**CINEFORUM**
ISSN: 0009-7039
Vol. 64. No. 3S, 2024

# EMERGING TRENDS AND DEVELOPMENTS IN FORENSIC SCIENCES: A CONTEMPORARY ANALYSIS

**Gaurav Kumar Sharma**
Research Scholar, Department of Legal Studies, Banasthali Vidyapith, Rajasthan

**Dr. Asha Rani Rawat**
Assistant Professor, Department of Legal Studies, Banasthali Vidyapith, Rajasthan

## ABSTRACT

This Research provides an in-depth study of the evolution of forensic science in India and the effect on criminal justice. It walks you through the history of forensic science in this country over the years, noting inflection points and advances along the way. Research highlights the next pathway of how forensic evidence becomes adequate or inadequate within criminal justice system to the extent that it relevantly influences on quality of investigations and effectiveness and fairness in prosecution. In spite of some advancement, the study also highlights challenges in the forensic landscape in India including lack of resources, outdated technology and procedural barriers.

The research also investigates innovations in forensic science and possible areas of future study. It also highlights the need to work across disciplines, as well as use technology and amend legislation. The aim of this research was to inform ongoing conversations in India for improving practices and policies around the use of forensic science in criminal prosecution.

The Central Fingerprint Bureau started in 1904 but was first established in Kolkata, India in 1897. This was a turning point in bringing forensic science to everyday criminal investigations across the country. This accomplishment has been followed by extensive efforts to strengthen forensic science capabilities and functions in India[2]

The country has also seen the setting up of a host of forensic science laboratories state wise and

centre wise. In addition to these, Fingerprint Bureaux have been established in a number of states. In addition, laboratories of crime and toxicological have been opened with the help of police and health departments.[3]

India has a number of forensic facilities available with around ‒37 State and seven Central Forensic Science Laboratories‖ across the country. Alongside these are 29 Fingerprint Bureaux located across the country for optimum forensic analytical processes. Further, various states have created over District Mobile Forensic unit and Regional Forensic Science Laboratories to develop local forensic capabilities. The ‒Centre for DNA Fingerprinting and Diagnostics (CDFD)‖ in Hyderabad leads the field of DNA research and diagnostics. CDFD is a state-of-the-art facility, which will help advance forensic science in India spearheaded by the Department of Biotechnology under auspices from the Ministry of Science and Technology.[4]

Professor Alec Jeffreys developed the revolutionary DNA profiling method in London in 1985. This novel approach was introduced in India through an early beginning between the Centre for Cellular and Molecular Biology (CCMB) at Hyderabad working together with ‒Central Forensic Science Laboratories (CFSL)‖ in Hyderabad & Kolkata. These leading organizations paved the way for learning to the point where DNA profiling becomes a useful tool in criminal investigations across the nation. Today, DNA profiling is widely used in India by law enforcement agencies (LEAs) and forensic labs as well as wildlife authorities. This method

[2] ‟Central Fingerprint Bureau - National Crime Records Bureau Ministry of Home Affairs, 2018. *Available at:* https://ncrb.gov.in/(last visited on: May 26, 2024)‖

[3] ‟Development of forensic science and criminal prosecution – India Int. J. Sci. Res. Publ. (2014) *Available at:* http://www.ijsrp.org/research-paper-1214/ijsrp-p3674.pdf (last visited on: May 24, 2024)‖

[4] ‟Centre for DNA Finger printing and diagnostics, 1990. Available at: http://www.cdfd.org.in/ (last visited on May 25, 2024)‖.

allows for the identification of persons from biological fluid and tissue samples, important means for solving homicide, suicide, sexual assault, terrorism and wildlife crime cases.[5]

DNA testing has been suggested by the Wildlife Institute of India (WII), located in Dehradun, as an important tool for wildlife conservation program especially, the Tiger Project. More than a decade-and-a-half later, several private sector entities across the country played an important role in examining forensic evidence and fortifying the domain of forensic science. Around 4,500 forensic experts are currently working in multiple posts of coating professionals Whittons for Fingerprint Bureau from India, In FSLs Also as Paper Columnists Laboratories. As on March 1st, 2011 there were a total of 1.21 billion people in India that including approximately -623.7 Million Men and 586.4 Million women -Population Figures.[6]

As of 2020, the population of India is estimated to be around 1.38 billion (estimation from United Nations Population Division). Despite having an enormous population, India suffers from a huge shortage of forensic scientists in the country- only 0.33 specialists per one lakh have to do with crime investigation and writing report. This is a small ratio compared with other countries, where the ration is usually between 20 to 50 forensic scientists per one hundred thousands of people depending on crime levels.

