



THE IMPACT OF FORENSIC EVIDENCE ON CRIMINAL JUSTICE DELIVERY SYSTEM: A SOCIO- LEGAL STUDY IN THE INDIAN CONTEXT

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Abstract

Increasingly, forensic evidence has become an essential instrument for investigation, prosecution, and adjudication in the proper administration of criminal justice in India. Forensic science offers impartiality and accuracy in the gathering, preservation, and interpretation of evidence that conventional oral and documentary evidence typically lack, by applying scientific principles to the process. Integration of forensic evidence into the justice delivery system, on the other hand, is both hopeful and troublesome from the perspective of India. Despite the fact that criminal trials have a stronger basis of evidence as a result of advancements in DNA profiling, fingerprint analysis, digital forensics, and ballistic testing, systemic challenges, such as a lack of awareness among police and the judiciary, a shortage of trained personnel, delays in forensic reporting, and inadequate infrastructure, have impeded the optimal utilisation of these advancements. The study examines the relationship between forensic science and the criminal justice system by using a socio-legal perspective. It emphasises how the use of forensic science can lead to higher conviction rates, fewer wrongful acquittals, and greater public confidence in the criminal justice system. At the same time, the study also expresses concerns about ethical safeguards, privacy, and admissibility standards under the Indian Evidence Act, 1872. The findings of this research emphasise the urgent need for capacity building, modernisation of forensic laboratories, and sensitisation of stakeholders in order to ensure that forensic evidence effectively contributes to fair, efficient, and transparent justice delivery in India. The results were obtained through an analysis of case laws, statutory frameworks, and empirical data.

Keywords: Forensic Evidence, Criminal Justice, System, Socio, Legal

Introduction

A democratic society cannot function without its criminal justice system, which is responsible for maintaining social order, safeguarding individual rights, and preserving the rule of law. The importance of forensic evidence in investigations and adjudications has been brought to light in India due to the increasing complexity of crimes and the societal expectations for quick and equitable justice. With the increasing technical sophistication of crimes and the inherent fallibility of human memory and perception, the traditional reliance on eyewitness testimony, confessions, and circumstantial evidence has frequently been found wanting. Accuracy and credibility are greatly enhanced to the criminal justice system by forensic science, which introduces scientific examination and objective validation procedures. When police use scientific understanding and methods to a criminal investigation, this is known as forensic evidence. It includes many different areas of study, including digital evidence, forensic

psychology, toxicology, ballistics, cyber-forensics, and DNA profiling. The use of forensic science in Indian courts is a social and legal requirement as much as a technological one. It ensures that the delivery of justice advances away from subjectivity and towards objectivity by bridging the gap between science and law. The use of forensic evidence has grown in importance in recent decades, impacting the conviction and acquittal rates as a result of technological advancements. According to the Indian Evidence Act of 1872, oral and recorded evidence have always played a significant role in Indian law. In light of the growing number of cases of wrongfully acquittals and convictions stemming from untrustworthy evidence, the evidentiary framework has progressively evolved to incorporate scientific methods. The use of DNA testing has greatly improved the trustworthiness of investigations in homicide, sexual assault, and paternity cases. Similarly, situations involving cybercrime, financial fraud, or acts of terrorism now heavily rely on digital forensics. In addition, judicial rulings have recognised the value of forensic evidence, citing its function in guaranteeing the honesty and fairness of criminal prosecutions. Forensic science has enormous promise, but there are many obstacles to its widespread use in India. Delays in receiving forensic reports are common due to the country's severe lack of forensic laboratories, modern technology, and qualified staff. There is also a lack of scientifically-based training for investigators and police officers when it comes to the proper handling, preservation, and presentation of forensic evidence. In addition to lowering the efficacy of forensic techniques, these gaps also make them less admissible in court. Prolonged trials are a result of forensic lab backlogs, which weakens the notion of rapid justice. From a socio-legal standpoint, forensic evidence affects more than simply the details; it also affects questions of justice system responsibility, fairness, and trust. When scientific data supports or contradicts human testimony, it leads to more credible outcomes, which strengthens the public's image of justice. But we also need to look closely at the ethical ramifications of surveillance technology, the invasion of privacy during DNA collection, and the possible fabrication or misuse of forensic evidence. To avoid a wrongfully convicted person's conviction, the Indian Evidence Act requires meticulous court examination of forensic results for their admissibility and credibility. Through a socio-legal perspective, this study seeks to investigate how forensic evidence might enhance the delivery of criminal justice in India. The article delves into the ways in which scientific progress has affected the way investigations are conducted, the choices made by judges, and the level of faith that the public has in the legal system. It also draws attention to systemic problems including inadequate infrastructure, inadequate legislation, and a lack of cooperation amongst different government agencies. This paper highlights the critical need for changes to forensic techniques in India by reviewing relevant case law, statutes, and current discussions. India must not fall behind in the use of forensic science in this age of globalisation, when multinational and technologically driven crimes are on the rise. To ensure that forensic evidence successfully contributes to justice delivery, it is important to modernise forensic infrastructure, increase the competence of specialists, revise the laws regarding the admissibility of scientific evidence, and sensitise police, attorneys, and judges. If the Indian criminal justice system is serious about being both fair and efficient, it must integrate scientific knowledge with legal principles while also protecting constitutional rights and human dignity.

