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Need of Forensic Science towards New Criminal Laws: an Empirical Study

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***Abstract*— India's new criminal code, Bharatiya Nagarika Suraksha Samhita (BNSS), mandates through Forensic investigation for every crime that carries a jail term of 7 years or more alongside the Bharatiya Nyaya Sanhita (BNS) and the Bharatiya Sakshya Adhiniyam (BSA), to reform the Criminal justice landscape comprehensively. The BNSS aims to create a more transparent, efficient, and victim-friendly system by leveraging technology and enforcing accountability. Cut to Indian reality, most states have 60 %- plus forensic staff vacancy, unsurprisingly, police has to wait for months, sometimes more than a year for forensic testing. That feeds into massive delays in disposal of criminal cases. This paper focuses on the applicability of forensic science in criminal investigation for serious crimes, time-bound trials and victim-centric measures. This paper also focuses on the possible uses of forensic technology in the Indian legal system, enhancing the accuracy of investigations and overcoming problems with the use of forensic evidence in courts.**

***Keywords*-- BNSS 2023, Forensic, Technology, Victim-centric, staff vacancy**

I. INTRODUCTION

Criminal Investigation, Forensic Science, Justice, Medical Jurisprudence

The West Bengal Police established the first forensic lab in Kolkata in 1952, marking the introduction of the justice system in India. At first, India's forensic expertise was limited to basic techniques like the analysis of fingerprints, which provide little understanding of the dynamics of criminal cases. Physical evidence was the primary objective of early forensic procedures since it was vital of investigations and court cases. But as science and technology were produced, forensic procedures in India altered, employing increasingly complex and varied technologies. A crucial turning point in criminal justice was reached in the 1990s with the creation of DNA profiling which made it feasible to identity people more precisely and use of DNA evidence in linking suspects to crimes. Similarly, the emergence of toxicology in forensics made it possible to identity persons, narcotics, and other dangerous substances with greater accuracy, which proved crucial in determining the root cause of fatalities in serious cases and conditions.

Other scientific specialties, such as digital forensics, developed in reaction to the increasing relevance of computers and other technological gadgets in contemporary CRIME a technological advances progressed. Because it enables detectives to recover and examine information saved on computers, handled devises and various other digital platforms, technological forensics has proven especially significant in cases regarding fraud, online crimes and online harassment. As modern technologies like recognition of facial features, and forensic geosciences have further improved the scope and efficacy of criminal investigations, the growth of forensic science techniques in India has followed worldwide trends. The Indian legal system has made substantial strides in non-cooperating forensic expertise into criminal investigations, acknowledge with the significance of forensic evidence. To standardize forensic procedures throughout the nation, the Indian government established the Department of forensic Science Services (DFSS) in 2001, marking the beginning of this integration. In addition to an extensive network of forensic labs throughout India, the DFSS has player a significant role in fostering consistency and raising the Caliber of forensic analysis. There are currently more that 50 forensic labs in the nation, and this number is only going to rise as forensic science becomes more accepted by the Indian legal system/.

II. OBJECTIVE OF THE STUDY:

- To research the Government of India (2023), Bharatiya Nagarik Suraksha Sanhita, 2023 (Act No.-46 of 2023)
- To research the Bharatiya Nyaya Sanhita 2023 and Bharatiya Sakshya Adhiniyam, 2023.
- To research the need of crime science investigation with forensic samples as a supporting evidence in criminal trial.
- To ascertain advice and reach a judgement based on specific inquiries.

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III. Research Methodology

The researcher used both primary and secondary sources together the information needed this article. The researcher employed a questionnaire and in-person interviews to ask fundamental questions about the application and significance of the needs in crime scene investigation inclusion of forensic science under new criminal law-2023. The forensic investigation done with the help of an expert at the crime site is the foremost important aspect in collection of any evidence. The second resource consists of books, journals, case records, law books, newspapers, websites on the internet, publications from the Government and records.

