps are addressed through adequate investment, staffing, transport, and timely examination, the mandate may increase laboratory workloads and delay reports, thereby weakening its intended contribution to efficient investigation and expeditious trials.[8]

This development reflects a broader shift within criminal justice administration. Scientific evidence is often viewed as more reliable because it is based on objective examination rather than personal recollection or subjective interpretation. DNA analysis, fingerprint comparison, toxicological reports, and digital forensic findings now play a significant role in many criminal prosecutions. Courts also frequently rely upon expert opinions when dealing with technical issues that require specialised knowledge.

The increasing use of forensic evidence has improved the quality of investigations in many cases. Scientific examination can help identify offenders, establish links between suspects and crime scenes, verify disputed facts, and support fair adjudication. However, greater reliance on forensic evidence also means that the efficiency of criminal investigations increasingly depends on the ability of forensic institutions to provide timely and reliable reports.

D. Current Status of Forensic Infrastructure

India has made notable progress in expanding forensic services over the last few decades. The country now possesses an extensive network of forensic laboratories and specialised scientific units. New technologies have been introduced in several areas, and the importance of forensic evidence is widely recognised within the criminal

[8] Bharatiya Nagarik Suraksha Sanhita, No. 46 of 2023, § 176(3) (India).

justice system. These developments demonstrate a clear commitment towards strengthening scientific investigation.[9]

Despite this progress, important challenges continue to affect the functioning of forensic institutions. The availability of resources is not uniform across the country, and significant differences exist between States in terms of infrastructure, staffing, and technological capacity. While some laboratories possess advanced facilities and specialised divisions, others continue to function with limited resources.

Concerns have also been raised regarding shortages of trained experts, delays in scientific examinations, and growing pressure on existing facilities. The increasing volume of cases requiring forensic analysis has placed substantial demands on laboratories that are already operating under resource constraints. As a result, the expansion of forensic services has not always been accompanied by a corresponding increase in institutional capacity.

E. Increasing Demand for Scientific Investigation

The demand for forensic services has grown rapidly in recent years. One reason is the changing nature of crime. Offences involving digital technology, electronic communication, online financial transactions, cyber fraud, organised criminal networks, and complex economic crimes frequently generate large amounts of scientific evidence that require specialised examination.[10] Investigators now encounter forms of evidence that were relatively uncommon a few decades ago.

At the same time, public expectations regarding criminal investigations have also changed. There is increasing emphasis on scientific accuracy, objective evidence, and professional investigation standards. Victims, courts, and society generally expect investigating agencies to support their conclusions with reliable forensic findings whenever possible. This expectation has further increased the workload of forensic institutions.

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[9] Bureau of Police Research & Development, *Model Forensic Science Laboratory Manual* 1–28 (2020). [10] United Nations Office on Drugs and Crime, *Crime Scene and Physical Evidence Awareness for Non-Forensic Personnel* 1–7 (2009).

The expanding use of DNA profiling, digital forensics, cyber investigation techniques, and advanced scientific methods has created new opportunities as well as new challenges. While these developments strengthen the quality of criminal investigations, they also increase the pressure on existing forensic infrastructure. Laboratories are expected to process larger volumes of evidence within shorter periods, often with limited resources and personnel. This growing gap between demand and capacity has become one of the most significant issues facing forensic administration today.

The discussion in this chapter demonstrates that forensic science has become deeply integrated into the criminal justice system and that reliance on scientific evidence continues to increase. At the same time, the ability of forensic institutions to meet these growing expectations remains a matter of concern. Understanding the present framework and the increasing demands placed upon it provides the necessary background for examining the central issue of this article. The next chapter therefore focuses on the nature and dimensions of the forensic infrastructure deficit and analyses the challenges that continue to affect forensic services in India.

