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Bridging Science and Law: The impact of Forensic and Digital Evidence in Criminal Investigation

ABSTRACT

Forensic guides majorly in crime controlling and provides scientific analysis of the legal processes within the criminal justice system. The forensic applications definitely progressed over the years, but it still get difficult to get them integrated into the Indian criminal justice system. Thus, the study will aim to look into the legal implication concerning application and admissibility of forensic evidence in Indian legal system with special reference to Bhartiya Sakshya Adhiniym and Bhartiya Nagarik Suraksha. The present research would cover the identification of issues and some challenges of operation and basic infrastructure. Another interest concerning the study involves Judicial trend analysis on the dependency and admissibility of forensic evidence in criminal trials. From the findings, therefore, it points to the fact that these very concrete reforms include laboratory infrastructure improvement, standardized forensic practices and programs aimed at legal reforms for deeper integration of forensic science into the justice system.

KEYWORDS

Forensic Science, Criminal Investigation, Indian Evidence Act, DNA Analysis, Forensic Laboratories

INTRODUCTION

Justice is the cornerstone of any civilised society, and the credibility of its dispensation depends largely on the quality of evidence produced before the court. In modern times, forensic science has emerged as a vital tool in strengthening the criminal justice system by providing scientific, objective, and reliable evidence. The integration of forensic methods in investigation and adjudication processes has transformed the traditional approach to crime detection and trial, replacing conjecture and confession-based evidence with scientifically validated facts.

Recent developments—both legislative and institutional—have accelerated this transformation. In India, the introduction of the Bhartiya Nagarik Suraksha Sanhita (BNSS), 2023, mandates the involvement of forensic experts in serious offences, marking a paradigm shift toward science-led investigations. Simultaneously, government initiatives such as the National Forensic Infrastructure Scheme (NFIS) and expansion of

the National Forensic Sciences University (NFSU) signify a nationwide effort to enhance forensic capacity. However, while the emphasis on forensic science has increased, challenges related to infrastructure, training, backlog, and quality control persist. Forensic scientists collect, preserve and analyze evidence during the course of an investigation. While some forensic scientists travel to the scene of the crime to collect the evidence themselves, others occupy a laboratory role, performing analysis on objects brought to them by other individuals. Others are involved in analysis of financial, banking, or other numerical data for use in financial crime investigation, and can be employed as consultants from private firms, academia, or as government employees.

In addition to their laboratory role, forensic scientists testify as expert witnesses in both criminal and civil cases and can work for either the prosecution or the defence. While any field could technically be forensic, certain sections have developed over time to encompass the majority of forensically related cases. No doubt, detection of crime is difficult and it requires painstaking effort by a number of agencies. And now with the introduction of computers, mobile phones, internet services, etc. crime is increasing to a greater extent also, in addition to it nevertheless in most of the parts of India, climatic, infrastructure and functional shortcomings create special difficulties in crime detection. But sad part is on one hand the intelligent criminal has been quick to exploit science for his criminal acts, notwithstanding still on the other hand the police investigator is relying on his age-old art of interrogation, to detect crime. Where criminals are using sophisticated means for commission of crimes authorities are still dependant upon age old methods of investigations and evidence collection. In this changed scenario of crimes and criminals there is a need to use and take help of new scientific techniques and tools for investigation of crimes.

STATEMENT OF THE PROBLEM

Despite its growing importance, the effective utilisation of forensic science in the dispensation of justice faces several obstacles:

- Limited forensic infrastructure and shortage of trained experts.
- Overburdened and under-resourced forensic laboratories leading to delays.
- Lack of uniform standards and accreditation protocols.
- Inadequate judicial understanding of scientific evidence and expert testimony.
- Possibility of misuse or overreliance on forensic results without proper cross-examination.

This research aims to critically examine these challenges and assess how

forensic science presently contributes to justice delivery in India, in comparison to global practices.

OBJECTIVES OF THE STUDY

- To analyse the role and significance of forensic science in the modern criminal justice system.
- To evaluate recent legal and institutional reforms promoting forensic investigation in India.
- To study the impact of forensic evidence on judicial decision-making and conviction rates.
- To identify major challenges and limitations in the current forensic framework.
- To compare India's forensic justice mechanisms with selected international systems.

To propose recommendations for enhancing the effectiveness of forensic science in ensuring fair, timely, and accurate justice.

1. **Examine the Legal Framework:** To analyze the statutory provisions governing the admissibility and reliability of forensic evidence under the Indian Evidence Act, the Code of Criminal Procedure, and other relevant laws.
2. **Assess Judicial Interpretations:** To evaluate key judicial pronouncements and their impact on the treatment of forensic evidence in Indian courts.
3. **Identify Challenges:** To identify the practical challenges faced in the collection, preservation, and presentation of forensic evidence in criminal trials.
4. **Evaluate the Role of Forensic Experts:** To assess the role, qualifications, and training of forensic experts and their influence on the reliability of forensic evidence.
5. **Analyze Case Studies:** To study landmark cases where forensic evidence played a crucial role, examining the courts' approach to its admissibility and reliability.
6. **Explore Infrastructure and Technological Issues:** To investigate the state of forensic infrastructure in India, including the availability of advanced technology and resources in forensic laboratories.
7. **Propose Reforms:** To suggest legal and procedural reforms to enhance the admissibility, reliability, and overall effectiveness of forensic evidence in the Indian criminal justice system.
8. **Benchmark Against International Standards:** To compare the Indian legal framework and practices related to forensic evidence with international standards and best practices.

