WWW.IJRPR.COM

International Journal of Research Publication and Reviews

Journal homepage: www.ijrpr.com ISSN 2582-7421

The Dark Side of Forensic Science: Issues and Pitfalls in India

Khushi Jadhav[1*], Dr. Pravin More[2], Yukti Meshram[3], Dr. G.C. Jadhav[4]

[1*]Student, Department of Forensic Physics, Institute of Forensic Science, Mumbai University, Mumbai, Maharashtra, India
[2*]Professor, Department of Forensic Physics, Institute of Forensic Science, Mumbai University, Mumbai, Maharashtra, India
[3*]Student, Department of Forensic Science, Guru Ghasidas Vishwavidyalaya, Guru Ghasidas University, Bilaspur, Chhattisgarh, India
[4*]Associate Professor, Department of Mechanical Engineering, Dr.BabasahebAmbedkar Technological University, Lonere, Maharashtra, India

ABSTRACT

India's criminal justice system depends on forensic science, although its trustworthiness and application suffer greatly. 500 forensic case reports from the National Forensic Science Laboratory (NFSL) spanning 2018–2022 were systematically assessed in this retrospective qualitative study in order to determine the most often used forensic techniques in India. Using a comprehensive theme analysis technique, the study identified major systematic issues compromising the integrity and quality of forensic evidence. Four main obstacles were found in the research: legal framework constraints, procedural discrepancies, poor professional training, and technological limitations (50.4% of cases affected by outdated equipment). Principal results showed that forensic investigations mostly comprised DNA samples (40.2%) and fingerprint analysis (29.6%), together with clear differences in evidence handling and interpretation. The effectiveness of forensic investigations was much influenced by technological constraints including device obsolescence and financial constraints. The study emphasises how urgently comprehensive changes in India's forensic science system are needed. Proposed interventions cover the modernisation of technological capabilities, standardisation of forensic methods, the application of thorough training programs for forensic experts, and legal framework change to increase evidence dependability. Fortifying the criminal justice system, preventing unfair convictions, and guaranteeing more exact court rulings depend on these strategic improvements.

Keywords: Criminal justice, Forensic science, Forensic training, Fingerprint, Criminal, Legal changes, Standardised practices, Technological limitations.

1. Introduction

A merging of legal and scientific domains, forensic science has evolved into a basic element of modern criminal justice systems everywhere. It covers a broad spectrum of scientific techniques and methods applied in court systems and criminal investigations. The development of forensic technology—including DNA profiling, fingerprint analysis, and digital forensics—has greatly improved the accuracy and effectiveness of criminal identification and court procedures in recent decades (Charan&Manikyam, 2023). These innovations notwithstanding, the use of forensic science in India faces many major obstacles that limit its ability to fairly administer justice. Over the past few years, the use of forensic evidence in India's criminal court system has notably rise. Many institutional obstacles include outdated technology, inadequate infrastructure, lack of standard procedures, and inadequate training for forensic experts limit its best use (Dinkar, 2015). Precise identification of offenders and protection of the innocent depend on forensic science being included into legal systems. These continuous problems typically call for criticism on the dependability of forensic evidence in India (Bhalshankar, 2023).

An important challenge in the field of Indian forensic science is the outdated and faulty technological foundation. Many forensic labs around the country lack modern tools and equipment, which greatly limits their ability to run thorough and accurate investigations (Tak, 2021). The differences in technology often cause delays in the processing of forensic evidence, therefore delaying the settling of criminal cases. Moreover, the absence of consistent methods aggravates the issue and causes differences in the accuracy and quality of forensic investigations (Chawla, 2023).

Apart from technical and infrastructure challenges, the forensic science industry in India has a major shortage of suitable experts. Often insufficiently trained to handle the complexities of modern forensic equipment and techniques, the current staff. The lack of expertise not only reduces the quality of forensic investigations but also compromises the integrity of the evidence turned in to courts (Gill & Verma, 2022).

To provide forensic experts the necessary skills and expertise to effectively carry out their duties, training and continuous education initiatives are absolutely essential. One obvious issue is the lack of guidelines in forensic techniques and procedures. Different methodologies are regularly used in diverse labs and forensic experts, which leads to differences in the results and forensic evidence interpretations (Charan, 2023). The lack of standards reduces the validity of forensic evidence, thereby maybe resulting in erroneous convictions or absences from guilt. Maintaining the integrity and dependability of forensic evidence within the judicial system depends on the standard protocols being followed and maintained.

Many times, accused for being outdated and inadequate is the legislative system controlling forensic evidence in India. Legal uncertainty and challenges in the acceptance of forensic evidence result from current rules and regulations failing to sufficiently reflect the complexity and advancement in forensic science (Verma & Goswami, 2014). Comprehensive legislative reforms are clearly necessary to match modern scientific standards and practices with the court application of forensic evidence.

