
FORENSIC EVIDENCE AND CRIMINAL JUSTICE IN INDIA: ASSESSING RELIABILITY, ADMISSIBILITY AND EVIDENTIARY VALUE UNDER THE CONTEMPORARY INDIAN LEGAL FRAMEWORK

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ABSTRACT

Forensic evidence has become an important part of criminal investigations and court cases in India. DNA analysis, fingerprints, forensic toxicology, ballistics, checking documents and digital evidence can help courts understand what happened and connect people, things and places. However forensic evidence is not the same as being completely correct. Mistakes can happen because of things like getting samples mixed up not taking samples people making biased choices using bad methods not writing down details properly not checking if methods work not keeping track of evidence properly lab mistakes and saying more than is true. So, the legal question is not just if forensic science is helpful. If a specific forensic result is important allowed in court scientifically correct and strong enough for the situation in the case.

This paper looks at the legal rules about forensic evidence focusing on the change from the Indian Evidence Act, 1872 and the Code of Criminal Procedure 1973 to the Bharatiya Sakshya Adhiniyam, 2023 (BSA) and the Bharatiya Nagarik Suraksha Sanhita, 2023 (BNSS). It looks at what experts say under Section 39 BSA facts that affect the opinions of experts, electronic and digital evidence under Sections 61–63 BSA, the requirement for forensic investigation under Section 176(3) BNSS and reports from government scientists under Section 329 BNSS. The paper also looks at how Indian courts deal with evidence DNA, fingerprint evidence, digital evidence, scientific techniques and the chain of custody.

The study says that Indian law has made protections through laws and court decisions but still doesn't have one full rule for checking if evidence is reliable like the Frye or Daubert rules in the United States. So, the right way for India should mix rules about being relevant and allowed in court with judges checking if the expert is good if the method is correct if it has been tested, if there are errors if quality is good if the chain of custody is correct and if the conclusion is limited. The paper suggests changes like making sure labs are approved checking if people are good, at their jobs having checks

sharing information letting the defense see forensic evidence managing crime scenes training experts and making reports clear.

Keywords: Forensic Evidence; Expert Opinion; Bharatiya Sakshya Adhiniyam, 2023; BNSS, 2023; DNA Evidence; Digital Evidence; Chain of Custody; Reliability; Admissibility; Criminal Justice.

1. Introduction

The modern criminal justice system is using more scientific methods to find, keep and understand evidence. Forensic science can link a person to a place figure out who someone is find what substances are involved understand injuries look at body materials and get information from devices that store data. The appeal of this is that it can take the place of or help with what people remember, which is not always clear. But the word “scientific” brings with it a risk: courts might trust a result just because it came from a lab or an expert.

The main problem is whether the results are trustworthy. A forensic result might be made correctly. Still be affected by bad samples getting mixed up not enough checks, wrong tools, methods that are not tested bias from the situation or problems in how it is understood. Just because there is high-tech tools does not mean the result is trustworthy. The legal system must look at both the result and how it was reached.

The original version of this study rightly pointed out reliability being able to repeat results, who had control of the items expert proof, DNA, fingerprints, guns, poison, medical exams, computer data and how labs work as issues. The laws that go with it needed a lot of change because Indias rules about evidence and how to handle criminal cases changed on July 1 2024. The new look at this must put the Bharatiya Sakshya Adhiniyam, 2023. Bharatiya Nagarik Suraksha Sanhita, 2023 in the middle of the legal talk.

This paper looks at proof as a place where science and law meet. It asks if Indian law has created rules, for using and checking forensic proof; if the new laws help with forensic work; and what kinds of protection are needed to stop wrong decisions without stopping the use of scientific proof.

2. Research Methodology

This study uses a legal research approach and adds an interdisciplinary look at forensic science

reliability. The main legal materials are the Constitution of India the Bharatiya Sakshya Adhiniyam of 2023 the Bharatiya Nagarik Suraksha Sanhita of 2023 the Criminal Procedure (Identification) Act of 2022 the Information Technology Act of 2000 and relevant court decisions. Other materials include science books, laboratory quality rules, institutional guidelines and comparative studies.

The method is mainly analytical, then empirical. The paper does not claim to measure the error rate of Indian forensic laboratories. Instead, it examines the outcomes of reliability concerns and checks whether the existing laws and court decisions can address those concerns.