While the intersection of law and science is not new, it has grown more important for the efficient administration of justice in the modern era. Forensic science offers a tool to improve credibility, openness, and accuracy in India's criminal justice system, which frequently faces the twin problems of inefficiency and delay. Because it may unite human subjectivity with scientific objectivity, forensic evidence is socio-legally significant. Evidence derived from scientific studies is more trustworthy and

objective than that which has traditionally been relied upon in judicial proceedings, such as eyewitness testimony, confessions, and circumstantial evidence, all of which are susceptible to manipulation or mistake. To keep the judiciary legitimate, this change is more than simply a formality; it reflects the broader social expectation of truth-based justice.

Over time, the criminal justice system in India has come to rely more and more on forensic science. For example, in situations including sexual assault, homicide, and paternity issues, DNA fingerprinting has become an essential tool. Legislative acknowledgement of the growing importance of scientific approaches in judicial proceedings is shown in the introduction of the DNA Technology (Use and Application) Regulation Bill, 2019. One of the first forensic applications, fingerprint analysis is still an essential investigative technique, particularly in cases involving property crimes. At the same time as data from ballistics analyses is crucial in instances involving weapons, cyber-forensics is becoming an important tool in the fight against the proliferation of cybercrimes including cyberterrorism, identity fraud, and online fraud. These developments show how forensic technologies are changing the way judges and investigators work in India.

Full integration of forensic evidence is still far off, despite these advances. Lack of proper infrastructure is one of the main problems. Unfortunately, many of India's licensed forensic laboratories lack the necessary equipment to meet the increasing demand. Trials can drag on for years due to an accumulation of forensic cases, which undermines the right to a quick trial guaranteed by Article 21 of the Constitution, according to reports from the National Crime Records Bureau (NCRB). Additionally, relying on overworked institutions and the rare reporting mistake is caused by a severe lack of qualified forensic specialists. Evidence frequently has to be moved across states due to a lack of regional forensic facilities, which raises worries about contamination, manipulation, and chain of custody.

Historical development and trajectory of forensic science in India

According to the literature, forensic practice in India has expanded steadily over time, starting with the analysis of basic chemicals and fingerprints and progressing to current methods like as DNA profiling, digital forensics, and complicated toxicology. Fingerprinting and serology were adopted into police practice, as documented in early descriptive studies. In addition, evaluations conducted more recently have traced the institutionalisation of DNA procedures and the growing role they have played in investigations and prosecutions. There is a focus in reviews and country-level syntheses that India was among the first countries to implement forensic DNA testing; nonetheless, many of its laboratories continue to struggle to achieve quality and throughput criteria on a worldwide scale. As a result, many laboratories produce extensive backlogs and inconsistent quality among sites.

Legislation, policy instruments and regulatory debate

According to scholars who are evaluating legal frameworks, although the Indian Evidence Act (Sections 45–51) officially acknowledges expert testimony, comprehensive statutory and regulatory tools that are unique to forensic technology have been slow to emerge. The DNA Technology (Use and Application) Regulation Bill, 2019, and the examination of this bill by the standing committee have drawn considerable commentary in the literature on law and policy. This is because the bill proposes to establish a regulatory framework, databanks, and procedural safeguards for the use of DNA in both criminal and

civil contexts. The conflict between the privacy and consent problems that are raised by DNA databanks and the usefulness of DNA databanks for investigative purposes is highlighted by legal experts.