Notwithstanding these challenges, forensic science still has great power to help India's criminal justice system be better. Effective utilisation of forensic evidence can lead to more accurate and quick resolutions of criminal cases, therefore strengthening public faith in the justice system. It can be quite important in clearing the innocent and making sure the responsible parties pay for it (Miranda & Maras, 2017).

2. Literature Review

The use and trustworthiness of forensic scientific evidence in India have been carefully investigated academically. This literature review compiles data from several scholarly sources to provide a comprehensive picture of the current state of forensic science within the Indian criminal justice system, limitations, and future directions.

Charan and Manikyam (2023) conducted an extensive investigation of the limitations of forensic science in Indian rape and homicide cases. They underlined that evidence collecting and crime scene investigation depend on forensic evidence—including DNA testing to confirm identification—and that They underlined that forensic science has many restrictions like poor sample sizes, improper collecting methods, and delays in processing; it is not perfect. These limitations can lead to mistakes, maybe leading to convictions or unjust acquittals. Standard operating procedure guidelines should be established, the research argued, to ensure the admittance of forensic evidence in court processes (Charan&Manikyam, 2023).

Dinkar (2015) looked at the main issues and flaws in forensic scientific data from India. The study exposed systematic defects compromising forensic science's credibility and underlined its great possibilities in criminal investigations and trials. The main problems were outdated technology and lack of standardising among forensic labs. The study underlined incidents of erroneous convictions originating from faulty forensic evidence, therefore stressing the need of improvements in forensic techniques and rules to prevent such injustices (Dinkar, 2015). Examining the important role forensic evidence plays in criminal investigations, Chawla (2023) underlined how it shapes India's justice system. Emphasising the need of forensic evidence in modern criminal investigations, the study underlined its major influence on court findings. The study underlined the problems resulting from the lack of consistent approaches and flaws in the training of forensic experts, therefore compromising the validity of forensic evidence in the court system (Chawla, 2023).

Bhalshankar (2023) investigated Indian criminal process dependability of forensic science. To assess the validity of forensic techniques, the study applied both qualitative and quantitative approaches Although the criminal justice system depends on the scientific qualities of forensic evidence, the accessibility and accuracy of forensic procedures still present significant challenges. The findings revealed the need of strict standardising and validation of forensic techniques to ensure their dependability in legal operations (Bhalshankar, 2023).

Charan (2023) With an eye towards its influence on court outcomes, conducted a retrospective analytical study analysing the relevance of forensic evidence in rape and murder cases. Examining Supreme Court of India decisions, the study found a rather favourable correlation between forensic evidence and court decisions. While poorly managed or contradicting forensic findings usually led in acquittals or reduced sentences, the careful handling of forensic samples greatly influenced conviction rates. This study underlined the critical part forensic evidence plays in attaining justice for severe crimes (Charan, 2023).

Gupta et al. (2021) looked at how forensic evidence applied inside India's Right to Information Act framework. The study underlined how important forensic results are for criminal investigations even if the legal system usually underuses them. The study underlined the low percentage of cases reported to forensic science laboratories and underlined the need of improved forensic techniques and legal systems to raise the validity and admissibility of forensic evidence in court procedures (Gupta et al., 2021).

Tak (2021) Emphasising forensic medicine, digital forensics, and many other scientific techniques, investigated the scientific approaches used in criminal investigation. The study looked at Indian legal systems related to forensic science and underlined the difficulties in research, education, and training in the forensic discipline. The study underlined the need of improving forensic science infrastructure and standardising approaches to increase its contribution in criminal investigations (Tak, 2021).

These studies underline the great relevance of forensic science in the Indian criminal justice system as well as the great obstacles preventing its effectiveness. These scholarly studies have as their common themes the need for technology developments, standardised procedures, improved training for forensic practitioners, and major legislative changes to raise the validity and admissibility of forensic evidence.

Though a lot of research on forensic science in India, there is still a great void in the comprehensive evaluation of how different approaches and outdated technology affect court findings. This study aims to close this void by methodically assessing how these challenges affect the credibility of forensic evidence and providing particular solutions to strengthen the forensic science structure in India. Examining this discrepancy is essential since it can lead to more accurate criminal investigations and fair court decisions, therefore improving the whole Indian criminal justice system.

3. Research Methodology

3.1 Research Design

This study makes use of a qualitative analysis of forensic case reports imported just from The National Forensic Science Laboratory (NFSL) in India. This strategy was chosen to help to provide a thorough knowledge of the problems and weaknesses in forensic scientific evidence in India. The study focused on looking over forensic case files spanning five years—from 2018 to 2022. This era was selected to cover modern advancements in forensic science as well as problems in those methods.