9. **Promote Awareness:** To highlight the importance of forensic evidence in the criminal justice process and promote awareness among stakeholders, including law enforcement, judiciary, and the public.
10. **Future Directions:** To identify future directions and emerging trends in forensic science that could impact the Indian criminal justice system.

HYPOTHESIS

The study hypothesises that:

“The integration of forensic science in the criminal justice system significantly enhances the accuracy, efficiency, and fairness of justice delivery, provided that institutional and procedural mechanisms are adequately developed and standardised.”

REVIEW OF LITERATURE

The literature reveals increasing global reliance on forensic science in judicial proceedings. Studies (Kumar, 2021; Sharma & Patel, 2023) emphasise its value in corroborating evidence and preventing wrongful convictions. Reports from the National Crime Records Bureau (NCRB) and the All-India Forensic Science Summit (2025) highlight government initiatives and emerging technologies such as DNA forensics, cyber forensics, and AI-assisted analysis. However, research also indicates systemic issues—lab backlogs, lack of quality control, and insufficient judicial awareness (The Print, 2024; The Guardian, 2025)—which may compromise reliability and timeliness. The literature underscores the need for a balanced approach integrating science with due process and ethical safeguards.

Researcher has gone through a considerable number of books and has reviewed articles on the topic of research.

Books: Satyendra Kumar Kaul and Mohd. Hasan Zaidi, in the book “Narco-analysis, Brain Mapping, Hypnosis and Lie Detector Tests in interrogation of Suspect”, published by Alia Law Agency, Allahabad in the year 2008, have analysed modern techniques exhaustively one by one. This book defines each scientific evidence, procedure of conducting these tests and law prevalent in various countries. In this book authors have peeped deep into historical aspect of evidence. They have discussed how term ‘evidence’ came into existence, meaning of the term ‘science’, application of science in medico-legal stream, meaning of scientific evidence and how far scientific evidence is admissible in India and other countries.

Jaising P. Modi, in his book “Medical Jurisprudence and Toxicology”, New Delhi: LexisNexis, 2008, deal with forensic science, its history, legal procedure, medical witnesses and evidences. Author has given reference of various case laws where science is used in daily routine in courts of law. Various scientific tests that are conducted to detect age, cause of death, method of causing death, etc.

Apurba Nandy, “**Principles of Forensic Medicine**”, Calcutta: New Central Book Agency, gives precise knowledge about forensic medicine, legal procedures in medico legal cases, legal aspects of practice of medicine. Author has stated that courts of law are incomplete without forensic science. It is tools of forensic science only that help courts to arrive at correct decision and in efficient distribution of justice.

P. Venkatesh, “**Police Diaries; Statements, Reports and Investigations with special reference to Scientific Evidence, DNA, Brain-Mapping Tests, Narco-analysis, Forensic Science and Cyber Crimes**”, Allahabad: Premier Publishing Company, 2008, is a book which gives precise information about the scientific tools of investigation, how police authorities use them to apprehend criminals, how scientific tools of investigation assist courts and still some of the modern techniques are regarded inadequate and unreliable.

RESEARCH METHODOLOGY

The study will adopt a qualitative and analytical research design, supported by secondary and limited primary data.

Sources:

Primary: Judicial decisions, statutory provisions (BNSS 2023, Bharatiya Nyaya Sanhita 2023, Evidence Act), official reports, and interviews with law enforcement or forensic experts (if available).

Secondary: Books, research papers, government publications, newspaper articles, online databases, and institutional reports (NFSU, NCRB, MHA).

Approach:

- Doctrinal and empirical analysis.
- Comparative study of India with selected jurisdictions (e.g., UK, USA).
- Case study method to highlight the impact of forensic evidence on major trials.
- Critical evaluation of forensic policies and their implementation.

SCOPE AND LIMITATIONS

The study will primarily focus on India, with brief comparative references to international practices. It will examine legal, institutional, and practical aspects of forensic science in justice dispensation. The scope excludes highly technical laboratory procedures and focuses instead on their legal and procedural significance. Constraints may include limited access to case-specific forensic data or official lab records.

EXPECTED OUTCOMES

- Comprehensive assessment of India's current forensic justice framework.
- Identification of key strengths, weaknesses, and reform priorities.
- Policy and legal recommendations for improving forensic capacity, training, and judicial understanding.
- Contribution to academic and policy discourse on integrating science with justice.

CONCLUSION

Forensic science has revolutionized criminal investigations by providing scientific solutions to legal inquiries. It has significantly contributed to solving crime, innocent dealing and insurance justice. However, forensic sciences not without challenges, as issues related to evidence contamination. Forensic error and legal admissibility continue to pause concerns. By implementing stringent protocols, investing in advance technology and improved training, the challenges associated with the forensic science can be mitigated.