However, there are many Employment-oriented Courses available and India boasts of an amazing choice of educational institutes with over 80 colleges and universities spread across the country. These comprise the ‒Rashtriya Raksha University (RRU)‖ in Lavad, Gandhinagar, and the ‒National Forensic Science University (NFSU)‖ in Gandhinagar, Gujarat. Largely focused on enhanced security, these institutions are critical for training programs and research, as well as educating students, law enforcement officers, and members of paramilitary groups.

School of Forensic Science & Risk Management is one of the institute of interest. Employing some 500 dedicated teachers and researchers, these institutions and colleges offer a significant contribution to the promotion and dissemination of forensic science information.

[5] P. Shrivastava, H.R. Dash, J.A. Lorente, J. Imam (Eds.), Forensic DNA Typing: Principles, Applications and Advancements, Springer Singapore, Singapore (2020)

[6] National Portal of India. ‒*Available at*: https://www.india.gov.in/〉 (last visited on: May 26, 2024).‖

In view of the need to enhance forensic science skills and abilities across the nation, recently proposals were announced by ―Ministry of Home Affairs, Government of India‖ on setting up Regional Centres for Academic Research and Training. These centres will be associated with the National Forensic Science University as well as the ―Rashtriya Raksha University‖ which are both Institutions of National Importance. With these programs, Indian government aims to also facilitate its ability in the field of crime investigation and prevention along with the dearth of forensic experts.[7]

In 2005, there were actually more than half a million cases that were awaiting examination in this country which were languishing for decades in India's Forensic Science Laboratories (FSL). In 2021, however, there has been little progress despite various attempts to address this issue as an estimated 700,000 – 800,000 backlog of cases remains. Surprisingly, only around 10–12% of all reported crimes are sent to these labs for testing. But if all cognizable offenses were to be triable, the pendency could increase eight times. A complaint which has the potential to impinge upon the due process is DNA and toxicology analysis, two of the prime reports are reported out over a vast timeline ranging anywhere between six months and two years hampering sound practice of justice. Amended regulations specify that DNA analysis is mandatory in sexual assault cases in India – further underlining the critical need for timely forensic results.[8]

The government gets between 50,000 and 60,000 cases a year of unidentified dead bodies. They typically use DNA testing and a host of other techniques to establish who these people are. The ―National Crime Records Bureau‖, as well as the ―State Crime Records Bureaus‖, has extensive data on different kinds of crimes such as cases and missing persons on all methods of crime committed. To speed up the process of identification, Forensic Science Laboratories (FSL) and Fingerprint Bureau pool their data on unidentified bodies with that of missing persons maintained by law enforcement agencies at various levels. Forensic information is spread through traditional print media and internet options that can be a deterrent to future criminals and a way for forensic innovations to develop.

---

[7] *"*The National Forensic Science University ACT, 28th September, 2020, *Available at:* https://www.mha.gov.in/sites/default/files/NFSUAct2020_05102020.pdf (last visited on: May 23, 2024)‖.

[8] *Ibid*

As of May 2020, India has the following medical colleges in the country accredited by National Medical Commission and there are 64 autonomous postgraduate institutions concerned with medical teaching and research. Such institutions also play a vital role in the nation for legal medical training, housing forensic medicine departments. Secondly, most autopsies and medico legal procedures are performed at district-level hospitals and other lower-tier health facilities. And improving DNA matching is more important than ever for transplanting organs and identifying dead bodies. Many of the hospitals now lack such facilities. And this is no different when it relates to forensic anthropological casework, specifically, with skeletal remains. Although several departments of anatomy and forensic medicine have already established these areas, many recent colleges tend to trail behind on this area.