Judicial approach, admissibility and standards of proof

The way in which Indian courts handle forensic evidence is a significant topic that comes up frequently in the literature on the subject. According to Section 45 of the Indian testimony Act, expert testimony is admissible; however, the weight that is given to this evidence is discretionary and differs from one judgement to the next. Forensic reports are treated as determinative by certain courts, but other courts consider them as corroborative, as shown by a number of assessments. Comparative doctrinal studies highlight international methodologies (for example, the U.S. Daubert standard) and make a case for clearer Indian rules to evaluate the scientific validity, methodology, and mistake rates of forensic procedures. The studies indicate that it is not sufficient to depend merely on the credentials of the expert witness. Critiques also call attention to the fact that courts do not sufficiently examine whether or not the methods that are employed in Indian laboratories are legitimate.

Institutional capacity — laboratories, backlogs, human resources

The empirical and policy literature both highlight chronic infrastructural restrictions. These constraints include the lack of accredited forensic labs, the unequal deployment of forensic laboratories across regions, the poor maintenance of equipment, and shortages of forensic scientists and personnel who are trained. Backlogs that obstruct the principle of rapid justice and delay trial procedures have been noted in a number of recent studies and government publications, including NCRB summaries and academic overviews. Policy assessments and field studies suggest that there should be extensive capacity building, decentralisation of forensic services, certification of laboratories, and investment in training for both scientists and police officers who are responsible for investigations. In addition, favourable achievements at the state level—such as training workshops, new laboratories, and mobile forensic vans—have been reported in recent press articles and program descriptions, but they have not been uniform.

Handling, chain of custody, and police practices

The acts of first responders have a significant impact on the forensic value of a situation. There is a significant amount of empirical evidence indicating that inadequate crime scene management, the possibility of contamination, and insufficient chain-of-custody protocols all contribute to a decrease in the reliability of evidence. Training treatments for investigating officers and procedural manuals are frequently proposed in the literature. There have been pilot studies of such training programs, and they have suggested benefits; nevertheless, broader systemic adoption has been restricted.

Socio-legal concerns: privacy, ethics, equality and public trust

A significant body of academic research situates forensic science within the framework of constitutional and human rights debate. Since the Supreme Court's acknowledgement of privacy as a basic right in the historic Puttaswamy decision in 2017, scholars have engaged in a discussion over the legality and boundaries of forced DNA samples, databanks, mass biometric systems, and digital monitoring. The literature highlights the need of balancing forensic imperatives with legality, necessity, and proportionality standards, also known as the Puttaswamy tripartite test. It argues that safeguards, open governance, and independent monitoring are important to minimise mission creep and breaches of rights.

There are a number of normative articles that warn against believing in the infallibility of forensics, which is referred to as the "myth of objectivity," and that urge for greater transparency on mistake rates, statistical interpretation, and the uncertainty of experts.

Empirical studies on impact: convictions, acquittals and miscarriages of justice

There is a lack of quantitative assessments in India that analyse the impact of forensic evidence on conviction rates, and the ones that do exist are frequently localised. The role that DNA and digital forensics play in securing convictions or exonerations has been illustrated by existing studies and case compendia. However, there is a lack of broad, systematic empirical studies that link forensic deployment to case outcomes, speed of trials, or net effects on wrongful convictions. The absence of large-scale mixed-methods studies that are methodologically rigorous is a notable gap in the Indian literature. Instead of relying on high-profile case narratives, causal influence has to be measured through large-scale mixed-methods research.