IV. Key Features Of BNSS

- One of the most notable reforms is the introduction of electronic First Information Reports (E-FIRs) and Zero FIRs. Citizens can now file FIRs electronically, enhancing accessibility and reducing procedural delays. The Zero FIR provisions allows individuals to Judge complains at any police stations, irrespective of jurisdiction, ensuring prompt action, especially in target cases.
- The BNSS mandates that investigations for most offenses be completed within 90 days, extendable to 180 days for serious crimes. This provision aims yto expedite the legal process and reduce case pendency.
- For offenses punishable with seven years or more of imprisonment, the BNSS requires mandatory forensic investigations. Forensic experts must visit crime scenes to collect evidence, which must be recorded electronically. This move seeks to enhance the scientific rigor of investigations.
- The certain grave offenses, police custody can now extend up to 60 days, subject to judicial oversight. This extension aims to provide law enforcement with adequate time for through investigations while ensuring checks against potential misuse.
- The BNSS facilitates the admissibility of electronic records and supports virtual court proceedings. This integration of technology aims to modernize the judicial process and make it more efficient.
- Victims are now granted participatory rights in the trial process, including receiving updates on case status and access the measures. This shift emphasizes the importance of victim welfare in the justice system.

Meaning of forensic Science.

Forensic science embraces all branches of science and applies to the purposes of law. Originally, all the techniques were borrowed from various scientific disciplines like chemistry, medicines, surgery, biology, photography, physics and mathematics. But in the past few years it has developed not only its own techniques but also its own branches, which are more or less exclusive domains of forensic science. The science of fingerprints, anthropometry, track marks, documents (especially the examination of handwriting) and forensic ballistics essentially belongs for forensic science alone. More advances that are significant have been made in serology, voice analysis, odor analysis, and in studies relating to pattern recognition through computers. The most important development of the 12 th century however had been DNA profiling for identification of human beings. The term forensic comes to us from the Latin word forensic which means the forum. Forensic science is acting as a bridge between the medical scientists and legal professionals. It is the science that comprises of the matters that provide a common platform to both scientists and legal professionals. In the ancient Rome, the forum was the site of debates concerning governmental issues, but also was the court-house, where trials were held. Consequently, forensic science has come to mean the study and practice of applying natural and physical sciences to the resolution of conflicts within a legal setting. More broadly, forensic science can be defined as identification, individualization and evacuation of physical evidence by the application of the principles and methods of natural sciences for the purpose of administration of criminal justice system. Moreover, it is one the most energetic, charismatic, contemporary and exhilarating branch of e=science used in identifying crimes and criminals. The role of forensic scientist is threefold to collect vital physical evidence from the crime scene, to analyse them in the laboratory and to provide expert testimony before the court of law.

V. What Is Forensic Investigation?

Basically, using scientific methods and techniques to analyze evidence, typically in criminal cases, but sometimes also in civil cases. A good FSL should be able to do the following: DNA analysis, fingerprint analysis, ballistics analyzing firearms, bullets and trajectories), toxicology (identifying drugs, poisons, or other substances in body fluids), blood spatter analysis (interpreting blood patterns at crime scenes), trace evidence, which deals with studying tiny particles like fibers, hair, etc, and last but also the fastest growing forensic specialty, digital device

analysis (desktop, laptops, tablets, smart phones). Digital documents can include emails, server logs, and documents in cloud storage, social media posts, messages, websites, location evidence and voice mail.

Need for Forensic Investigation under BNSS :

The BNSS, which replaces the Code of Criminal Procedure, 1973 (CrPC), aims to modernize India's criminal justice system by shifting from subjective evidence (like confessions) to objective scientific proof. The need for this emphasis is rooted in several factors.

- Mandatory Provision: Section 176 (3) of the BNSS marks it mandatory for a forensic experts to visit the crime scene and collect evidences for all offenses punishable by imprisonment of seven years or more. This ensures scientific methods are systematically applied in serious cases.
- Enhanced Conviction Rates: By relying on verifiable scientific data like DNA profiling and ballistics, the law seeks to improve evidence reliability, which is expected to increase conviction rates and reduce the margin of human error or bias.
- Reduced Reliance on Confessions: The new law aims to decrease the dependence on potentially coerced or unreliable custodial statements by prioritizing factual, scientific evidence, thereby protecting the rights of the accused.
- Modernization: The CrPC was an archaic, colonial-law. The BNSS integrates modern technology, including digital forensic and electronic proceedings, to address contemporary crimes effectively.
- Clearer Procedures: The Samhita establishes stricter "chain of custody" protocols for forensics samples to prevent tampering and ensure the integrity of evidence from the crime scene to the court room.