2.1. Research Questions

1. What is the contemporary statutory framework governing the admissibility and evidentiary value of forensic evidence in India?
2. How do Indian courts assess the expertise, methodology, reliability and probative value of forensic opinion?
3. Does Indian jurisprudence provide a reliability threshold comparable to Frye or Daubert, or has it developed a distinct approach?
4. What legislative, institutional and procedural reforms are required to ensure that forensic evidence assists rather than distorts the administration of criminal justice?

2.2. Objectives

- To examine the statutory framework governing forensic evidence under the BSA and BNSS.
- To analyse leading judicial decisions on expert, DNA, fingerprint, electronic and scientific evidence.
- To examine reliability, reproducibility, contamination and chain-of-custody concerns.
- To distinguish relevance, admissibility, reliability and evidentiary weight.
- To identify institutional weaknesses affecting forensic services in India.

- To propose legal, procedural and institutional reforms.

2.3. Hypothesis

Even though the BSA and BNSS do strengthen the integration of forensic science into India's criminal justice system there is still no single comprehensive statutory reliability framework. The lack of a statutory reliability framework is made worse by problems, in validation, quality assurance, chain of custody and forensic infrastructure. These gaps keep putting risk on the accuracy and fairness of adjudication.

3. Historical Evolution of Forensic Science in India

Forensic science in India grew slowly over time starting with identification and medico-legal work. It gradually transformed into a system of specialized labs and scientific support services. One major step came during the era when fingerprint identification became official. The creation of the Calcutta Police Central Fingerprint Bureau in 1904 marked a moment in this development. Later new areas emerged such as chemical testing, serology, forensic pathology analysis of questioned documents, firearms examination and more advanced biological and digital techniques.

This historical path matters because on the legal system mainly dealt with forensic evidence through expert testimony. As the science improved the focus shifted. Of questioning whether science could be used in court people began asking whether a particular method, lab process or conclusion was trustworthy. So today's discussion is not about bringing science into the courtroom but about how to manage its quality.

At the time the growth of forensic science has brought practical problems. Advanced methods need workers, tested procedures proper tools, strict quality checks and quick handling. A law that demands science won't work if the system can't reliably collect, protect, analyze and report evidence. That means the new BNSS requirement, for crime scene forensics makes infrastructure not an administrative issue but a legal necessity.

4. Nature and Classification of Forensic Evidence

Forensic evidence can be thought of as evidence that comes from technical analysis of things like biological samples, fingerprints, physical marks, firearms, tools, drugs, poisons, injuries,

documents, audio-visual recordings and data from computers or phones. These are all types of material or digital traces connected to an event being investigated.

4.1. Relevance, Admissibility, Reliability and Weight

There are four ideas that need to be kept separate. Relevance asks if the evidence is connected to a fact that matters in the case. Admissibility asks if the law allows the court to accept and look at this evidence. Reliability looks at how trustworthy the science or method used to get the result really is. Probative value is about how strong the evidence's in supporting a claim when you consider it along with everything else in the case.

So, an item might be allowed into court even if it's not very strong. It could be relevant but based on something that's not dependable. It might be scientifically solid but still not enough by itself to prove someone is guilty.

This difference is especially important when dealing with evidence. Experts don't decide if someone is guilty or innocent. They provide knowledge and opinions based on their training and experience. The final decision, about what the opinion means and how it fits with all the evidence stays with the court.

5. Contemporary Statutory Framework

5.1. Bharatiya Sakshya Adhiniyam, 2023

The Bharatiya Sakshya Adhiniyam 2023 is now the legal framework for evidence. The old Indian Evidence Act 1872 should be used for comparing history and for understanding older court decisions. The Bharatiya Sakshya Adhiniyam became effective on 1 July 2024. The Bharatiya Sakshya Adhiniyam structure clearly deals with opinion and with modern electronic and digital records.

5.2. Expert Opinion under Section 39 BSA

Section 39 BSA gives the legal basis for expert opinion. Section 39 BSA recognises opinions of people who're specially skilled in science, art, foreign law or specialised fields. Section 39 BSA also covers handwriting, finger impressions and the opinion of the Examiner of Electronic Evidence. This Section is central to evidence because most forensic conclusions come to court

through expert opinion.

The legal recognition of opinion does not make the experts conclusion final. The court must examine the qualifications and expertise of the witness the material examined the method used, the quality of the underlying data the reasoning process and the extent to which the conclusion is supported by established principles. The difference between admissibility and weight must stay clear.