3.2 Data Collection

Data were gathered from the NFSL, an Indian main forensic laboratory assigned to handle forensic investigations for several criminal investigations. The NFSL was selected for its large database and central importance in national forensic investigations. The data collecting process involved compiling case reports from the digital archive of the NFSL, which boasts thorough records of forensic investigations carried out on many kinds of evidence. Table 3.1: (Columns)

3.3 Data Analysis

The data analysis tool used in this study was thematic analysis. To find, examine, and document trends (themes) within the data using this qualitative approach was decided upon. Understanding the fundamental problems and recurring themes in forensic evidence techniques requires especially the help of theme analysis.

Steps in Thematic Analysis:

1. **Familiarization with Data:** Researchers read and re-read the forensic case reports to become deeply familiar with the content.
2. **Coding:** Initial codes were generated based on the data. Codes are essentially labelling that identify significant features of the data relevant to the research question.
3. **Searching for Themes:** Codes were examined to identify potential themes. Themes represent broader patterns of meaning.
4. **Reviewing Themes:** Themes were reviewed to ensure they accurately represent the data and are distinct from each other.
5. **Defining and Naming Themes:** Each theme was clearly defined and named to capture its essence.
6. **Producing the Report:** The final step involved producing a detailed report of the themes identified, with supporting data from the forensic case reports. (Table 3.2)

Among the several main topics found by the thematic study were legislative barriers, inadequate training, differences in forensic techniques, and technical limitations. The results and debate sections of this study effort were arranged using themes.

This paper investigated the difficulties and flaws in the forensic scientific evidence field in India by means of a methodical approach for data collecting and analysis. The results of this study try to direct suggestions for improving policies and forensic techniques.

4. Results and Analysis

4.1 Results

Several important results came out of the thematic study of the forensic case reports from the National Forensic Science Laboratory (NFSL). Each of these results is shown in tabular form; a thorough interpretation and discussion accompany each.

Interpretation (Figure 1): Of the instances, 40.2% included DNA samples and most followed fingerprints (29.6%). Of the cases, 16.4% were digital evidence; toxicological and ballistic reports were less common, at 7.8% and 6.0% respectively. This distribution shows how mostly forensic investigations in India depend on DNA and fingerprint analysis.

Interpretation (Figure 2): Affecting 50.4% of the instances, outdated equipment was the most often cited technical problem. In 29.8% of the cases, insufficient resources were mentioned; technical faults in 19.8% of them. These results highlight the need of improved resource allocation in forensic labs and technology updates.

Interpretation (Figure 3): Present in 35.8% of cases, variation in methods was found to be the most often occurring discrepancy. Affecting 30.2% and 20.2% of instances correspondingly, respectively, were inconsistent results and mislabelling of samples. Thirteen percent of cases revealed delayed reporting, suggesting ineffective procedures.

Interpretation (Figure 4): Of the cases recorded, a noteworthy 40.2% said they lacked specific forensic professional expertise. Additionally, common were inadequate hands-on experience and poor continuing education, which affected 30.2% and 19.8% of cases respectively. Affecting 9.8% of cases, limited access to training materials was a smaller but nonetheless significant problem.

Interpretation (Figure 5): Affecting 35.8% of cases, admissibility problems were the most often occurring legal barrier. Also, major influences on 30.2% and 19.8% of instances respectively were a lack of a thorough legal foundation and challenges in cross-examination. In 13.8% of cases, there were observed variations in interpretation, underscoring the difficulties in court processes using forensic evidence.

Interpretation (Figure 6): Of the 50.2% of instances examined, 50.2% of the convictions derived from forensic evidence in 29.8% of cases, acquittals took place usually because from problems with forensic evidence. Less often occurring were commuted sentences and mistrials, at 14.2% and 5.8% respectively. These results show the vital part forensic evidence plays in court rulings.

Interpretation(Figure 7): Comprising 40.2% and 29.8% of instances respectively, homicide and sexual assault were the most often occurring forms of crime studied. With 16.4% and 7.8%, theft and fraud were less common; other crimes accounted for 5.8%. This distribution captures the grave nature of cases usually needing forensic analysis.

Interpretation (Figure 8): Affecting 39.8% of instances, most forensic investigations took 3-6 months to finish. While more than six months were needed in 20.2% of cases, 29.8% of cases indicated turn-around times between one and three months. Given that just 10.2% of studies were finished in less than one month, more effective procedures are clearly needed.

Interpretation (Figure 9): Affecting 40.2% of cases, human mistake was the main cause of forensic faults. Significantly affecting 30.2% and 19.8% respectively were technological faults and sample contamination. Less often occurring in 9.8% of cases were administrative errors. These results underline the need of including technological as well as human elements into forensic procedures.

Interpretation(Figure 10): Cited in 50.2% of cases, upgrading technology was the most often suggested development. Suggested in 29.8% and 19.8% of cases respectively were standardising practices and improving training programs. These suggestions fit the found problems and offer a road map for improving the accuracy and potency of forensic evidence used in India.

These findings underline the important difficulties and possible enhancements in the field of forensic science in India. Improving the accuracy, dependability, and significance of forensic evidence in the criminal justice system requires addressing several challenges.