Role of forensic science in criminal investigations:

By presenting objective, scientifically verified evidence that can stand up to security in court, forensic analysis plays a crucial part in crime solving. Forensics subjects improve the precision and dependability of investigations into crimes by closing the gap between research and law, thereby advancing justice. The application of forensic expertise to investigations the crimes in India has proven crucial in handling complicated cases, and guaranteeing that prejudice does not skew the evidence.

Forensic DNA analysis:

One of the most accurate and trustworthy forensic methods is generally accepted to be DHA profiling. It is increasingly essential in India govt identifying offenders, solving lawful crimes, and clearing innocent people. DNA is an important instrument in criminal investigations because of its district genetic code, which guarantees great accuracy. The case of the 2012 Delhi sex assault case was one of the historic instances where DNA analysis was essential. DNA evidence connected the offenders to the crime scene, greatly aiding in their detection and conviction. DNA testing has also been essential in solving paternity cases, missing person situations, and massive disaster identifications.

Forensic Pathology:

To ascertain the cause, procedure, and duration of death, forensic pathology performs autopsies and post-mortem examinations. This field is essential in violent crimes because they can shed light on the type of wounds, the kinds of weapons used, and the circumstances that led to the victim's death. Forensic pathology has been crucial in resolving cases where autopsy results revealed intentional misconduct in staged suicides or inexplicable deaths.

Forensic Toxicology:

Finding and analyzing poisonous substances in biological fluids like blood, urine, or tissues is the primary objective of forensic toxicology. In circumstances involving intoxication, overdoses of drugs, offenses involving alcohol, and interaction with dangerous substances, it is essential in prominent instances like the murder of Aarushi Talwar in India, where sedatives were found during the toxicological examination, forensic toxicology has played a crucial role.

Forensic ballistics:

The study of ammunition, weapons, and bullet trajectory is known as forensic ballistics. Since it offers details about the kind of weapon used, how it fired, and the events surrounding the incident, this discipline is essential in offenses involving firearms. Forensic ballistics was essential in recreating the events and connecting the firearms used to the criminals used to the criminals in incidents like the 26/11 Mumbai attacks. Using microscopic striation patterns to link bullets to particular rifles has been crucial in resolving multiple firearm crime cases in India.

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Digital forensics:

Digital forensics is now an essential tool for modern investigations due to the quick development of technological advances and the rise in cybercrimes. Data recovery, analysis, and interpretation from electronic devices, including smart phones, desktops, and media for storage, are all part of digital forensics. Digital evidence frequently serves as the foundation for investigations into instances involving cyber fraud, identity theft, terrorist activity, and even more conventional crimes. For instance, information retrieved from the defendant's cell phone in the well-known Sheena Bora murder case from 2016 offered vital proof that connected conversations and incidents to the killing.

Forensic evidence in Indian courts:

In the Indian legal system, forensic proof has become a vital instrument that greatly improves the precision and dependability of investigations into crimes and convictions. Forensic evidence still faces many legal institutional obstacles, despite being regulated by laws like the Bharatiya Sakshya Adhiniyam, 2023. Nonetheless, its use in many well-known cases proves its indisputable

Legal framework and forensic science in India:

Following the implementation of three historic laws in 2023 – the Bharatiya Nagarika Suraksha Sanhita (BNSS), the Bharatiya Nyaya Sanhita (BNS), and the Bharatiya Sakshya Adiniyam (BSA), India's legal system saw a dramatic change. These statutes represent an important change in the way forensic science is incorporated into criminal, investigations and legal proceedings. Collecting forensic evidence in serious crimes is now mandatory to enhance investigation quality and boost conviction rates. This nationwide implementation empowers states by improving infrastructure. Moreover, the increased collection of samples and granting expert exemptions further strengthens forensic procedures.