V. FORENSIC INFRASTRUCTURE DEFICIT: NATURE AND DIMENSIONS OF THE PROBLEM

A. Shortage of Forensic Laboratories and Regional Disparities

The growing dependence on forensic evidence has exposed a problem that has existed for many years but has become more visible in recent times. While the demand for scientific examination has increased rapidly, the availability of forensic facilities has not expanded at the same pace. In many parts of the country, investigating agencies continue to depend on a limited number of laboratories to process a large volume of evidence. As a result, laboratories are often required to handle far more cases than their existing capacity permits.[10]

[10] Directorate of Forensic Science Services, Ministry of Home Affairs, Government of India, *Annual Report 2022– 23*.

Another concern is the uneven distribution of forensic facilities across different States. Some States have developed relatively advanced forensic institutions with specialised divisions and modern equipment, whereas others continue to depend on a small number of laboratories serving large geographical areas. This imbalance affects accessibility as well as efficiency. Evidence collected from one district may have to be sent to a laboratory located far away, increasing transportation time and delaying examination. In serious criminal cases where timely analysis is essential, such delays can affect the overall progress of an investigation.

The problem is not simply the number of laboratories available. The issue is whether those laboratories are capable of meeting present demands. Crime has changed significantly over the years, and investigations now require expertise in areas such as DNA profiling, cyber forensics, digital evidence analysis, and financial investigation. Expanding the use of forensic evidence without creating sufficient institutional capacity has placed considerable pressure on existing facilities. Consequently, the gap between demand and availability continues to widen.

B. Human Resource and Technical Capacity Constraints

Infrastructure is not limited to buildings and equipment. The effectiveness of any forensic institution ultimately depends on the people working within it. A laboratory may possess modern facilities, but its performance will remain limited if there are not enough qualified professionals available to conduct scientific examinations. One of the major challenges facing forensic services in India is the shortage of trained experts across several specialised fields.[11]

Forensic examination often requires technical knowledge that can only be acquired through specialised education and practical training. DNA analysts, forensic pathologists, cyber forensic experts, toxicologists, and digital evidence specialists perform highly technical tasks that require accuracy and professional competence. Recruiting and retaining such professionals has not always been easy, particularly when demand for specialised skills continues to increase.

[11] B.R. Sharma, *Forensic Science in Criminal Investigation and Trials* 41–49 (5th ed. 2016).

The shortage of personnel creates a chain reaction throughout the forensic system. Existing experts are frequently required to manage large numbers of cases, increasing workload and reducing the time available for individual examinations. This situation can contribute to delays in reporting and place additional pressure on institutions that are already functioning under resource constraints. As criminal investigations become more dependent on scientific evidence, the need for trained human resources becomes as important as the need for physical infrastructure.

C. Laboratory Backlogs and Delayed Forensic Reports

Among all the challenges affecting forensic services, delays in the examination of evidence remain one of the most visible. Forensic laboratories across the country regularly receive large numbers of samples relating to criminal investigations. Biological materials, digital devices, narcotic substances, questioned documents, firearms, and other forms of evidence must be scientifically examined before reports can be issued. When incoming cases exceed institutional capacity, backlogs become unavoidable.[12]

The consequences of these delays extend beyond the laboratory itself. Investigating officers often depend upon forensic findings before taking further steps in a case. Prosecutors may require scientific reports before finalising prosecution strategies, and courts may wait for expert opinions before proceeding with important stages of a trial. Therefore, a delay within a forensic laboratory can influence several other parts of the criminal justice process.

The situation becomes more concerning when delays continue for months or even years. By that stage, the value of evidence may be affected, witnesses may become unavailable, and the overall pace of proceedings may slow considerably. Although forensic science is intended to strengthen criminal investigations, delays in obtaining scientific reports can sometimes become a source of procedural delay rather than procedural efficiency.

[12] Bureau of Police Research & Development, *Model Forensic Science Laboratory Manual* 24–28 (2020).