5.3. Facts Bearing upon Expert Opinion and Grounds of Opinion

The Bharatiya Sakshya Adhiniyam also keeps the structure where facts that relate to expert opinion and the grounds of an opinion may become important. This is important because an experts conclusion cannot be separated from the facts and methods that it is based on. Courts should therefore be able to examine not the last sentence of a report but also the material, observations, assumptions and analytical steps that produced that conclusion.

5.4. Electronic and Digital Evidence: Sections 61–63 BSA

Sections 61–63 BSA set up the framework for electronic and digital records. Section 61 stops an digital record from being denied admissibility simply because it is electronic or digital. Section 63 sets conditions for admissibility and includes a certification framework. The statutory Schedule specifies the certificate structure, which includes identification of the record device details and relevant technical information.

Digital evidence has a reliability problem because digital data can be copied, altered, deleted or changed while leaving only small visible signs. The legal response therefore requires focus on acquisition methods keeping data safe forensic imaging, hash verification, documentation, device identification, access controls and examination logs. Certification should be seen as one safety measure inside a forensic process not as a replacement for proper acquisition and preservation.

5.5. Bharatiya Nagarik Suraksha Sanhita, 2023

The Bharatiya Nagarik Suraksha Sanhita brings a forensic-investigation element. Section 176(3) allows a forensic expert to visit the crime scene in serious offences and to record the process on video subject to the statutory implementation framework. This is a policy change

because forensic science is now brought closer to the start of the investigation instead of being treated only as a laboratory task after collection.

The practical importance is large. Early forensic participation can reduce contamination improve documentation identify exhibits and make sure that collection follows the rules for later scientific examination. At the time the success of this provision depends on having trained crime-scene personnel, laboratories, transport, equipment and timely examination.

5.6. Government Scientific Expert Reports under Section 329 BNSS

Section 329 BNSS gives a framework for reports from certain government scientific experts. This provision continues the role that was earlier in Section 293 of the Code of Criminal Procedure. Government scientific reports can therefore have an evidentiary role but the court still has the power to require examination of the expert if needed.

The provision must not be seen as turning every government laboratory conclusion into proof.

5.7. Other Relevant Statutes

The Criminal Procedure (Identification) Act 2022 is relevant to identification records and measurements including forms of identification. The Information Technology Act, 2000 still matters for offences and electronic systems although questions about records are now mainly handled by the Bharatiya Sakshya Adhiniyam.

Constitutional guarantees, Article 21 give the general framework that guides investigation, evidence collection and criminal adjudication.

6. Judicial Approach to Expert and Forensic Evidence

Courts have long treated expert evidence as opinion evidence, not as an automatic replacement for judicial reasoning. The Supreme Court has repeatedly stressed that expertise must be shown and that expert opinion must be examined based on its basis reasoning and consistency, with the evidence.

6.1. State of Himachal Pradesh. Jai Lal

In State of H.P. V. Jai Lal, (1999) 7 SCC 280 the Supreme Court explained what expert

evidence is and that it needs knowledge or skill. The case shows that expertise depends on the situation and that the court must look at the opinion of simply accepting it. The decision should be an authority in any Indian discussion of forensic expert evidence.

6.2. S. Gopal Reddy v. State of Andhra Pradesh

S. Gopal Reddy v. State of A.P. (1996) 4 SCC 596 is important for the idea that expert evidence's only an opinion and does not bind the court. The court must check the reliability of evidence on its own and see how it fits with other evidence. This rule stops words from taking over the court's role.

6.3. Ramesh Chandra Agrawal v. Regency Hospital Ltd.

Ramesh Chandra Agrawal v. Regency Hospital Ltd., (2009) 9 SCC 709 gives guidance about expert opinion the qualifications needed and the role of specialised knowledge. It reinforces that the court must check the competence and basis of testimony instead of assuming that the word "expert" makes it final.

6.4. Scientific Evidence and the Risk of Overstatement

A recurring judicial concern is the danger of overstatement. A forensic examiner may say that a sample matches a source strongly supports an association or rules out a source. That does not necessarily mean that the result is certain. Courts should be careful.

7. DNA Evidence

DNA profiling is one of the forensic tools that police can use. It can link material to a person rule out people identify remains and help rebuild events. Its power however depends on the quality of the sample how the sample was collected, controls for contamination the lab methods, how the data is interpreted and how the biological material matters to the case, in front of the court.

7.1. Pattu Rajan v. State of Tamil Nadu

Pattu Rajan v. State of Tamil Nadu (2019) 4 SCC 771 is important because the Supreme Court recognised the value of DNA evidence while also treating DNA as expert opinion whose evidentiary value must be evaluated in context. DNA should not be treated as an self-executing

form of proof. The court must consider how the DNA sample was obtained, examined and connected with the alleged offence.