Application Of Forensic Science In Indian Criminal Justice System

When investigating a crime, the scientific proofs provided by forensic science from evidences gathered at the scene of the crime are invaluable. It shows how the accused, who is really involved in the crime, is an individual. The evidence clearly lays forth the type and components of the crime that was committed. Environmental evidence often provides clues as to when the occurrences occurred. It is possible to pinpoint the exact location of the crime thanks to the forensic evidence. What the offender does is also considered by the forensic investigator. The criminal justice system has benefited from forensic science as a modern tool, but its application must be careful so as not to overstep legal boundaries. Forensic evidence and its admissibility in court became the subject of heated controversy. No one can coerce an accused person into testifying against him in court against his will in India because of the "right of self-incrimination" guaranteed under Article 20(3) of the country's constitution. Here, "the individual is innocent until proven guilty" serves as the fundamental foundation. Only in cases of coercion can the protections provided by Article 20(3) be invoked. A person has the right to refuse to answer any question or provide any document or object if doing so may put them at risk of being convicted of a crime. On the other hand, the court has the power to order the taking of a finger impression of anybody, including the accused, under Section 73 of the Indian Evidence Act. The Supreme Court has determined that requiring someone to provide their fingerprints does not violate the aforementioned constitutional clause, even if it appears to be a breach of Art. (3). A court in *The State of Bombay v. KathiKaluOghad& Others* decided that an offender who provides a specimen of their signature, blood, hair, thumb impression, or semen does not qualify as "being a witness" under the definition in Art. 20(3), which has been the subject of many questions. Thus, the criminal has no grounds to contest the evidence-gathering DNA test. Additionally, narco-analysis was the spark that ignited the controversy. Through the use of narco-analysis, the investigating officer attempts to obtain a statement from a subject while they are in a semi-conscious condition in order to utilise that statement as evidence. However, there are legal and ethical concerns with this technique. There was also concern that this forensic technique violated Art.20 (3). Thus, the validity of narco-analysis, truth serum, lie detector tests, and brain fingerprinting was supported by the High Court of Bombay in the case of *Ramchandra Reddy and Ors. v. State of Maharashtra* 9. The court's decision to reinstate the special court order enabling the SIT to conduct scientific testing on the perpetrator and primary offender in the stamp paper scam case is highly encouraging. The Madras High

Court held in the case of *Dinesh Dalmia v. State* that "obliging an accused person to undergo narco-analysis does not constitute forced testimony." In contrast, the court ruled in *Selvi & Ors v. State of Karnataka & Anr.* that statements made when a person is only partially aware cannot be considered conclusive and that this technique cannot be used in an inquiry. If the investigating officer believes that the accused person would benefit from a medical examination in order to give evidence, he or she can request that the accused person undergo such an examination under Section 53 of the Criminal Procedure Code, 1976. Although swab examinations, DNA profiling, semen tests, blood stains, etc. were authorised in 2005 by an amendment to the criminal process legislation, they were first limited to rape cases. It is well-known that if DNA samples are contaminated due to negligence, they would be useless and the evidence for the case would be ruined, but the key question is whether medical experts are competent enough to collect such samples under Criminal Procedure Code S.164(14), which gives them the authority to examine rape victims within 24 hours. A forensic report is defined as an expert's "belief or opinion" as stated in the Indian Evidence Act of 1872. "An expert is someone who has mastered a particular scientific field or area of competence by extensive study and hands-on experience. This person has spent much time and effort becoming an expert in a certain sector, and as a result, they are well-equipped to offer advice in that area. The main responsibility of the expert witness is to provide the court with all pertinent facts and the reasoning behind his findings. This will enable the court to make a decision based on their own review of the material, even though they do not possess expert knowledge. An expert witness's credibility is wholly dependent on the evidence presented in support of their findings as well as the methods, resources, and equipment that led to those findings. Despite this, the court is free to reject the expert's findings and instead rely on other evidence when making a decision.

IMPACT OF FORENSIC SCIENCE

When it comes to the criminal justice system, forensic science is seen as crucial. Part of this process is looking for clues the criminal may have left behind at the site of the crime. The time, place, and perpetrator of the crime can be better ascertained with its help. It provides evidence on the crime, the offender, and the victims, which is useful for assessing the crime from all angles. More and more criminal investigations and prosecution proceedings rely on forensic evidence gathering, which increases the impact of forensic science because it allows the court and police to move quickly without wasting time on lengthy procedures to determine guilt. Even criminal techniques have evolved throughout the years, as society and technology have progressed at a dizzying rate. This is because criminals look for new ways to commit crimes. Since the offenders typically escape the scene of the crime or even attempt to frame themselves so that the police may capture an innocent person, it becomes exceedingly difficult for the police administration to apprehend the criminal. Thus, it is now fairly feasible to identify the offender using various methods, thanks to the development of forensic science.