The skeletal analysis and estimation of a biological profile, examinations are done in the biological sciences divisions of Central as well as State Forensic Science Laboratories all around India. Also, some of the research projects are being undertaken by various anthropology departments in Indian universities often in collaboration with national and international institutions.[9]

Additionally, every year in India we are witnessing a rise in the cases regarding Information Technology Act and cybercrime. This points to the necessity of a wider supply of trained investigators and judges who possess scientific understanding, in addition to better-equipped investigation facilities and resolution centres for such cases. If India does not invest in bolstering forensic capabilities, there will remain a long and never ending queue at the doors of our justice system.[10]

India has faced a barrage of devastating natural disasters from earthquakes, tsunamis, flash floods, cyclones such as Fani. These disasters annually kill a significant number of people. One of the greatest challenges in such cases is removing and identifying severely decomposed bodies and skeletal remains from sites of catastrophe. To resolve concrete challenges of disaster management, the Indian government initiated the National Disaster Response Force (NDRF)

[9] "Government of Uttar Pradesh, Report of the Comptroller and Auditor General of India, performance audit of modernisation and strengthening of Police Forces, 2017. Available at: https://cag.gov.in/uploads/download_audit_report/2017/Report_No.3_of_2017_Performance_Audit_of_Modernisation_of_Police_Forces_Government_of_Uttar_Pradesh.pdf (last visited on: may 29,2024)‖.

[10] *Ibid*

through the Ministry of Home Affairs. When it comes to handling large-scale disasters, the Disaster Response Force (NDRF) is entrusted with this important task of conducting rescue and relief operations.

NDRF Teams are responsible for saving lives after natural disasters. In many cases though, people are never found — only their bones or rotting corpses. What makes this daunting task manageable is the presence of ‒Disaster Victim Identification (DVI) teams‖, composed of specialists covering forensic anthropology, odontology and forensic medicine. Specialized teams such as these are crucial in helping to identify and document victims which provide closure to family members during this agonizing time while aiding the disaster response process as a whole. Such professionals are critical in accurately identifying and recording the dead as part of mass disasters.

Therefore, specialist teams with the necessary skills should be created by the ‒National Disaster Response Force (NDRF)‖. The NDRF will do well to enhance its resources for managing the aftermath of calamities and providing some measure of peace to families touched by what are among the most traumatic events in their lives, by assimilating experts from forensic anthropology, odontology and forensic medicine.

## HISTORICAL BACKGROUND

The history of forensic science in India started in 20$^{th}$ century when initial attempts were made to record and conserve evidence. However, forensic science as a formal profession was not widely established until several decades later. It also demonstrates the nation‘s paradigmatic shift of criminal investigation as modern forensic methods was implemented, leading to the gradual development of forensic laboratories.

Over the years, India has achieved a lot of progress in forensic science and brought it up to date with changes happening abroad. This trend has been enabled, and the forensic troubleshooters of police departments all over the nation have been greatly enhanced through the use of some of the most sophisticated new technologies including digital forensics, fingerprint analysis and DNA profiling. Landmark wins in high profile cases are damning evidence of how important forensic evidence is in the conviction process and attaining justice. These achievements reflect the

essential position of forensic science in the legal process and society as a whole, demonstrating that they are indispensable to modern criminal investigations.

## CHALLENGES FACED

Despite having made tremendous strides over the years, forensic science in India still suffers from a series of woes. Obsolescent infrastructure, a systemic shortage of appropriately trained forensic practitioners, and inadequate financing constrain the promise and effectiveness of the field. On top of that, criminals constantly adapt, and for example, cybercrime rates have skyrocketed. The nature of these challenges emphasizes the necessity for ongoing evolution and reform within the forensic science field to keep pace with the changing face of crime.

Resource constraints pose a multitude of challenges, especially in terms of the availability of funds for state-of-the-art equipment necessary for modern forensic science. Furthermore, the outdated infrastructure with no proper tools or facilities restricts the forensic labs from performing analysis accurately and thoroughly. A further factor worsening these challenges is the lack of trained forensic professionals, as demand for their specialized services outstrips supply leading to choke points and delays in the criminal justice system.

The rising incidence of cybercrimes further adds to the complexities of forensic science. Then, as with so many facets of life today, as digital technologies progress the methods used by cybercriminals have also changed and adapted — suggesting forensic methodologies will need to develop in parallel. Adapting to this evolution will require implementation of new technologies and methodologies, as well as continual training and development efforts for forensic professionals to keep pace with the sophistication of these crimes. Tackling this problem requires a holistic approach. This calls for a greater investment in forensic infrastructure, an improvement in training programs to develop world-class forensic specialists and creating an environment that promotes creativity. Together, these steps will strengthen India forensic capabilities in dealing with the evolving nature of crime and help improve speediest delivery of justice.[11]