Manoj v. State of Madhya Pradesh (2023) 2 SCC 353 is particularly significant for quality and reliability in DNA analysis. The case highlights the importance of handling, contamination safeguards and meaningful scrutiny of DNA evidence. For a forensic-law paper it provides a bridge between scientific reliability and fair-trial concerns.

7.2. DNA and Chain of Custody

DNA evidence is highly sensitive to contamination and substitution. The chain of custody must therefore identify the DNA sample the person collecting it the time and place of collection, packaging and sealing, transfers, laboratory receipt, storage conditions, examination and subsequent handling. A strong DNA profile cannot cure an unreliable chain of custody. The evidentiary question is not simply whether the laboratory obtained a DNA profile but whether the court can confidently connect that DNA profile to the material collected from the place or person.

7.3. Statistical Interpretation

The presentation of DNA results also requires care. A match probability or likelihood statistic does not automatically equal the probability that the accused committed the offence. The court must avoid the prosecutor's fallacy. Must understand what the statistic actually measures. Expert reporting should therefore explain the proposition in accessible language and avoid absolute claims where the underlying methodology supports only probabilistic conclusions.

7.4. Fingerprints and Identification Evidence

Fingerprint examination remains an identification technique. It involves comparison of friction-ridge detail between questioned and known impressions. Although fingerprints have a history of forensic use legal reliability should not be based solely on the assumption that a technique is traditional. Courts should remain attentive to quality of the impression examiner competence, comparison methodology, documentation and the possibility of confirmation bias.

Mohd. Aman v. State of Rajasthan (1997) 10 SCC 44 is relevant to the treatment of fingerprints and the importance of proper procedure in obtaining and using specimen impressions.

Fingerprint evidence should be presented as identification evidence with the experts reasoning and the quality of the comparison available, for scrutiny.

Modern automated fingerprint systems can assist examiners but automated outputs should not be treated as independent proof of guilt. The systems database, limitations, quality thresholds and human verification process may all affect the reliability of the result.

8. Ballistics and Toolmark Evidence

Forensic firearms examination can look into questions about cartridge cases, bullets, firearms, firing mechanisms, shooting distance and other features of a firing event. Toolmark examination also looks at marks made by tools or mechanical processes. These areas can provide a lot of information but often require examiners to make interpretative judgments. The court should therefore look closely at the method used the quality of the test materials the examiners skills, the documentation and how strongly the conclusion is supported by the evidence.

A big legal issue is the urge to say a personal comparison is an identification. A report that is scientifically sound should explain the limits of the method. Should separate what is seen as similar, from the final legal decision. When an examiner's opinion is mostly based on experience it is especially important to have cross-examination.

9. Forensic Toxicology and Pathology

Forensic toxicology examines drugs, alcohol, poisons and other substances in biological material. Forensic pathology addresses cause, mechanism and manner of death, together with interpretation of injuries and post-mortem findings. Both disciplines illustrate the importance of contextual interpretation. A detected substance does not necessarily establish that the substance caused death; concentration, tolerance, timing, post-mortem redistribution, medical history and other findings may all matter.

Similarly, a pathologist's conclusion concerning cause and manner of death is an expert opinion. The court must distinguish between the medical findings and the legal inference to be drawn from those findings. Where toxicology and pathology interact, communication between disciplines and transparent reporting become essential.

10. Digital Forensics and Electronic Evidence

Digital evidence is now central, to criminal investigations. In my view digital evidence can be found on phones, computers, cloud services, messaging platforms, CCTV systems, GPS data, social-media material and network records. These sources may hold evidence of identity, communication, location, timing and conduct. The sheer volume and mutability of evidence create distinctive evidentiary risks.

10.1. Anvar P.V. v. P.K. Basheer

Anvar P.V. v. P.K. Basheer, (2014) 10 SCC 473, was a foundational Supreme Court decision on the statutory treatment of electronic evidence under the former Evidence Act. It established the importance of the statutory certification framework for electronic records and shaped subsequent litigation concerning electronic evidence.

10.2. Arjun Panditrao Khotkar versus Kailash Kushanrao Gorantyal

Arjun Panditrao Khotkar versus Kailash Kushanrao Gorantyal, (2020) 7 SCC 1 explained the method for handling evidence and the need for a certificate under the old Section 65-B rules. These cases are still important, for knowing how the current Sections 61–63 of the BSA came into being.