Overview of the Criminal Justice System

Shali, (2018) determined that the criminal justice system is a framework for protecting both persons and communities from harm. The Indian government and other authorised bodies draughted it to organise the country's legal system. It aids people in responding correctly to difficult and upsetting acts and behaviours. The Indian criminal justice system is primarily concerned with administration, which is

carried out by the police, courts, prosecution, and prisons. Criminal justice professionals play an essential role in society by preventing, detecting, trialling, adjudicating, and punishing those who break the law. The criminal justice system relies on the courts to determine the offender's level of guilt. Determining the offender's guilt is an involved procedure that relies on facts and proof. When it comes to investigating crimes and gathering evidence against perpetrators, the police are indispensable. So, a safe and tranquil society is provided for as a result of the criminal justice system's efficient investigation and upkeep of law and order. Oral evidence, which includes the testimony of eyewitnesses or anybody else who was physically present at the commission of the crime and has their credibility established under Section 60 of the Indian Evidence Act (IEA) of 1872, is one type of evidence. Section 3 of the IEA 1872 states that the parties may submit documentary evidence to the court in order to aid in the inquiry. Evidence that gives essential information about the incident or event through recorded proofs is considered primary evidence, the highest rated evidence under Section 62 of the IEA. Section 63 of the IEA states that secondary evidence is of lower quality. It is presented in court when main evidence is lacking. The term "real evidence" refers to the tangible artefacts discovered at the crime scene that can be examined under a microscope in court. The weakest kind of evidence is hearsay, which occurs when a witness learns about the crime from someone other than themselves and so has no direct experience with it. Confessions given by criminals are one type of evidence that can be presented to a court as judicial evidence. Confessions given by the perpetrator outside of a courtroom setting and in the presence of an impartial third party are considered non-judicial evidence. When a witness who was there at the commission of the crime provides documentation or visual representations of what happened, this is known as direct evidence. Evidence relevant to the present case is provided via indirect evidence, also known as circumstantial evidence, through relational facts. Following this, the Court determines the offender's guilt using several pieces of evidence and then orders sentences commensurate with the seriousness of the crime.

Understanding the Concept of Criminalistics/Forensic Science

Narejo & Avais, (2012) researched the field of criminal law as it pertains to forensic science and criminalistics. It encompasses the use of information and technology in the context of law. When investigating a crime, forensic scientists use cutting-edge tools from fields like computer science, engineering, and DNA profiling. For example, the structure of the blood dispersion can be determined by physics, the fingerprints of the suspect can be determined by biology, and the chemical makeup of drugs may be determined by chemistry. Nevertheless, the Indian criminal justice system severely underutilises and restricts the use of forensic science in criminal investigations. Sir William Herschel relied heavily on fingerprinting as a forensic science tool to help identify criminal defendants. Both the Argentinean and English courts eventually accepted fingerprint evidence in the 1890s and 1900s, respectively. The Indian criminal justice system has always made use of forensic science in order to examine cases and confirm the facts of crimes. By supplying credible evidence, forensic science aids detectives in their pursuit of criminals and bolsters the Indian legal system.

Menaker, Campbell & Wells, (2017) looked into the fact that forensic science and criminalistics scholarly writings focus on the analytical procedures used to decipher physical evidence found at crime scenes. The scientific analysis of physical evidence retrieved from crime scenes, victims, and suspects is often performed by laboratories specialising in forensic science and criminalistics. According to Rana (2020), the definition of forensic science is evolving in tandem with the development of new technology. It

incorporates state-of-the-art investigative methods including mass spectrometry, liquid chromatography, 3D printing, and DNA testing for the precise examination of facts from physical evidence collected at the scene of the crime. Pathology, Odontology, Biology, Anthropology, and Toxicology are some of the subfields within forensic science. While the main focus is on odontology, scientific procedures are also used to identify the victim's corpse when it is placed in an unrecognisable posture. Teeth, mouth, or body alignment analysis is used to identify the victim. One subfield of forensic biology is DNA profiling, which involves identifying a suspect using samples of their hair, blood, or sperm, among other bodily fluids. The culprit can also be identified by fingerprint analysis. As part of anthropological research, the timing and manner of the victim's death are examined. In addition to establishing the skeleton's age, gender, and family tree, it aids in victim identification when they are in an unrecognisable state. When examining cases of poisoning, sexual assault, accidents, or other toxicological incidents, it is common practice to examine the victim. In order to determine the precise cause of death, pathologists analyse the victim's body after death. As a result, forensic science is a very valuable investigative discipline that aids in case inspections by identifying perpetrators, victims, and methods of crime.