D. Infrastructure, Technology and Funding Challenges

Modern forensic investigation depends heavily on technology. Scientific examination today involves sophisticated instruments, specialised software, secure data systems, laboratory equipment, and continuous technological upgrades. Maintaining such facilities requires substantial investment and long-term planning.[13]

However, technological development within forensic institutions has not always progressed uniformly. Some laboratories have successfully introduced advanced scientific techniques, while others continue to face difficulties due to limited resources and outdated equipment. These differences become particularly important in areas such as cybercrime investigation and digital evidence analysis, where technology evolves rapidly and investigative methods must adapt accordingly.

Funding limitations also affect institutional development. Establishing laboratories, purchasing equipment, maintaining facilities, and training personnel require consistent financial support. When resources remain limited, expansion plans are often delayed, and existing infrastructure may struggle to keep pace with increasing demands. The result is a forensic system that is expected to perform more functions without always receiving the resources necessary to support those expectations.

E. Quality Assurance and Institutional Limitations

The value of forensic evidence depends not only on speed but also on reliability. Courts place confidence in forensic findings because they are expected to be based on recognised scientific methods and professional standards. For this reason, quality assurance is an essential part of any forensic system.[14]

Maintaining consistent standards across a large and diverse network of forensic institutions presents its own challenges. Differences in training, equipment, procedures, and institutional resources may affect the quality of examinations. While efforts have been made to promote accreditation and quality control, concerns

[13] United Nations Office on Drugs and Crime, *Crime Scene and Physical Evidence Awareness for Non-Forensic Personnel* 17–24 (2009).
[14] National Human Rights Commission, *Quality Assurance in Forensic Science Laboratories: Issues and Challenges* 20–27 (2019).

regarding standardisation continue to arise from time to time. The reliability of forensic findings also depends upon the demonstrable competence of the personnel who generate them. In State of H.P. v. Jai Lal,[15] the Supreme Court clarified that, before a witness's opinion can be treated as expert evidence, it must be shown that the witness has undertaken special study of the subject or acquired special experience and possesses adequate knowledge. The decision underscores that expert opinion is advisory and must rest on disclosed reasons, data, and scientific criteria capable of independent judicial evaluation. Accordingly, uneven training, qualifications, or quality-control practices across forensic institutions may affect not merely administrative efficiency but also the evidentiary weight that courts can attach to forensic conclusions.

Another issue relates to coordination among different institutions involved in criminal justice administration. Forensic laboratories do not function independently from police agencies, prosecutors, or courts. Delays or communication gaps at one stage can influence the effectiveness of the entire process. In practice, weaknesses in coordination may sometimes reduce the benefits that scientific investigation is expected to provide.

The challenges discussed in this chapter demonstrate that the forensic infrastructure deficit is not the result of a single problem. Instead, it emerges from a combination of laboratory shortages, human resource constraints, growing backlogs, technological limitations, funding concerns, and institutional weaknesses. Together, these factors affect the ability of forensic institutions to respond efficiently to the increasing demand for scientific investigation. More importantly, these deficiencies have consequences that extend beyond forensic administration itself. They directly influence the speed and effectiveness of criminal proceedings. The next chapter therefore examines how weaknesses in forensic infrastructure contribute to delays in criminal trials and affect the broader functioning of the criminal justice system.

[15] State of H.P. v. Jai Lal, (1999) 7 SCC 280.

VI. IMPACT OF FORENSIC INFRASTRUCTURE DEFICITS ON CRIMINAL TRIALS

A. Delays in Investigation and Filing of Chargesheets

The deficiencies discussed in the previous chapter do not remain confined to forensic laboratories. Their effects are felt throughout the criminal justice process, beginning from the earliest stages of investigation. In many criminal cases, forensic examination forms an important part of the evidence-gathering process. Investigating officers often rely on scientific reports to verify facts, identify suspects, establish links between evidence and accused persons, or determine the cause and circumstances of an offence. When forensic examination is delayed, the investigation itself may slow down because important decisions cannot be taken until scientific findings become available.[16]

This problem becomes particularly visible in cases involving DNA evidence, digital devices, cybercrime, toxicology reports, or complex forms of physical evidence. Investigating agencies frequently wait for laboratory results before finalising their conclusions. In practice, delays in forensic examination can postpone the completion of investigations and affect the timely filing of chargesheets before competent courts. Although procedural laws prescribe timelines for investigation in certain situations, delays in obtaining scientific reports often create practical difficulties for investigating officers attempting to comply with those requirements.