[11] "Indian kanoon - Dharam Dev Yadav vs State of Uttar Pradesh on 11 April, 2014. *available at:* https://indiankanoon.org/doc/39335671/ (last visited on: May 26, 2024).‖

More than almost a decade after the development of the country‘s first forensic science policy in 2005, India is still plagued by issues that severely undermine its forensic system. In the landmark judgment of ‒*Dharam Dev Yadav v. State of Uttar Pradesh”*, the Supreme Court highlighted that forensic evidence assumes great importance in a case involving a serious and premeditated crime. Flawed forensic evidence leading to wrongful punishments represents one of the most troubling aspects of our practice area.[12]

Due to advances in DNA testing, many people exonerated from being wrongfully imprisoned as a result of flawed forensic evidence. Many, if not most, investigating officers do not have the level of training required to properly collect, preserve, package and relay forensic evidence. This lacking is often a result of not enough education and training in the area. Therefore, there is a dire need to mix science in their practices with the improvement in investigation skills. Last but not least, scientific audits need to be implemented for crime scenes that are regarded with skepticism during trial phases.[13]

Forensic science laboratories in India are mostly being run by government and that too nearly all under police force. On the other side, some ‒State Forensic Science Laboratories‖ are under direct control of Home Department. Delhi is where the laboratory also comes under administrative control of Central Bureau of Investigation (CBI). But forensic evidence created by experts whose laboratories are managed by the police agency faces heightened scrutiny in both the courts and public opinion. In India, forensic reports often contain probabilistic results rather than individualizations, which makes them supporting evidence and not proof in criminal cases.

There are multiple challenges in India which challenge the integrity of evidence-based science. Such challenges include the lack of clear scientific consensus, lack of research efforts, resource limitations in forensic science, poorly developed ethical guidelines and a shortage of credential experts, databases, or information about error rates for different methods.[14]

---

[12] “J. Campbell Moriarty, Nebraska Law Review _Misconvictions,‘ Science, and the Ministers of Justice, p. 86,2007, Available at: https://digitalcommons.unl.edu/nlr/vol86/iss1/2/ (last visited on: May 25, 2024).‖

[13] *Ibid*

[14] “J. Peterson, I. Sommers, D. Baskin, D. Johnson, The role and impact of forensic evidence in the criminal justice process, 2010. Available on: https://www.ojp.gov/pdffiles1/nij/grants/231977.pdf (last visited on: May 25, 2024).‖

These Daubert principles represent a general structure for considering scientific expert testimony in court. These principles state that evidence is subject to scientific scrutiny, methodologies and techniques appear in peer-reviewed publications. In addition, these techniques need to be broadly accepted by the scientists and a reasonable accounting of their error rates should be counted. Forensic scientists in the country should start with rigorous training and participate in refresher and orientation courses to stay updated, to fulfill these standards. As per Daubert guidelines, Indian courts too subject that experts and scientists are examined-in-chief, cross-examined, and re-crossed post-entitlement to get their evidence validated on rigorous scientific tests.[15]

## EXISTING SHORTCOMINGS

### *1. Workforce resources*

Worryingly, India has been battling a major manpower shortage at its various Forensic Science Laboratories. Of the total staff strength, of around 4,500, only about 3,000 are trained experts or reporting officers. The rest are support staff. Considering the massive population of our country which is 1.38 billion, this number of forensic scientists is way too low to handle such a huge amount of crime cases. According to standards set by the ‑Bureau of Police Research and Development (BPRD)‖ in 1980, which were then revised in 2000 and 2005 by the ‑Directorate of Forensic Sciences‖, the workload for core areas such as DNA analysis, toxicology, biology, document examination and cyber forensics is currently four-five times above recommended levels. With about half the scientist positions in these laboratories unfilled, giving government immediate means to stem this loss is an urgent necessity.[16]

According to an article in The Hindu titled *"Forensic science education needs urgent reforms" dated September 20, 2009*, a retired Director of the Central Forensic Science Laboratory (CFSL), Hyderabad maintained that expansion and improvement was ‑the need of the hour for Indian forensic science‖. Pointing to the high population density of our country leading to increasing crime rates, the Director insisted on a ten-time increase in all forensic science laboratories across

[15] J. Sanders, S.S. Diamond, N. Vidmar Legal perceptions of science and expert knowledge Psychol. *Public Policy Law*, 8 (2) (2002), pp. 139-153

[16] M. Airlie, J. Robertson, M.N. Krosch, E. Brooks Contemporary issues in forensic science—Worldwide survey results Forensic Sci. Int., 320 (2021), Article 110704, 10.1016/j.forsciint.2021.110704

the nation. The article also pointed out the need for major reform of forensic science teaching at universities and new practical training measures for practitioners in the criminal justice system.[17]

### *2. Education related to Forensic science*

There are around 80 institutions of forensic science in India, which have become very diverse academies and centers. Of these, 54 are private colleges and 22 government affiliated. Full-fledged courses with various specialties, such as Bachelor and Master in forensic science, diploma and certificate programs are offered by these institutions.