5. Discussion

The study results are interpreted in the context of current literature and given practical policy recommendations in the debate.

5.1 Comparative Analysis with Literature Review

Consistent with prior findings, this study highlights significant flaws in India's forensic science system. Delays in evidence processing and inconsistent protocols were emphasised by Charan and Manikyam (2023), which line up with the results of this study of procedure variability (35.8%) and delayed reporting (13.8%). Dinkar (2015) also underlined outdated machinery, as this survey shows, where 50.4% of cases ran against technological limitations.

In the court system, forensic evidence is indispensable and helps to produce convictions in half of the cases under investigation. Nevertheless, restrictions include admissibility issues (35.8%) and difficulty in cross-examination (19.8%), which underline the need of a stronger legislative framework to support forensic science in court processes (Chawla, 2023). Furthermore, underlined as main causes of forensic inaccuracy (40.2%), insufficient handling and human errors highlight the need of better training programs and standardised procedures (Bhreshankar, 2023; Charan, 2023).

This paper aimed to investigate the discrepancy in the body of research about the consequences of outdated technology and irregular practices on court decisions. By means of a thorough investigation of forensic case reports from the NFSL, this study has highlighted important areas needing technical improvements and procedural standardising. The findings imply that addressing these issues will significantly increase the accuracy of forensic evidence, hence improving judicial results and public confidence in the criminal justice system.

5.2 Policy Recommendation for Practical Implementation

Outdated equipment influences 50.4% of cases and causes 30.2% of mistakes in technological sense. Improving forensic lab tools will help to increase case results, accuracy, and efficiency.

Standardising of Procedures: Consistent procedures are clearly needed from differences in protocols (35.8%) and inconsistent results (30.2%). Reliable and admissible forensic evidence in court will come from well-defined criteria.

Training and Education: Lack of instruction (40.2%) and little hands-on experience (19.8%) lead to mistakes. Frequent training courses can enable forensic experts manage difficult analyses more skilfully.

Legal Framework: Reforms are needed in the legal framework (30.2%) and admissibility concerns (35.8%). It is also outdated. To guarantee forensic evidence is used in court correctly, well defined policies are required.

Human Factors: Improved training, quality control, and consistent processes help to lower human errors - 40.2% of mistakes - by means of which

Resource Allocation: Restricted resources (29.8%) draw attention to the necessity of more money to upgrade lab equipment, training courses, and standard practices.

5.3 Broader Implications

Increasing public confidence in the criminal justice system by means of better accuracy and dependability of forensic evidence can help Reliable forensic evidence raises the possibility of accurate court decisions, which is absolutely important for preserving public confidence in the legal system.

Preventing Miscarriages of Justice: Dealing with the discovered problems can help to prevent erroneous convictions and acquittals, therefore ensuring that the guilty are held responsible and the innocent are safeguarded. In major crimes as homicide and sexual assault, where reliable forensic evidence is essential for attaining justice, this is especially crucial.

Policy recommendations: This are based on the results of the study help to shape policies meant to enhance the state of forensic science in India. These realisations can help policymakers create focused treatments for technological, procedural, and training-related issues in forensic laboratories.

Future Research Directions: The study underlines the necessity of more investigation to investigate in forensic laboratories the use of technical improvements, standardising of practices, and training programs. Future studies can also look at how changes in legislation affect the admissibility and application of forensic evidence in court processes.

6. Conclusion

Emphasising issues including outmoded technology, inconsistent procedures, insufficient training, and legal challenges, this paper carefully examined the constraints and opportunities inside India's forensic science system. These challenges directly affect the validity and efficiency of forensic evidence, therefore affecting court decisions and public faith in the criminal justice system. Improving these structural problems will help forensic science to contribute more in delivering justice.

Important results show a clear need for technical improvements since outdated equipment affected 50.4% of cases. Given 35.8% of cases show protocol discrepancies, standardising forensic methods is absolutely vital. The inadequate instruction received by forensic experts (40.2%) emphasises the need of constant learning and practical experience. Dealing with challenges like admissibility concerns—which arise in 35.8% of cases—a thorough legal foundation is important.

The results of the study highlight the need of carrying out certain projects to improve forensic procedures. Advice covers the modernisation of forensic labs, the application of consistent standards, the growth of training courses, and the adoption of clear legal norms. By minimising mistakes and guaranteeing more exact court decisions, these techniques can greatly improve the dependability of forensic evidence.

Although this study provides insightful analysis, it acknowledges constraints including reliance on single source (NFSL) data. More comprehensive data sets and investigation of the impact of these programs on the criminal justice system should be part of next studies. Through addressing these issues, forensic science in India can more successfully support fair and reasonable court findings, so strengthening public confidence in the judicial system.