The issue is not simply one of administrative inconvenience. Delayed investigations affect the overall progress of criminal proceedings. Evidence may become more difficult to verify as time passes, witnesses may become unavailable, and the momentum of the investigation may gradually weaken. Consequently, deficiencies within forensic institutions often become one of the hidden causes of prolonged investigations and delayed prosecution.

[16] Paul C. Giannelli & Edward J. Imwinkelried, *Scientific Evidence* § 1-1 (6th ed. 2016).

B. Impact on Prosecution, Courts and Judicial Efficiency

The consequences of forensic delays continue even after an investigation has been completed. Prosecutors frequently depend on scientific reports to assess the strength of evidence and prepare cases for trial. When forensic findings are unavailable or delayed, prosecutors may face uncertainty regarding important aspects of the case. This can affect the framing of charges, preparation of witness examinations, and overall prosecution strategy.[17]

Courts are similarly affected by delays in forensic examinations. Scientific reports often constitute important documentary evidence in criminal proceedings, particularly in cases involving serious offences. When reports are pending, courts may be required to adjourn proceedings and wait for expert findings before moving forward. Such adjournments contribute to delays that are already common within the judicial system.

The problem becomes more significant when forensic evidence forms the central basis of the prosecution case. In such situations, the absence of scientific reports may prevent effective progress during trial. Even where courts are prepared to proceed, incomplete evidence can create practical obstacles that slow the administration of justice. Therefore, the efficiency of criminal courts is often linked not only to judicial capacity but also to the ability of forensic institutions to provide timely support.

C. Effect on Rights of Accused Persons and Victims

The impact of delayed forensic examination extends beyond institutions and directly affects individuals involved in criminal proceedings. Both accused persons and victims may experience the consequences of prolonged investigations and delayed trials. From the perspective of the accused, lengthy delays can create uncertainty and place individuals under continued legal scrutiny for extended periods. The principle of a fair trial includes the expectation that criminal proceedings should be conducted within a reasonable time.[18]

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[17] Max M. Houck & Jay A. Siegel, *Fundamentals of Forensic Science* 14–27 (4th ed. 2015).
[18] Hussainara Khatoon v. State of Bihar, (1980) 1 SCC 81 (India)

Where forensic reports remain pending for long durations, accused people may find themselves waiting for investigations or trials to progress. This concern becomes particularly important when individuals are held in custody or when unresolved criminal proceedings affect employment, reputation, and personal life. Delays therefore raise broader concerns relating to procedural fairness and access to justice.

Victims are also affected by the slow pace of proceedings. Many victims enter the criminal justice system expecting that investigations will be completed efficiently and that courts will provide timely resolution. However, when scientific examination takes months or years to complete, frustration and dissatisfaction may increase. Delayed proceedings can prolong emotional distress and weaken confidence in the ability of institutions to deliver justice effectively.

The interests of both victims and accused people therefore converge around a common concern. Regardless of their position within the criminal process, prolonged delays resulting from forensic deficiencies can undermine confidence in the fairness and effectiveness of criminal justice administration.

D. Forensic Delays as a Cause of Criminal Justice Backlogs

Public discussions on delays in criminal trials often focus on judicial vacancies, procedural complexity, and the large number of pending cases before courts. While these factors undoubtedly contribute to delay, forensic infrastructure receives comparatively less attention. Yet the functioning of the criminal justice system increasingly depends on scientific evidence, making forensic institutions an important factor in the overall pace of proceedings.[18]

A criminal case passes through several stages before reaching final adjudication. Investigation, collection of evidence, scientific examination, filing of chargesheets, prosecution preparation, trial proceedings, and judicial determination are all interconnected. Delays occurring at one stage frequently affect every stage that follows. Consequently, delays within forensic institutions contribute indirectly to broader case backlogs within the justice system.