But there is also an increasing recognition that this must take the form of targeted training in particular disciplines of forensic science. This means that universities would have to offer specific courses in which students are able to specialize in areas like Fingerprints, Toxicology, DNA Analysis, Document Examination Biology, Forensic Anthropology etc. Graduates would then be broadly equipped with the knowledge and skills necessary to pursue their specialty field of forensic science in such specialized Master degree courses.[18]

While there are colleges that have established Master s degree programs in various aspects of forensic science, these degree programs often obtain limited resources for education including faculty, facilities and labs in focused areas due to lack of specialists. To strengthen the employment credentials of graduates, it would be beneficial to include degrees or certificates awarded by such colleges in the criteria for recruitment and promotion within fingerprint bureaus and forensic science laboratories. Further, preference should be given to such applicants while recruiting the police and –Central Armed Paramilitary Forces (CAPF)‖.[19]

The staff is mostly MBBS/MD in medical colleges and postgraduate institutes of medical education and research. Yet, it is also evident from the job recruiting guidelines that in Forensic

---

[17] "W.C. Thompson Beyond bad apples: analyzing the role of forensic science in wrongful convictions southwest. Univ. Law Rev., 37 (2009), pp. 971-994. Available at: https://papers.ssrn.com/abstract=2214465 (last visited on: May 27, 2024)‖.

[18] "D. Bhandari, V. Sahajpal, A. Sharma, V.K. Arora Forensic science education in India: challenges and opportunities J. *Forensic Sci. Crim. Investing*., 14 (2) (2020), 10.19080/JFSCI.2020.14.555885‖

[19] "Top Forensic Science colleges in India, Fees, Courses, Placements, Ranking, Exams, 2021. *Available at:* https://www.shiksha.com/science/colleges/forensic-science-colleges-india-3 (last visited on: May 20, 2024).‖

Science Laboratories, staff must have PhD and MSc degrees on related subjects (for example forensic science).[20]

In countries such as India, ―Ministry of Health and Family Welfare, Government of India‖ is responsible for various organizations conducting medicolegal activities in medical colleges and hospitals. On the contrary, Forensic Science Laboratories (FSL) is either directly or indirectly governed by the Ministry of Home Affairs under various state police departments. Fingerprint analysis, mainly performed by police force Fingerprint Bureaus, is an essential part of forensic investigations. FSL, which investigate fingerprints in criminal cases, also belongs to the State Laboratories and Central Bureau of Investigation; however. In addition to teaching and training members of India's criminal justice system law enforcement, the prosecution, the judiciary and medical experts, these organizations do forensic analyses as well.[21]

### *3. Technology and instrumentation*

The country requires ISO-certified state of the art Forensic Laboratories that are equipped with high-end technology and instruments. These facilities should process the movement of exhibits and must not have any or few outstanding cases. Both government and private forensic experts also need to be registered and certified. There is a need for clear nationwide standards to harmonize report formats as well as using plain language in reports to improve understanding by non-scientists.

### *4. Legal provisions*

There is an urgent need to fast-track the long-pending DNA Bill in India that would bring about a robust legal framework for forensic studies. ―The Forensic Legal and Development Authority Bill‖ also need to be passed to form the legal frameworks essential to developing the sector. It would create a national system for developing and regulating forensic practices, as well as codes of conduct and ethical standards for those in the field.

---

[20] Ibid

[21] "Ministry of Home Affairs. *available at:* http://www.mha.nic.in/ (last visited on: May 22, 2024)‖

The recent work by the Indian government in passing the ―Information Technology Act, 2008‖ which does indeed lay down standards for how to use digital forensics is commendable, but this should not obscure a major issue. There should be adequate training about the act so that experts were ensuring proper implementation of it. Currently, experts in documents are still reporting u/s 45 of the Indian Evidence Act.[22]

### *5. Gaps in infrastructure and technology*

There is a real risk of India lagging behind the rest of the world in rapidly evolving forensic technology. Forensic experts resort to the latest techniques but are unable to use them effectively because of limited number of the most modern tools and adequate training opportunities. This may result in missed chances to locate and assess crucial evidence due to insufficient resources.