Figures:

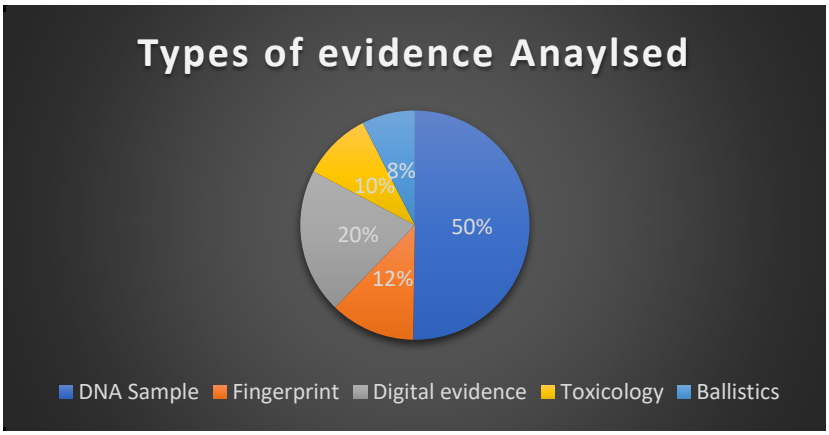

Figure 1 Types of Evidence Analyzed (Pie Chart)

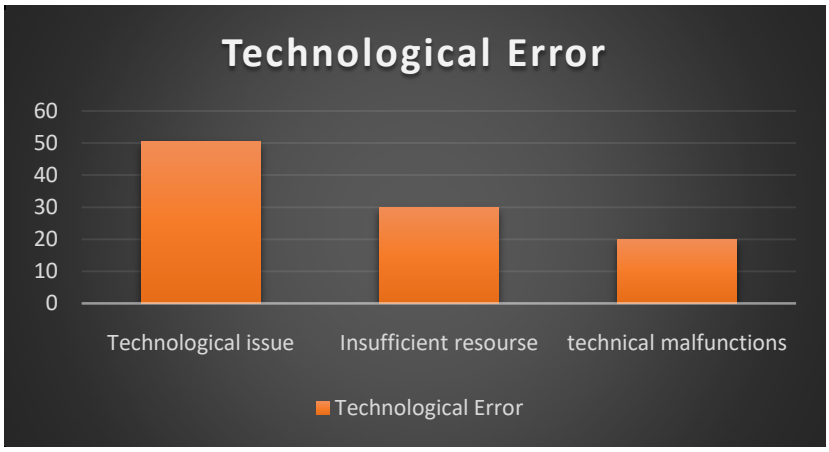

Figure 2 Technological Issues Identified (Column Chart)

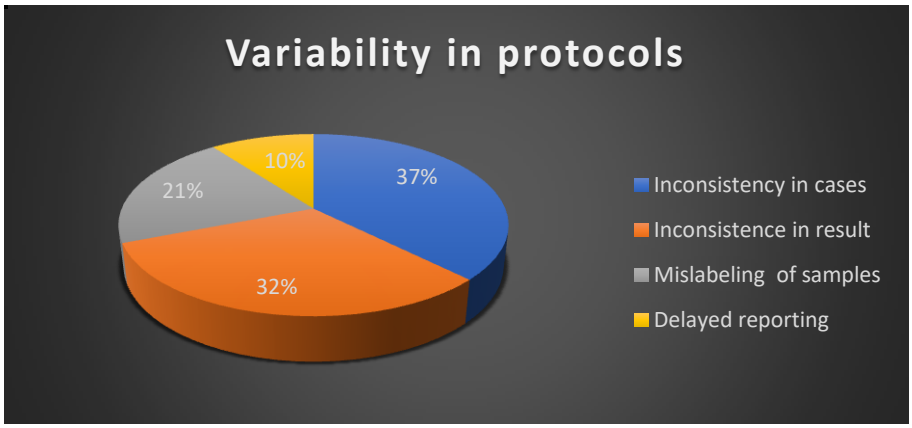

Figure 3 Inconsistencies in Forensic Procedure (Pie Chart)