Role and Impact of Forensic Evidence

Jyotirmoy Adhikary, (2007) investigated, forensic science is a cornerstone of the criminal judicial system. Methodical and physical evidence retrieved from the scene of the crime are part of this process. The time, place, and perpetrator of the crime can all be better understood with its aid. Evidence regarding the victim, the perpetrator, and the crime itself can be found, which aids in the investigation of the crime in its entirety. In modern times, criminal investigations and convictions rely heavily on forensic evidence collecting and the forensic sciences. There are numerous functions that forensic evidence plays in criminal investigations. These functions include providing proof of a crime's commission or the presence of essential elements of a crime, linking the perpetrator to the victim or the scene of the crime, identifying any persons linked to a crime, clearing the innocent, supporting the testimony of victims, and helping to establish the events that transpired. The forensic science method is utilised in criminal investigations to identify the primary elements of a crime, identify the suspect, validate the offender's testimony, and exonerate the innocent (McEwen, 2010). Building forensic databases to facilitate the speedy completion of criminal investigations is a part of this. On a global and national scale, forensic investigations are conducted by means of databases pertaining to criminals and forensic profiles created by various organisations, such as the Automated Fingerprint Identification System (AFIS), the Combined DNA Index System (CODIS), and the National DNA Index System (NDIS). Forensic science is considered expert testimony and is incorporated in the Indian Evidence Act of 1872, according to Pragati Ghosh (2018). Someone with substantial knowledge in the field and the ability to utilise that knowledge to provide an expert opinion on the criminal case is considered an expert. *Pantangi Balaram Venkata Ganesh v. State of Andhra Pradesh* is a case where the decedent was shot and killed by the accused and their accomplices. The witness verified that the assailant was wounded when the gunshots rang out and noted that the accused was donning a pink shirt. The cops found a pink blouse covered with blood spots during their inquiry. In order to determine who was responsible, the police submitted it to a forensic lab for DNA testing. In addition to other pieces of evidence, the findings of the DNA test led the police to believe that the accused was guilty. Because they help identify the perpetrator and provide evidence for a crime, forensic investigations are crucial to the success of other investigative efforts.

Legal Provisions Supporting Criminal Investigation

Patel, Gautaman & Jangir, (2013) determined that the primary goal of forensic science is to establish the defendant's guilt or innocence by eliminating any room for doubt or uncertainty in the case. In 2011, forensic science evidence was used to decide 47 cases by the Supreme Court and High Court, according to a study. Also, out of all the cases, the Delhi High Court decided on around 23.4% of those involving forensic science investigations. Furthermore, DNA evidence derived from forensic science was presented in rape and murder cases (2.3%) and murder cases (4.7%). Criminal investigations that made use of forensic science were better able to identify perpetrators and reach satisfactory conclusions. So, more and more judges in India are accepting forensic science findings as legitimate evidence, leading to a rise in their usage in the criminal justice system. In the case of Ramchandra Reddy and Ors. v. The state of Maharashtra, forensic evidence such as brain fingerprinting, lie detector tests, and narco analysis was recognised and accepted. During a special hearing, the court authorised the Scientific Investigation Team (SIT) to conduct scientific testing on Abdul Karim Telgi, the primary defendant in the case, in relation to the allegations of the phoney stamp paper fraud. The validity of the forensic evidence, however, was called into doubt due to a breach of Article 20(3) of the Indian Constitution, which safeguards the accused against coerced testimony. The criminal justice system in India has come to rely more on forensic evidence as a result of decisions like State of Bombay v. Kathi Kalu Oghad & Others. Examining the suspect's thumb imprint, specimen signature, blood, hair, and semen allowed the forensic evidence to be gathered in the case of The State of Bombay v. Kathi Kalu Oghad & Others. Article 20(3) of the Indian Constitution safeguards the criminal from coerced evidence, which is why the suspect raised an objection. However, the suspect is required to comply with investigators and has no legal right to contest DNA investigations, as stated by the court. So, it's safe to say that forensic evidence and investigation are crucial to thoroughly examining cases and reaching accurate conclusions. The ruling handed down by the Madras High Court in the Dinesh Dalmia v. State case stated, among other things, that the narco analysis-based forensic evidence could not be used as evidence. However, the Supreme Court's ruling in Selvi & Ors v. State of Karnataka & Anr cast doubt on the reliability of the scientific evidence utilised in the case's inquiry. The scientific evidence presented by the P-300 test and the polygraph examination was deemed indecisive and unconvincing by the Supreme Court. Results from these scientific investigations could not be considered in the court's decision-making process. Because it was deemed an unlawful conduct, the Supreme Court further limited the mandatory use of forensic science investigating procedures for criminal cases.