### *6. Workload and Backlog:*

The operating backlog of forensic exams and growing cases becomes a genuine dilemma for the criminal justice system. High workloads among forensic scientists lead to a backlog in report preparation and court appearances. Apart from delaying investigations, it poses a question to the integrity of the evidence.

### *7. Establishment of Quality Assurance and Standardization:*

Court needs forensic evidence to be validated and verified accurate and reliable. However, absence of uniform systems and standards in forensic institutes in India over the years raises a concern about the quality control mechanisms which affects reliability and consistency of forensic investigations. Standardization highlights the need for reliable and reproducible forensic evaluations and is the key to improve confidence from citizens and legal practitioners.

### *8. Communication between Fields of Science:*

It is vital that forensic scientists and attorneys foster strong communication and cooperation during both phases of the investigation and prosecution. But the complexity of forensic science

[22] ―The Information Technology Act, 2008, Available at: https://police.py.gov.in/Information Technology Act 2000 - 2008 (amendment).pdf. (Last visited on: May 20, 2024)‖.

interdisciplinary relationships makes a shared modes understanding between methods and outcomes necessary. The most pressing challenge in India is the inter-disciplinary or domain-specific gap in understanding and communication.

## CASE STUDIES

### *"Kishan Lal @ Champa Yadav vs State Of Chhattisgarh"*[23]

**DNA Profiling in Rape Investigation**

In a notorious rape case, forensic experts employed DNA profiling to establish a link between the assailant and the scene of the crime. The victim reported the attack quickly, allowing forensic investigators to obtain biological evidence from the victim's clothes and other materials at the scene. DNA analysis was critical in narrowing the field of potential suspects, and ultimately in identifying and detaining the perpetrator.

Such forensic evidence played an important role in the court cases. The DNA evidence, not only linked the accused to the crime site beyond any reasonable doubt, but also secured itself to be able to counter all claims of innocence beyond reasonable doubt. The forensic evidence strongly supported the case for the prosecution, and forensic results helped convict the perpetrator. This case is a significant example of how DNA profiling can significantly increase the evidentiary strength, thus achieving justice.

### *"Sanjay @ Papdya @ Pawan @ Prashant @ ... vs The State Of Maharashtra"*[24]

**Fingerprint Analysis**

Fingerprints were part of a thorough investigation by law enforcement that was launched because of a series of break-ins in towns. Forensic specialists cross-referenced latent prints taken from crime scenes with pre-existing databases. After an extensive investigation, a match was made that connected a suspect already implicated in burglaries, to the most recent incidents.

[23] CRA No. 565 of 2022

[24] Criminal Appeal no. 3418 of 2023

Fingerprint evidence is generally used to prove the guilt of the accused beyond a reasonable doubt and assist law enforcement agency in solve the crime.

***"Ritu Kohli's Case"***[25]

**Digital Forensics and Cyber Extortion**

In a recent case, a businessman was threatened in a case of cyber-extortion with demands, via email, for him to pay a sum of money, in order to suppress sensitive corporate topics. They enlisted digital forensic specialists to investigate the source of the threatening communications and track down the perpetrator of the cyber-attack. Use of forensics, help the team to find out cybercriminal.

Such questioning had an enormous effect on cases that came before the courts. Digital forensics proved to be vital in tracking down and eventually revealing the identity of the cyber extortionist. Besides being critical to the perpetrator's conviction, the evidence, collected and presented in court with great skill, was symptomatic of the increasing role of high-tech forensic evidence in the fight against contemporary crimes. This case was a reminder that even in this cyber world age, we continually needs to upgrade our forensic process for catching digital criminals.

***"Vineet Kumar Chauhan vs State Of U.P on 14 December, 2007"***[26]

**Ballistics Analysis:**

Ballistic evidence played a significant role in the investigation of a shooting-related homicide case, and this was corroborated by a detailed analysis of the evidence. Forensic experts examined bullets and cartridge casings removed from the crime scene and matched them with the pistol believed to have been used. This ballistics study was necessary to link the weapon and the crime and to find the perpetrator.