[18] Bureau of Police Research & Development, *Model Forensic Science Laboratory Manual* 24–28 (2020).

The growing reliance on scientific investigation has made this issue even more significant. As more cases require forensic examination, existing institutional limitations become more visible. Laboratories burdened with heavy workloads may struggle to process evidence within reasonable periods, creating a chain of delays that eventually reaches the courts. In this sense, forensic infrastructure should not be viewed merely as a technical or administrative concern. It is also a criminal justice issue with direct implications for the speed and efficiency of legal proceedings.

E. Consequences for Public Confidence and Rule of Law

The effects of forensic delays are not limited to individual cases. They also influence broader public perceptions regarding the effectiveness of criminal justice institutions. Public confidence is strengthened when investigations are conducted professionally, evidence is examined efficiently, and cases are resolved within a reasonable time. Conversely, repeated delays may create doubts regarding the ability of institutions to fulfil these expectations.[19]

Scientific evidence is often viewed by the public as one of the most reliable forms of proof available in criminal proceedings. Consequently, delays in obtaining forensic reports can create the impression that important investigations are progressing slowly despite the availability of modern scientific methods. Such perceptions may weaken trust in investigative agencies, forensic institutions, and the justice system as a whole.

The issue also has implications for the rule of law. A justice system that struggles to process evidence efficiently may find it difficult to deliver timely outcomes. Delayed justice affects not only individual litigants but also public confidence in legal institutions. As forensic science becomes increasingly central to criminal investigation, the effectiveness of forensic infrastructure becomes closely connected with the credibility of the justice system itself.

The discussion in this chapter demonstrates that deficiencies in forensic infrastructure have consequences far beyond the boundaries of forensic laboratories. They affect

[19] National Human Rights Commission, *Quality Assurance in Forensic Science Laboratories: Issues and Challenges* 20–27 (2019).

investigations, prosecutions, courts, accused people, victims, and public confidence in the administration of justice. Delays in forensic examination often create delays throughout the criminal process, making forensic capacity an important factor in the overall efficiency of criminal trials. These challenges raise important policy questions regarding the future development of forensic services in India. The next chapter therefore examines the broader policy and governance issues that continue to affect forensic administration and explores the need for more comprehensive institutional reform.

VII. POLICY CHALLENGES AND THE NEED FOR FORENSIC REFORM

A. Governance and Coordination Challenges

The increasing use of forensic science has highlighted the importance of coordination among the various institutions involved in the criminal justice process. Forensic laboratories do not function in isolation. Their effectiveness depends upon continuous interaction with police authorities, prosecutors, medical professionals, courts, and administrative agencies. When coordination between these institutions is weak, delays and inefficiencies become difficult to avoid.

In practice, the movement of evidence from the crime scene to the laboratory and eventually to the courtroom involves multiple stages. Any delay at one stage can affect every stage that follows. For example, evidence that is not collected properly may require additional clarification, while incomplete documentation can slow scientific examination and delay the preparation of reports. Similarly, communication gaps between investigators and forensic experts may affect the quality and usefulness of scientific findings.[20]

Another challenge relates to the absence of a fully integrated approach towards forensic administration. Different institutions often function according to their own priorities and administrative structures. Although each institution performs an important role, the lack of a coordinated framework may reduce overall efficiency. As

[20] Paul C. Giannelli & Edward J. Imwinkelried, *Scientific Evidence* § 1-1 (6th ed. 2016).

forensic evidence becomes increasingly central to criminal investigations, improving institutional coordination has become an important policy concern.