10.3. Trustworthiness of Digital Forensic Collection

The BSAs certification system should not be seen as replacing storage. Digital evidence should usually be collected in a way that keeps the condition records the device and the collection process makes sure to create checkable forensic hashes when needed keeps important details stops people from getting into the data without permission and keeps records of all the steps taken. Judges should be very careful when the person presenting the file can't explain where it came from how it was kept safe or the path it followed from the time it was collected.

11. Dimensions and Fair Trial

I believe forensic evidence has a direct constitutional dimension. Inaccurate scientific evidence can lead to conviction while reliable evidence can protect victims and society by strengthening accurate adjudication. Article 21 guarantees a just and reasonable procedure. Therefore Article

21 supports investigation and gives the accused meaningful chances to challenge forensic evidence.

11.1. Selvi v. State of Karnataka

Selvi v. State of Karnataka (2010) 7 SCC 263 shows that scientific availability alone does not make something permissible. The Supreme Court discussed narco-analysis, polygraph and other techniques. These discussions reveal that scientific investigation must follow safeguards, such as protecting personal liberty and preventing testimonial compulsion. I think Selvi v. State of Karnataka is valuable for establishing a principle: forensic innovation must stay within constitutional limits.

11.2. Defence Access and Disclosure

I think fair evaluation of evidence needs meaningful disclosure. The defence within limits should have access, to the forensic report, the underlying material, chain-of-custody documents and other data needed to test the conclusion. If the defence cannot see the foundation of an expert opinion cross-examination may become merely formal. Transparency is therefore part of both reliability and procedural fairness.

12. Chain of Custody

Chain of custody is the documented history of the possession, transfer, storage, examination and handling of an evidentiary item. Although the BSA does not present chain of custody as a single freestanding section titled “chain of custody,” the integrity of forensic evidence is a necessary concern in determining whether the material examined is the same material connected with the investigation and whether contamination or substitution can reasonably be excluded.

A robust chain should record:

- (i) who collected the material;
- (ii) when and where it was collected;
- (iii) how it was packaged;

- (iv) how it was sealed and labelled;
- (v) every transfer;
- (vi) storage conditions;
- (vii) laboratory receipt;
- (viii) examination performed;
- (ix) whether the exhibit was consumed or altered; and
- (x) final disposition. The greater the possibility of contamination or alteration, the more important detailed documentation becomes.

A chain-of-custody deficiency should not be treated mechanically in every case as producing automatic exclusion. Its legal consequence depends on the nature and seriousness of the defect, whether the identity and integrity of the sample can nevertheless be established, and whether the deficiency affects the reliability of the conclusion. The better approach is to analyse the defect and its effect on evidentiary weight and fairness.

13. Reliability, Reproducibility and Error Rates

Reliability is not the same as perfection. A method can be helpful. Backed by science while still having known problems and a chance of making mistakes. Reproducibility is about whether similar steps taken by skilled people can lead to the same results. Validation is about whether the method works for what it is meant to do under certain conditions.

Forensic reports should when it makes sense scientifically share the weaknesses, how well the method has been tested, the ways to keep quality high and any chances of error. Courts should be careful about phrases like “100% sure” “no mistakes,” or “complete identification” unless the science really supports those words. Saying much can turn a helpful expert opinion into wrong information.

13.1. Cognitive and Contextual Bias

Forensic analysis can be affected by information about the person accused a confession a

witness saying they saw something or the plan from the prosecution. This kind of information can change how an examiner sees the evidence without them even realizing it. Rules, like managing the case details having a separate person check the work showing the information one step at a time and comparing without knowing what the answer should be can help lower the chance of biased thinking. Indian forensic policy should focus more on bias as part of making sure the work is good.

14. Frye, Daubert and the Indian Approach

Frye and the United States and Daubert and Merrell Dow Pharmaceuticals Inc. Are American examples about scientific evidence. Frye is connected with acceptance while Daubert asks courts to look at factors like testability peer review, known or possible error rate, standards and controls and general acceptance. These ways of thinking give ideas to compare but should not be seen as laws that Indian courts have completely taken over.

India does not have one law that directly brings in Daubert. Indian courts have instead created a way of looking at things based on the law of evidence. The important questions are about the expert's background, the base of the method the quality of what was looked at the thinking used how it matches what is already known and how the expert's conclusion fits with other evidence.