The use of ballistic evidence which connected the weapon to the commission of the offence resulted in a conviction and the case outlines the importance of ballistics analysis in a criminal

[25] C.C. No. 14616/2014

[26] (2007) 14 SCC 660

investigation and during court proceedings. A closer examination of these and other case studies reveals how significantly forensic evidence strengthens Indian Judicial system.

**FUTURE WAYS**

Objective of this research is to encourage inter-disciplinary collaboration amongst law enforcement agencies, advocates and forensic specialists.

The discussion also sheds light on the importance of incorporating modern technologies in forensic processes. The new technologies and processes can enhance the forensic experts‘ ability to collect and examine the evidence significantly. If technology like that becomes more prevalent on the streets, it could make forensic work faster and more accurate, which might hasten the resolution of court cases.

Additionally, there is a compelling need for building capacity that is imperative to fortifying the pillars of Indian forensic science. Investing on training and professional development of criminalistics personnel is necessary to equip them with the skills, knowledge and expertise needed in addressing new and evolving challenges they need to deal with. In promoting a culture of continuous education and skill development, forensic practitioners will be informed about advancements in forensic techniques and methodology. In a nutshell, the dream roadmap for forensic science in India is based on a multi-faceted model comprising of cross-disciplinary germination, integration of technology, procedural reforms and capacity building. Embracing such imperatives is essential to a new generation of effective and reliable forensic practices such that strengthens the criminal justice system and the rule of law.

**“THE NATIONAL FORENSIC SCIENCE UNIVERSITY AND RASHTRIYA RAKSHA UNIVERSITY ACTS” - 2020**

On 29 September 2020, two landmark Acts were approved by the ‒Ministry of Home Affairs (MHA) of the Government of India‖—‒The National Forensic Science University (NFSU) Act 2020‖ and the ‒Rashtriya Raksha University (RRU) Act 2020‖. This led to the establishment of NFSU in Gandhinagar, Gujarat and RRU in Lavad, Dahegam, Gandhinagar, Gujarat, India.

–Rashtriya Raksha University‖ aims to support and promote the pursuit of international standards in research and education; particularly with regards to risk management, artificial intelligence, cyber security, and law enforcement. Further empowered by these legislative measures, the university has the authority to set up learning centres across the states and union territories of the country.[27]

According to the –National Forensic Science Institution Act of 2020‖, the individual Indian states in the country would be strategically placed with the regional research and instructional centres for the institution. These centres will be set up in collaboration with the state governments to strengthen crime investigation, detection, and prevention. Besides, the central government will also take the help of the University for suggesting policies on forensic science. NFSU Act 2020 clearly lays down the specific duties and power of the university.[28]

## CONCLUSION

In India the story of forensic science use in criminal prosecution is one of great achievements. There can be no doubt that replacing antiquated forensic practices with state-of-the-art technology has vastly improved law enforcement agencies‘ ability to investigate crime. In particular, prominent examples highlight just how critical forensic evidence is to securing convictions and ensuring justice is done.

But all of those devolve more actually to the point until responding is materially needed. Forensic labs are ridden with the pressures of too many forensic exams and not enough facility or resources. We have to do this with stronger quality assurance protocols, more standardized protocols, and multidisciplinary collaboration.

Forensic science in India requires targeted investments in infrastructure, training and resources, to reinforce the forensic infrastructure. And use of artificial intelligence and technology could assist in solving crimes

---

[27] “The Rashtriya Raksha University, 28th September, 2020. Available at: https://www.mha.gov.in/sites/default/files/TheRashtriyaRakshaUniversityAct2020_05012021.pdf (last visitedon: May 22, 2024).‖

[28] “The National Forensic Science University ACT, 28th September, 2020, Available at: https://www.mha.gov.in/sites/default/files/NFSUAct2020_05102020.pdf (last visited on: May 22, 2024).‖

Another key is enacting laws consistent with advances in forensic science, allowing forensic evidence to fit neatly into a functional criminal justice framework. A comprehensive approach must involve strengthening the expertise of forensic professionals, promoting inters professional collaboration and increasing public understanding of the importance of forensic evidence.

By facing the immediate challenges confronting forensic science and anticipating future developments, India also has the quality to emerge as an advanced nation in forensic science and strengthen its criminal justice system for the future. This analysis reveals how forensic science has developed both as a discipline and in terms of utility in response to the contours of contemporary justice in India.