B. Uneven Development of Forensic Facilities Across States

The development of forensic infrastructure in India has not occurred uniformly across all regions. While some States have invested considerably in forensic laboratories, specialised units, and scientific resources, others continue to face limitations in infrastructure and professional capacity.[21] This uneven development creates differences in the quality and speed of forensic support available to investigating agencies.

The consequences of these disparities become particularly significant in serious criminal cases. Investigators operating in regions with limited forensic resources may face greater difficulty obtaining timely scientific examination. Evidence may need to be transported over long distances, and laboratories serving large populations may experience heavier workloads than they are capable of handling efficiently. Such circumstances often contribute to delays that are beyond the control of individual investigators or courts.

The issue also raises broader concerns regarding equality within the criminal justice system. Access to scientific investigation should not depend upon the geographical location in which an offence occurs. However, differences in institutional capacity may result in varying levels of forensic support across different parts of the country. Addressing these disparities therefore remains an important challenge for policymakers seeking to strengthen forensic services at the national level.

C. Emerging Challenges from Cybercrime and Digital Evidence

The nature of crime has changed significantly over the last two decades, and this transformation has created new demands on forensic institutions. Traditional forms of evidence continue to be important, but investigators are increasingly required to deal with electronic records, mobile devices, online communications, financial transactions, and digital storage systems. Offences involving cybercrime, identity

[21] Bureau of Police Research & Development, *Model Forensic Science Laboratory Manual* 6–12 (2020).

theft, online fraud, ransomware attacks, and digital harassment have become more common and often require specialised forensic examination.[22]

The statutory framework under section 63 of the Bharatiya Sakshya Adhiniyam, 2023 governs the admissibility of electronic records. Section 63 treats a qualifying computer output as a document and requires a certificate to accompany the record each time it is submitted for admission. The certificate must identify the record and its manner of production, provide appropriate particulars of the relevant device, and address the statutory conditions. It must be signed by the person in charge of the computer or communication device, or of the relevant activities, and by an expert. The prescribed Schedule provides Part A for the party and Part B for the expert. The provision therefore connects the evidentiary use of digital material to the availability of competent technical assistance: deficiencies in digital-forensic expertise may delay the authentication and admissibility of crucial electronic evidence. This framework builds on the certification regime under section 65B of the Indian Evidence Act, 1872; in Arjun Panditrao Khotkar v. Kailash Kushanrao Gorantyal, the Supreme Court held that the predecessor certificate was a condition precedent to the admissibility of secondary electronic evidence.

These realities create important policy questions regarding the future direction of forensic services. Investment in traditional laboratory facilities alone may no longer be sufficient. Forensic institutions must also develop the technical capacity required to address new forms of criminal activity. Failure to keep pace with technological developments may create additional delays and reduce the effectiveness of criminal investigations in an increasingly digital environment.

D. Limitations of Existing Reform Measures

In recent years, several efforts have been made to strengthen scientific investigation and improve the use of forensic evidence within the criminal justice system. Legislative reforms, institutional expansion, and growing public awareness have all contributed to greater recognition of the importance of forensic science. The increased

[22] United Nations Office on Drugs and Crime, *Comprehensive Study on Cybercrime* 43–57 (2013).

emphasis placed on forensic examination under recent criminal law reforms reflects this broader shift towards evidencebased investigation.[23]

However, legal reforms alone cannot resolve structural problems within forensic administration. The effectiveness of any reform ultimately depends upon the availability of adequate infrastructure, trained personnel, technological resources, and institutional support. In many instances, expectations regarding the use of forensic evidence have increased more rapidly than the capacity required to meet those expectations.

Another limitation is that reforms often focus on individual aspects of the forensic system rather than addressing broader structural issues. Expanding laboratory facilities, introducing new technologies, or creating additional procedural requirements may improve specific areas of forensic administration, but such measures may produce limited results if they are not supported by a comprehensive and coordinated policy framework. Consequently, despite recent progress, several of the challenges discussed in previous chapters continue to affect forensic services.