A better way to compare is to say that Indian court decisions have ideas that might look like parts of Frye and Daubert but do not officially use either test. Not having one law, about reliability does not mean that forensic evidence is not checked. It means that the checking is spread out over laws, court decisions, how evidence is handled and how forensic work is done.

14.1. Proposed Indian Reliability Checklist

1. Is the forensic discipline sufficiently established for the particular purpose?
2. Has the method been validated for the type of sample or question presented?
3. Are relevant error rates or limitations known?
4. Are appropriate controls, standards and quality-assurance procedures in place?
5. Was the examiner adequately trained and competent?

6. Was the sample collected, preserved and examined through a documented chain of custody?
7. Is the report transparent enough to permit meaningful review and cross-examination?
8. Does the conclusion exceed what the underlying data scientifically support?
9. Are alternative explanations addressed where relevant?
10. How does the forensic conclusion interact with the other evidence in the case?

15. Accreditation, Standards and Quality Control

Quality assurance plays an important role in making sure that forensic work is reliable. Accreditation can offer a way for laboratories to show they are competent. It includes things like steps for work control over equipment tests to check skills and good ways to manage everything. The standard called ISO/IEC 17025 is an one for labs. In India NABL accreditation is also a part of the system for lab accreditation.

Accreditation should not be seen as a guarantee that a lab's perfect. A lab can be. Still have problems with a specific test. This can happen if the sample was not taken well if the person doing the test made a mistake if there was something with the sample or if there was something different about the case. Courts should look at accreditation as one sign that a lab's good, but not, as proof that a single result is completely correct.

15.1. Proficiency Testing and Independent Audits

Proficiency testing helps check how well examiners and laboratories are doing by using an evaluation. Regular independent audits can find problems in the system that internal checks might miss. India would do better with clearer proficiency testing programs. These should include steps for fixing issues and regular updates on forensic areas that have different levels of scientific development.

15.2. Crime Scene Management

The new BNSS rules on crime scenes make it more important to follow standard procedures.

Officers at a scene must take notes limit who enters, spot trace evidence stop contamination keep records made at the time and safely hand over items, to the lab. Video recording can help track what happened. It should support written records and evidence logs not take their place.

16. Institutional Challenges in Indian Forensic Science

I believe India's forensic framework cannot succeed through legislation. The law expects investigation but that needs enough labs, trained staff, equipment, transport, storage, digital tools and expert knowledge. If there are delays the evidence can lose its value for biological samples or volatile substances. A backlog can also make forensic science less useful when time is critical. Therefore, a national plan must fix the access that exists between states and districts. It must also. Keep good experts grow lab capacity build crime-scene teams offer ongoing learning, certify work, test skills boost digital forensic capacity and make forensic databases work together. Investing money in forensic infrastructure is a key part of making criminal justice fair and effective.

16.1. Access for the Defence

A reliable system should not operate on the assumption that forensic expertise belongs exclusively to the prosecution. Defence access to independent expert assistance, relevant reports and underlying material can improve accuracy by exposing errors before trial and enabling meaningful cross-examination. Such access is especially important where the forensic conclusion is central to the prosecution case.

17. Emerging Technologies and Artificial Intelligence

The future of evidence will rely more and more on artificial intelligence, machine learning, probabilistic genotyping, automated fingerprint systems, facial recognition, deepfake detection and advanced digital analytics. These tools can speed up work. Make results more consistent.. They also raise fresh questions about how clear the algorithms are, what data they learn from whether they show bias how they are validated how easy they are to explain and how often they make mistakes.

A court should not simply accept a forensic conclusion just because the system gives a number or an automatic classification. The person who uses the AI must be ready to explain the purpose of the AI, how the AI was tested how well it performs what its limits are, how humans keep an

eye on it and how the AI's output ties into the expert opinion.

17.1. Deepfakes and Synthetic Evidence

Synthetic audio, video and images create a growing authentication challenge. Digital forensic examination may be required to study metadata encoding details file history, device origins, compression signs and other clues. The legal system must develop rules that let courts tell the difference, between digital editing and real fabrication without assuming every digital file is either true or false.

18. Comparative Perspective

I think that the American Frye and Daubert frameworks give us a comparison because they clearly explain how scientific validity connects to what can be admitted in court. International laboratory standards look at the issue in another way by focusing on competence, written procedures and quality management. India's current system mixes evidentiary rules, court judgments and institutional standards and it does not run under one single forensic admissibility test.