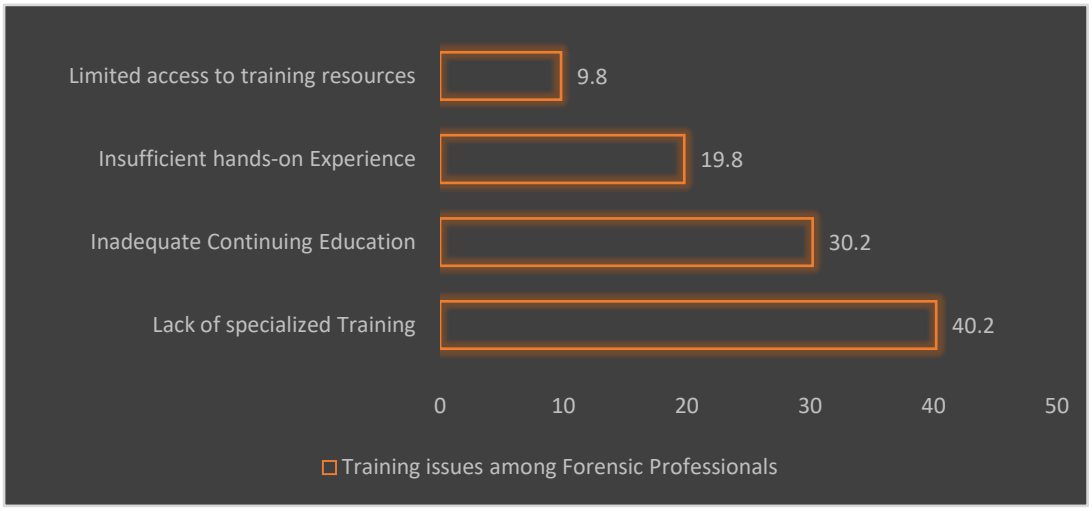

Figure 4 Training Issues among Forensic Professionals (Bar Chart)

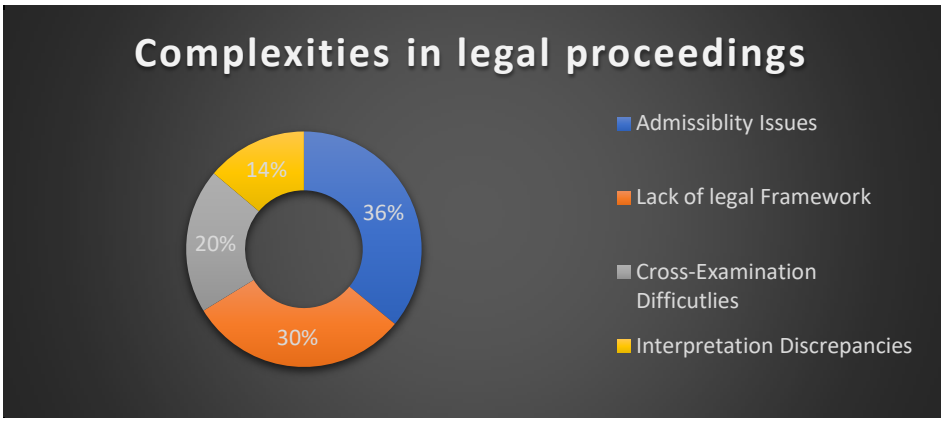

Figure 5 Legal Challenges in Forensic Evidence (Pie Chart)

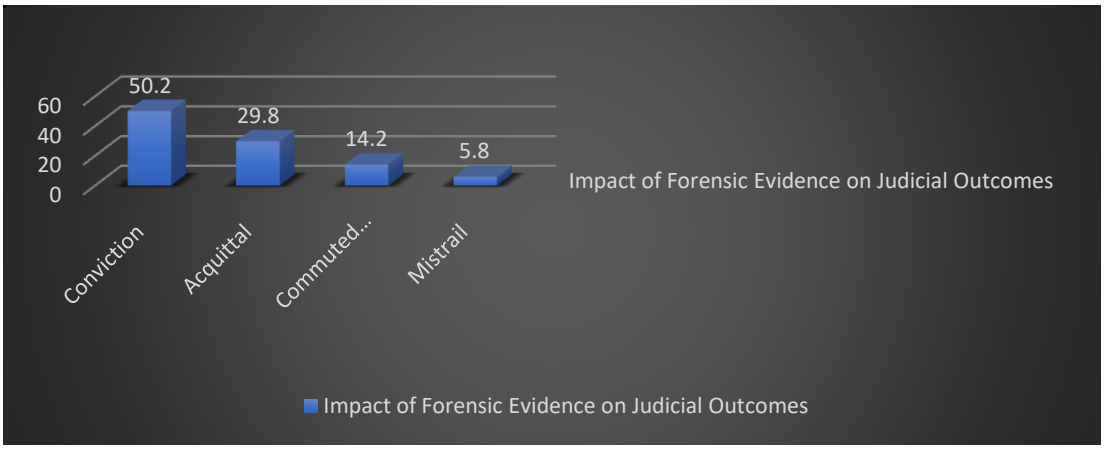

Figure 6 Impact of Forensic Evidence on Judicial Outcomes (Column Chart)