E. The Case for a National Forensic Infrastructure Strategy

The issues discussed throughout this article suggest that forensic administration requires a more comprehensive and long-term approach. The challenges facing forensic institutions are not isolated problems but interconnected issues involving infrastructure, staffing, technology, governance, training, funding, and institutional coordination. Addressing one issue without addressing others is unlikely to produce sustainable improvements.

A national strategy focused on forensic infrastructure could provide a clearer framework for future development. Such an approach would allow policymakers to identify long-term priorities, establish common standards, promote uniform growth across different regions, and improve coordination among institutions involved in

[23] Bharatiya Nagarik Suraksha Sanhita, No. 46 of 2023, § 176 (India).

criminal justice administration.[24] It could also assist in balancing the growing demand for scientific investigation with the resources required to support that demand.

The need for such a strategy becomes more pressing as criminal investigations increasingly depend on scientific evidence. The success of modern criminal justice administration is now closely linked to the ability of forensic institutions to provide accurate and timely support. Without sustained policy attention, the gap between demand and institutional capacity is likely to continue widening.

The discussion in this chapter demonstrates that the challenges affecting forensic services extend beyond laboratory shortages or administrative delays. They involve broader questions of governance, planning, institutional development, and long-term policy direction. While recent reforms have strengthened the position of forensic science within the criminal justice system, significant challenges remain unresolved. These realities highlight the need for more comprehensive reforms aimed at strengthening forensic capacity and reducing delays throughout the criminal process. The final chapter therefore proposes a set of recommendations designed to address these concerns and improve the effectiveness of forensic services in India.

VIII. RECOMMENDATIONS AND CONCLUSION

A. Recommendations

The findings of this study indicate that strengthening forensic infrastructure should become a priority within criminal justice reform. While India has made considerable progress in promoting scientific investigation, the increasing dependence on forensic evidence has exposed significant gaps in institutional capacity. One of the most important measures required is the expansion of forensic laboratory infrastructure across the country. Existing laboratories in many regions are required to handle large numbers of cases, often beyond their available capacity. Establishing additional regional laboratories and strengthening existing facilities can help reduce the pressure on overburdened institutions and improve access to forensic services. Such expansion

[24] National Human Rights Commission, *Quality Assurance in Forensic Science Laboratories: Issues and Challenges* 20–29 (2019).

should not be limited to major urban centres alone. It is equally important to ensure that forensic facilities are available in regions where investigators currently face difficulties in obtaining timely scientific assistance. Better geographical distribution of forensic resources can contribute significantly to reducing delays in criminal investigations and trials.[25]

Alongside infrastructure development, greater attention must be given to human resource capacity. Scientific investigation ultimately depends on the knowledge and skills of forensic professionals. Laboratories cannot function efficiently if there is a shortage of trained experts capable of examining evidence and preparing reports. The growing demand for DNA analysis, cyber forensic examination, digital evidence recovery, toxicology, and other specialised services require continuous investment in education and professional training. Recruitment processes should be strengthened, and opportunities for specialised training should be expanded through collaboration with academic institutions and forensic training centres. Continuous skill development is particularly important because forensic science is a rapidly evolving field that requires professionals to adapt to new technologies and investigative techniques.[27]

Another important recommendation relates to technological modernisation. Modern criminal investigations increasingly involve electronic devices, online communication platforms, financial technology, and digital data. As a result, forensic institutions require advanced equipment and specialised software capable of dealing with these forms of evidence.