India does not have to copy Daubert. A statutory framework could ask courts to consider a set of reliability factors while still giving judges flexibility for different forensic disciplines. That framework must remember that DNA, fingerprints, handwriting, toxicology, digital forensics and emerging AI systems do not all share the scientific characteristics.

18.1. The proposed Indian model

First, it checks that evidence is relevant and admissible under the BSA. Second it ensures integrity under the BNSS. Third it uses scientific quality controls such as validation, accreditation and proficiency testing. Fourth it lets judges assess the reliability and weight of the evidence. This layered model fits India's forensic disciplines better, than a single rigid test.

19. Findings of the Study

1. Indian law recognises forensic evidence primarily through expert opinion and specialised statutory provisions rather than through a separate comprehensive forensic-evidence code.

2. The BSA provides a contemporary statutory foundation for expert opinion and electronic/digital evidence.
3. BNSS Section 176(3) represents an important move toward integrating forensic expertise at the crime-scene stage.
4. BNSS Section 329 preserves an important mechanism for using reports of government scientific experts while retaining judicial control over expert examination.
5. Indian courts generally treat expert evidence as opinion evidence and do not permit the expert to replace judicial evaluation.
6. DNA evidence is powerful but must be evaluated in relation to collection, contamination, chain of custody and statistical interpretation.
7. Digital evidence requires particular attention to acquisition, preservation, certification, authenticity and integrity.
8. Chain of custody is an essential component of evidentiary reliability even though it is not contained in a single freestanding statutory provision.
9. India has no single statutory equivalent of the Frye or Daubert tests.
10. Accreditation and quality control are important but do not automatically make every case-specific forensic conclusion correct.
11. Constitutional fair-trial principles require meaningful scrutiny and, where appropriate, disclosure and challenge of forensic evidence.
12. Emerging AI-based forensic systems require transparency, validation and safeguards against algorithmic bias and overreliance.

20. Recommendations and Reform Proposals

20.1. Development of a Statutory Reliability Framework

India should consider creating rules or standards for evaluating scientific evidence either through law or court decisions. These rules do not need to copy the Daubert standard from

another country. They should clearly include factors like validation, testability, error rates, peer review, accepted standards, proper controls and the competence of examiners. They should also take into account whether a method is generally accepted in the community.

20.2. Strengthening Section 176(3) BNSS Implementation

States must set up trained forensic teams at crime scenes. The legal requirement for visits and video recording needs real support—this means having trained staff, proper tools and enough lab capacity. Progress should be tracked using measures such as how quickly teams respond how many items are waiting to be processed and how fast labs finish their work.

20.3. Uniform Chain-of-Custody Protocols

There should be one system for handling evidence from the moment it is collected until it is used in court. All police agencies and forensic labs should follow the procedures. Using records, barcodes or RFID tags can help track each item reduce human mistakes and keep a clear audit trail.

20.4. Mandatory Validation and Proficiency Testing

Forensic labs should keep records showing that their methods have been properly tested and validated. They should also take part in proficiency tests that measure how well they perform. When writing reports labs should point out any limits to what their findings can prove. They should avoid making claims unless the evidence fully supports them.

20.5. Independent Quality Audits

Internal quality checks are important. They should be supported by outside audits done by independent experts. If problems are found, steps to fix them should be written down. Reviewed by someone who does not work for the lab.

20.6. Defence Access and Transparency

When forensic evidence is used strongly against a person accused of a crime the defence should be allowed access to the report the data and all related documents needed to challenge it. This access should be granted within limits that protect privacy and security.

20.7. Specialist Judicial and Investigative Training

Judges, prosecutors, defence lawyers and investigators need training on forensic science. Topics should include how forensic methods work, statistics, cognitive biases, digital evidence and the limits of expert opinions. Better scientific understanding helps courts avoid both rejecting evidences too easily and accepting flawed evidence without question.

20.8. Regulation of AI-Assisted Forensic Evidence

Before relying on intelligence tools in forensic work agencies must make sure these tools are properly tested and validated. There should be performance standards, ways to check how the tool works, full documentation and human oversight. If an algorithm is used to reach a conclusion that conclusion should be open, to scrutiny even if the algorithm is proprietary. The fact that a tool is private does not mean it should be protected from questioning when its results are being challenged.

21. Conclusion

Forensic evidence plays a role in India's criminal justice system but it must be used with care. It can help investigations support witness statements identify people and piece together what happened. Still just because forensic results look scientific does not mean they are always certain. The law needs to make sure that any evidence presented in court is not produced correctly but also relevant collected legally kept safely backed by solid science clearly explained and open to proper review.