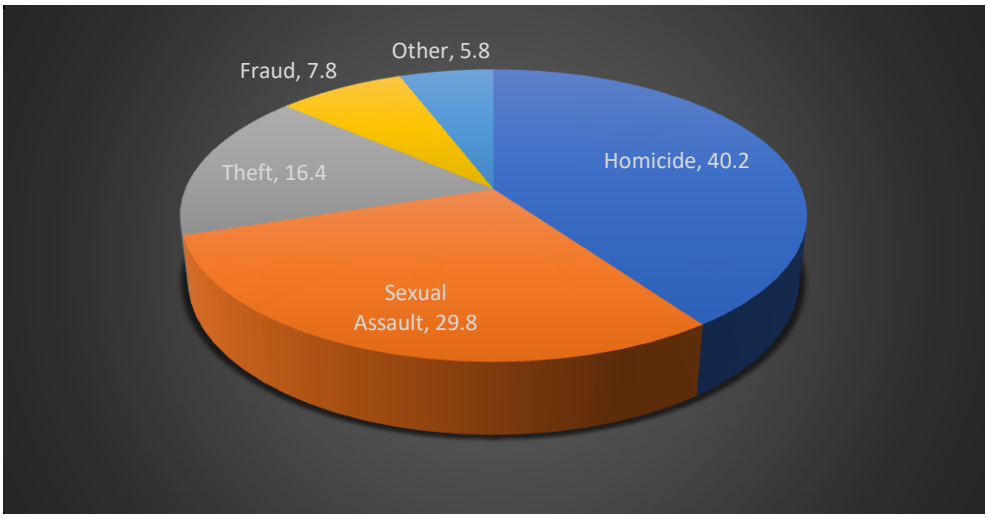

Figure 7 Common Types of Crimes Analyzed (Pie Chart)

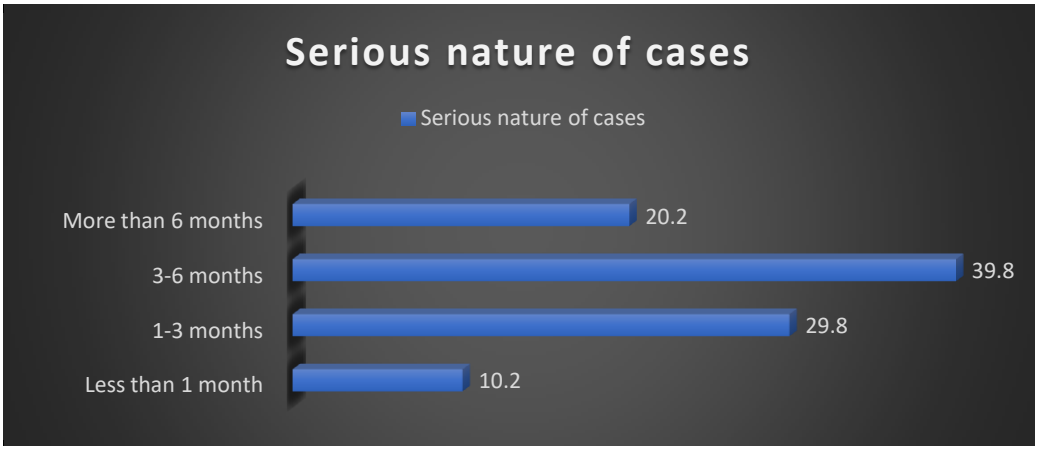

Figure 8 Turnaround Time for Forensic Analysis (Bar Chart)

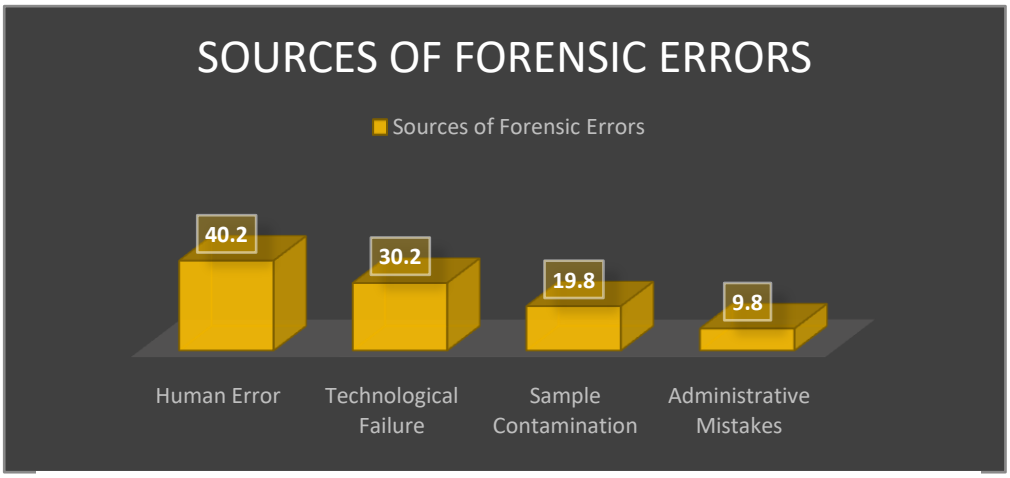

Figure 9 Sources of Forensic Errors (Column Chart)