Investment in digital forensic laboratories, DNA facilities, automated case management systems, and emerging scientific technologies can significantly improve efficiency and reliability. At the same time, technological development should be accompanied by regular maintenance, quality assurance measures, and professional

[25] Bureau of Police Research & Development, *Model Forensic Science Laboratory Manual* 24–28 (2020). [27] National Forensic Sciences University Act, No. 32 of 2020 (India).

training to ensure that resources are used effectively. Modernisation should therefore be viewed as an ongoing process rather than a one-time institutional reform.[26]

Reducing delays in forensic examination should also receive focused policy attention. One of the recurring concerns identified throughout this study is the growing backlog of cases awaiting scientific analysis. Delays in forensic reporting affect investigations, prosecutions, and court proceedings, creating consequences that extend beyond the laboratory itself. Addressing this problem requires a combination of infrastructure expansion, additional staffing, improved case management practices, and better allocation of resources. Policymakers may also consider establishing administrative mechanisms for monitoring pending cases and identifying areas where delays are particularly severe. Such measures can help ensure that forensic reports are produced within reasonable timeframes and reduce their contribution to overall criminal justice delays.[27]

The effectiveness of forensic science also depends on cooperation among different institutions involved in the criminal justice process. Police authorities, forensic laboratories, prosecutors, medical professionals, and courts all contribute to the handling of scientific evidence. Weak communication or procedural gaps between these institutions can reduce efficiency and create avoidable delays. Greater coordination can be achieved through integrated evidence management systems, standardised procedures, regular training programmes, and improved information sharing mechanisms. Strengthening institutional cooperation is important because forensic evidence passes through several stages before reaching the courtroom, and weaknesses at any stage can affect the overall process.[28]

Finally, the challenges discussed throughout this article highlight the need for a broader and more comprehensive policy approach. Many of the existing problems arise not from a single institutional weakness but from a combination of infrastructure

[26] United Nations Office on Drugs and Crime, *Crime Scene and Physical Evidence Awareness for Non-Forensic Personnel* 17–24 (2009).
[27] Directorate of Forensic Science Services, Ministry of Home Affairs, Government of India, *Annual Report 2022– 23*.
[28] Paul C. Giannelli & Edward J. Imwinkelried, *Scientific Evidence* § 1-1 (6th ed. 2016).

shortages, staffing limitations, technological constraints, and coordination difficulties. For this reason, a long-term national strategy focused on forensic infrastructure may provide a more sustainable solution. Such a framework can establish common standards, encourage uniform development across States, promote quality assurance, and support future planning. As scientific evidence continues to play a larger role in criminal investigations, the development of a coordinated national approach becomes increasingly important for ensuring that forensic institutions remain capable of meeting future demands.[29]

B. Conclusion

The role of forensic science within the criminal justice system has expanded considerably over the last few decades. Scientific methods now influence many stages of criminal investigation and prosecution, making forensic evidence an important component of modern justice administration. Recent legal reforms and growing reliance on scientific investigation demonstrate the increasing confidence placed on forensic methods. However, the effectiveness of forensic science depends not only on scientific techniques but also on the institutional capacity available to support them. This study has shown that significant deficiencies continue to affect forensic infrastructure in India. Shortages of laboratories limited human resources, technological constraints, case backlogs, and coordination challenges have created difficulties for institutions responsible for scientific examinations. These deficiencies do not remain confined to forensic laboratories alone. Their effects extend to investigations, prosecutions, court proceedings, and ultimately the timely delivery of justice. Delays in forensic examination frequently contribute to delays in criminal trials, making forensic infrastructure an important factor in the broader discussion on criminal justice reform.

The article further demonstrates that addressing delays in criminal trials requires attention not only to judicial efficiency but also to the institutions that support criminal investigations. As the use of scientific evidence continues to expand, the demand

[29] National Human Rights Commission, *Quality Assurance in Forensic Science Laboratories: Issues and Challenges* 20–29 (2019).

placed on forensic services is likely to increase further. Unless corresponding improvements are made in infrastructure, staffing, technology, and institutional coordination, existing challenges may become more pronounced in the future. Forensic science has the potential to improve accuracy, strengthen fairness, and enhance public confidence in the criminal justice system. However, these benefits can only be fully realised when forensic institutions possess the capacity required to perform their functions effectively. Strengthening forensic infrastructure should therefore be viewed not merely as a technical or administrative objective but as an essential step towards ensuring timely justice, protecting procedural fairness, and strengthening the overall credibility of the rule of law in India.

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