Findings and Discussion

Forensic science may be defined as technology-based investigation approaches that assist in the logical and reasonable resolution of significant situations, according to the literature study facts described above. A suspect and a crime can be substantiated through the use of a variety of forensic investigative techniques, including the narco test, the P-300 test, and the polygraph examination. The investigative process is heavily reliant on various forms of evidence, which are divided into many categories under the Indian Evidence Act (IEA) of 1872. These categories include oral evidence, documentary evidence, primary evidence, and judicial evidence. It was also examined that the use of forensic science techniques for investigations and evidence of the crime in India is subject to some constraints. This is due to the fact that the Court of Law has placed limitations on it as a result of the provisions of Article 20(3) of the Constitution of India. According to the article, the protection afforded to the offender against compelled

testimony is unlawful. The research found that forensic investigations are extremely beneficial since they follow the ramifications of illegal drugs and identify the remnants by reconstructing the crime scene again. Forensic investigations are also beneficial in determining who the victim is and gaining an understanding of the motives and circumstances surrounding the crime. Therefore, it can be stated that forensic science techniques are extremely important for the investigation of both criminal and civil cases and for resolving these situations efficiently (Shali, 2018).

Conclusion

Forensic evidence analysis of India's criminal justice delivery system reveals both the system's inherent limitations and its potential for revolutionary reform. As a field, forensic science has produced priceless tools for bolstering investigations, bolstering testimony, and decreasing reliance on subjective evidence, such as digital forensics, toxicology, DNA profiling, fingerprint analysis, and ballistics. Its introduction has improved objectivity, increased the number of people convicted of violent crimes like murder and sexual assault, and helped clear the names of innocent people. Judicial acknowledgement under Section 45 of the Indian Evidence Act, 1872 and legislative endeavours like the DNA Technology (Use and Application) Regulation Bill, 2019 show that scientific approaches are becoming more accepted in the legal system. Success in incorporating forensic evidence is still hindered by systemic issues, despite these developments. A lack of licensed laboratories, insufficient infrastructure, huge backlogs, and skilled professionals are among the many causes of delays that reduce the value of scientific findings. Crime scene mismanagement, weak chain-of-custody procedures, and misunderstandings between police and judges all work together to undermine the credibility and admissibility of forensic evidence. Without fixing these capacity issues, forensic science will fall short of its goal of providing trustworthy justice quickly. From a socio-legal standpoint, forensic evidence affects more than just the details; it also affects issues of public trust, ethics, and individual rights. Due process and scientific methods reduce bias and arbitrary rulings, which increases public confidence in the justice system. They raise concerns about privacy, misuse, and over-reliance, especially in relation to digital surveillance and DNA databases. The case of *Puttaswamy v. Union of India* (2017), which acknowledged the right to privacy as a fundamental right, reinforced the necessity of using forensic techniques in compliance with clear statutory safeguards, transparency, and accountability. Therefore, scientific inquiry must advance social fairness without trampling on fundamental rights protected by law. We can only move forward by committing to a thorough reform program. This includes training programs for judges, lawyers, and police officers as well as decentralising laboratories, modernising the forensic infrastructure's organisational structure, and ensuring certification and quality assurance. Judicial criteria on admission need to be established to ensure reliability and uniformity in the assessment of expert testimony. The most effective policies and procedures in other nations should serve as models for these recommendations. Above all else, forensic evidence must be part of a justice and human rights framework so that it can supplement, not replace, due process. Finally, forensic evidence may help make India's criminal justice system more efficient, fair, and scientific. But until similar institutional, ethical, and legal protections are put in place simultaneously, this change will not be complete. Justice, equality, and human dignity must accompany technological investment in order to close the gap between the legal and scientific communities. India can ensure that forensic evidence serves as a basis for truth and justice rather than merely a tool for conviction by striking a balance between the two.