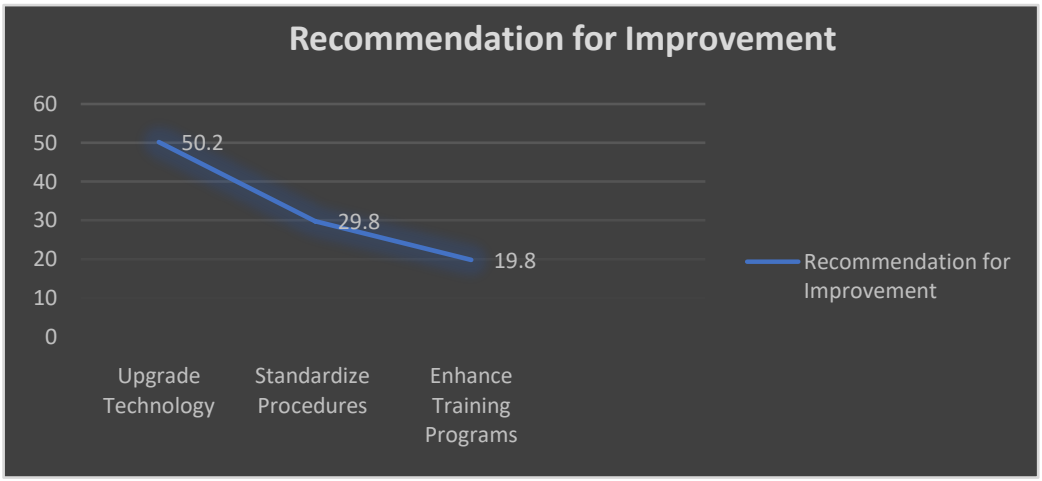

Figure 10 Recommendation for Improvement (Line Chart)

Tables:

Table 3.1: Data Source Details

Parameter	Description
Source	National Forensic Science Laboratory (NFSL)
Location	New Delhi, India
Timeframe	2018-2022
Data Type	Forensic case reports
Types of Cases	Rape, murder, theft, fraud, and other criminal cases
Types of Evidence	DNA samples, fingerprints, digital evidence, toxicology reports, ballistic reports
Access Method	Digital archive access through NFSL's secure database
Data Collection Method	Retrieval of electronic case files
Data Collected By	Forensic analysts and researchers
Total Cases Analyzed	500

Table 3.2: Thematic Analysis Steps

Step	Description
Familiarization with Data	Researchers reviewed forensic case reports to understand the content and context.
Coding	Initial codes were assigned to significant features of the data.
Searching for Themes	Related codes were grouped to form broader themes.
Reviewing Themes	Themes were reviewed for accuracy and relevance to ensure they capture the main issues related to forensic evidence.
Defining and Naming Themes	Themes were defined and named to reflect their essence clearly.
Producing the Report	A comprehensive report was generated, detailing each theme with examples and supporting data from the forensic case reports.

References

1. Bhalshankar, D. S. (2023). Opportunities in ensuring forensic science reliability in criminal proceedings in India. *International Journal for Multidisciplinary Research*, 9, 91-97. https://doi.org/10.36948/ijfmr.2023.v05i04.4263
2. Charan, J. (2023). A Retrospective Analytical Study of Forensic Evidence in Rape and Murder Cases and its Implications on Judicial Outcomes in India. *Journal of Forensic Science and Medicine*. https://doi.org/10.4103/jfsm.jfsm_108_22
3. Charan, J., &Manikyam, K. (2023). Forensic science and its limitations in rape and murder cases in India. *Journal of Forensic Science and Medicine*, 9, 91-97. https://doi.org/10.4103/jfsm.jfsm_98_21.
4. Chawla, D. S. (2023). The Role of Forensic Evidence in Criminal Investigations in India. *International Journal for Research in Applied Science and Engineering Technology*. https://doi.org/10.22214/ijraset.2023.56099
5. Dinkar, V. R. (2015). Forensic scientific evidence: problems and pitfalls in India. *Journal of Forensic Science*, 79-84. https://doi.org/10.19070/2332-287X-1500020

6. Gill, S., & Verma, U. V. (2022). Development of scientific techniques in investigation of criminal cases in India. *International Journal of Advance Research and Innovation*. https://doi.org/10.51976/ijari.1022207

7. Gupta, A., Gupta, V., & Singh, A. (2021). The Use of Information Gained under RTI Act- 2005 in Forensics and Toxicology- An Indian Perspective. *Indian Journal of Forensic Medicine & Toxicology*. https://doi.org/10.37506/ijfmt.v15i2.14273

8. Miranda, M., & Maras, M.-H. (2017). Sexual violence perpetrated against women in India: the role of forensic evidence. *International Journal of Comparative and Applied Criminal Justice*, 41, 107-95. https://doi.org/10.1080/01924036.2016.1245205

9. Tak, A. (2021). Scientific mechanisms in crime investigation: A study. *The Journal of Unique Laws and Students*. https://doi.org/10.59126/v1i3a14

10. Verma, S. K., & Goswami, G. K. (2014). DNA evidence: current perspective and future challenges in India. *Forensic Science International*, 241, 183-189. https://doi.org/10.1016/j.forsciint.2014.05.016