The BSA and the BNSS are changes in the legal framework. The BSA updates the rules for opinions and electronic evidence. The BNSS brings science closer to crime scenes and keeps the role of government lab experts strong. These reforms improve the structure. Their real success depends on laboratories that work well trained staff, strong quality control and judges who understand how to evaluate forensic findings.

Indian courts have already built principles through landmark cases like *State of H.P. V. Jai Lal*, *S. Gopal Reddy*, *Ramesh Chandra Agrawal*, *Pattu Rajan*, *Manoj*, *Anvar P.V.*, *Arjun Panditrao Khotkar* and *Selvi*. The way expert evidence is judged today should not simply copy models like *Frye* or *Daubert*. Instead, India is developing its approach—one that checks the qualifications of experts the methods they use the reliability of their results and how useful the

evidence really is.

The goal should be balance. A fair justice system must not reject science just because it is new. Should it accept weak or faulty science just because it comes from a lab. Reliable forensic evidence helps protect victims, catch criminals and stop wrongful convictions. Unreliable forensic evidence can harm people and undermine trust in the system. That is why the rule of law demands a system where innovation goes hand in hand with testing, openness, responsibility, strong quality measures and fairness, under the Constitution.

Table of Cases

Case	Citation	Principal relevance
Anvar P.V. v. P.K. Basheer	(2014) 10 SCC 473	Electronic evidence under the former statutory certification framework.
Arjun Panditrao Khotkar v. Kailash Kushanrao Gorantyal	(2020) 7 SCC 1	Clarification of electronic-evidence certification under the former Evidence Act.
Manoj v. State of Madhya Pradesh	(2023) 2 SCC 353	DNA evidence, quality, contamination and evidentiary evaluation.
Mohd. Aman v. State of Rajasthan	(1997) 10 SCC 44	Fingerprint/specimen identification and procedural safeguards.
Pattu Rajan v. State of Tamil Nadu	(2019) 4 SCC 771	DNA evidence as expert opinion and contextual probative value.
Ramesh Chandra Agrawal v. Regency Hospital Ltd.	(2009) 9 SCC 709	Nature and evaluation of expert evidence.
S. Gopal Reddy v. State of A.P.	(1996) 4 SCC 596	Expert evidence is opinion evidence and is not conclusive.
Selvi v. State of Karnataka	(2010) 7 SCC 263	Constitutional limits on scientific investigative techniques.
State of H.P. v. Jai Lal	(1999) 7 SCC 280	Qualifications, nature and evaluation of expert evidence.

Table of Statutes and Key Provisions

Statute	Provision	Relevance
Bharatiya Sakshya Adhiniyam, 2023	Sections 39–45	Expert opinion, facts bearing on opinion and grounds of opinion.
Bharatiya Sakshya Adhiniyam, 2023	Sections 61–63	Electronic/digital records and admissibility framework.
Bharatiya Nagarik Suraksha Sanhita, 2023	Section 176(3)	Forensic expert at crime scene and videography for specified serious offences.
Bharatiya Nagarik Suraksha Sanhita, 2023	Section 329	Reports of specified government scientific experts.
Criminal Procedure (Identification) Act, 2022	Relevant provisions	Identification records and measurements.
Information Technology Act, 2000	Relevant provisions	Electronic systems and cyber-law context.
Constitution of India	Article 21	Fair, just and reasonable criminal procedure and fair trial.

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- State of H.P. v. Jai Lal, (1999) 7 SCC 280.
- S. Gopal Reddy v. State of A.P., (1996) 4 SCC 596.

- Ramesh Chandra Agrawal v. Regency Hospital Ltd., (2009) 9 SCC 709.
- Pattu Rajan v. State of Tamil Nadu, (2019) 4 SCC 771.
- Manoj v. State of Madhya Pradesh, (2023) 2 SCC 353.
- Anvar P.V. v. P.K. Basheer, (2014) 10 SCC 473.
- Arjun Panditrao Khotkar v. Kailash Kushanrao Gorantyal, (2020) 7 SCC 1.
- Selvi v. State of Karnataka, (2010) 7 SCC 263.
- Mohd. Aman v. State of Rajasthan, (1997) 10 SCC 44.
- ISO/IEC 17025, General requirements for the competence of testing and calibration laboratories.
- National Accreditation Board for Testing and Calibration Laboratories (NABL), relevant accreditation and laboratory guidance materials.
- Government of India, Bureau of Police Research and Development, forensic and crime-scene management guidance.