References

- [1] Bharadwaj, A., & Sharma, R. (2020). Forensic science in criminal investigation and trials in India: Emerging trends and challenges. *Journal of Indian Law and Society*, 11(2), 145–162.
- [2] Goud, N., & Rao, P. V. (2019). The role of forensic evidence in the criminal justice system: An Indian perspective. *International Journal of Law, Crime and Justice*, 57, 1–12. <https://doi.org/10.1016/j.ijlcj.2019.03.005>
- [3] Government of India. (2019). The DNA Technology (Use and Application) Regulation Bill, 2019. New Delhi: Ministry of Science and Technology.
- [4] Kumari, V. (2021). DNA evidence and privacy concerns: A socio-legal study in India. *Indian Journal of Legal Studies*, 13(1), 57–76.
- [5] National Crime Records Bureau (NCRB). (2022). Crime in India: Statistics 2021. Ministry of Home Affairs, Government of India.
- [6] National Institute of Criminology and Forensic Science. (2018). Forensic science in criminal justice: Capacity and challenges. New Delhi: NICFS Publications.
- [7] Puttaswamy v. Union of India, (2017) 10 SCC 1.
- [8] Rastogi, P., & Rani, S. (2020). The use of forensic science in Indian courts: A critical appraisal. *Journal of Forensic and Legal Research*, 5(2), 34–47.
- [9] Saks, M. J., & Koehler, J. J. (2005). The coming paradigm shift in forensic identification science. *Science*, 309(5736), 892–895. <https://doi.org/10.1126/science.1111565>
- [10] Shukla, A. (2020). Forensic evidence in India: Admissibility and judicial approach. *Indian Bar Review*, 47(3), 215–232.
- [11] Singh, R. (2019). Forensic science and criminal investigation in India: A socio-legal study. *International Journal of Research in Social Sciences and Humanities*, 9(4), 89–102.
- [12] Supreme Court of India. (2012). *Mukesh & Anr. v. State (NCT of Delhi)*, (2017) 6 SCC 1.
- [13] United Nations Office on Drugs and Crime (UNODC). (2016). Forensic services and infrastructure support for criminal justice systems. Vienna: UNODC.
- [14] 5Prapti Kothari, Exploring the Role of Forensic Science in Indian Criminal Justice System, SSRN, 2-3 (20230).
- [15] 6 INDIA CONST. Article 20(3).
- [16] 7 Ibid.
- [17] 8AIR 1961 SC 1808.
- [18] 9AIR 1961 SC 307
- [19] Shali, S. K. (2018). Applicability of Forensic Science in Criminal Justice System in India With Special Emphasis on Crime Scene Investigation. Medico-Legal Desire Media and Publications, MedicoLegal Reporter, Inaugural Issue.
- [20] Narejo, N., & Avais, M. A. (2012). Examining the Role of Forensic Science for the Investigative-Solution of Crimes. *Sindh Univ. Res. Jour.(Sci. Ser.)* Vol, 44(2), 251-254.
- [21] Menaker, T. A., Campbell, B. A., & Wells, W. (2017). The use of forensic evidence in sexual assault investigations: Perceptions of sex crime investigators. *Violence against women*, 23(4), 399-425. https://www.researchgate.net/publication/301500979_The_Use_of_Forensic_Evidence_in_Sexual_Assault_Investigations_Perceptions_of_Sex_Crimes_Investigators/link/5a7904c70f7e9b41dbd44740/download
- [22] Jyotirmoy Adhikary, DNA Technology in Administration of Justice, (LexisNexis, Butterworths, 2007

- [23] McEwen, T. (2010). The role and impact of forensic evidence in the criminal justice system. National Institute of Justice.<https://www.ncjrs.gov/pdffiles1/nij/grants/236474.pdf>
- [24] Pragati Ghosh, Evidentiary Value of Expert Evidence under Indian Evidence Act, 1872, <http://www.shareyouressays.com/119180/evidentiary-value-of-expert-evidence-underindianevidence-act-1872>, (accessed on 26.05.2018)
- [25] Patel, N., Gautaman, V. K., & Jangir, S. (2013). The role of DNA in a criminal investigation–Admissibility in Indian legal system and future perspectives. *Int J Humanit Soc Sci Invent*, 2, 15-21