VI. Legal Provision

Section (176)3

This section mandates the collection of forensic evidence at the crime scene by a 'forensic expert' for offenses punishable by imprisonment of seven years or more. The provision prescribes a five-year period for implementation.

Section 349:

Section 349 expands Magistrates' power to order forensic samples, including fingerprints and voice samples, from any person upon a written order. BNSS Section 349 and CrPC Sec. 311A both empower first0class Magistrates to order sample collection for investigations, with BNSS offering a broader scope, including finger impressions and voice samples. Notably, BNSS allows sample collection without prior arrest, providing more flexibility in comparison to CrPC 311A.

Section 329:

Section 329 allows the submission of a report by a government scientific expert without requiring oral testimony in court, expanding categories of exempted experts. While both BNSS and CrPC include Government Scientific experts, BNSS extends its applicability to "any other scientific expert" specified or certified by the State of Central Government. In contrast, CrPC limits it to "any other Government scientific expert" specified only by the Central Government. The BNSS provision allows a broader range of scientific experts to be involved in legal proceedings.

Section 330:

In BNSS, when any document is filed, its particulars must be included in a list. The prosecution or accused, along with their advocates, are required to admit or deny the genuineness of each document within thirty days of supply. The court, at this discretion may relax the time limit, and no expert can be called unless the expert's report is disputed. Both BNSS Section 330 and CrPC Section 294 outline a similar process for handling documents filed in court, including the admission of denial of genuineness. However, BNSS 2023 introduces the element of time limit for admission of denial, along with the provision regarding expert reports. BNSS Section 330 simplifies the document admission process by introducing time limits and restricting expert testimonies unless reports are disputed. Similar to CrPC Section 294, BNSS offers added flexibility through court discretion, enhancing procedural efficiency.

Bharatiya Nagarika Suraksha Samhita, 2023 (BNSS)

Criminal investigation procedures have been upgraded under the Bharatiya Nagarika Suraksha Samhita, 2023. This law places a strong emphasis on enhanced forensic techniques and is driven by technology the law enforcement. Important aspects of forensic science include.

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Required use of scientific evidence: To provide scientific backing for cultural investigations, the BNSS requires that forensic evidence be used in cases of heinous crimes. Enhanced chain of custody requirements: To guard against tampering, the legislation establishes strict rules for upholding the chain of custody for scientific samples, including DNA and digital evidence. Electronic evidence collection: It describes procedures for the legal gathering and examination of digital evidence, with a focus on using accredited forensic laboratories to preserve the integrity of the evidence. Specialized forensic units: Promotes the creation of investigative units in police forces to speed up the gathering and examination of evidence.

Bharatiya Nyaya Sanhita, 2023 (BNS)

The Indian Penal Code is replaced by the Bharatiya Nyaya Sanhita, 2023, which also includes progressive amendments to improve the administration of justice. It illustrates how crucial forensic evidence is becoming to criminal prosecution. It consists of the following: Incorporation of scientific-based offenses:

The BNS specifically acknowledges crimes including illicit drug trafficking, online crimes, and ecological offenses that call for forensic assistance.

Forensic expert testimonies:

To enable forensic experts to offer specialized views during trials, rules for expert testimony are strengthened. Punishment measures for evidence tampering: To ensure the integrity and dependability of forensic evidence in court, the legislation establishes harsh penalties for tampering with it.

Role of advanced forensic technology:

To provide a futuristic approach to crime solving by encouraging the use of modern technologies like Artificial Intelligence (AI) and the analysis of DNA in investigations

Bharatiya Sakshya Adhiniyam, 2023 (BSA)

The Bharatiya Sakshya Adhiniyam, 2023, redefines the dependability and admissibility of evidence in court, especially forensic evidence. Important clauses consist of: Acknowledgement of contemporary forensic methods: Broadens the scope of evidence admissible to encompass findings from contemporary forensic methods.

Digital evidence authentication:

To ensure adherence to accepted forensic standards, the act adds particular rules for identification of digital and electronic evidence.

Simplifying expert testimonies: It codifies the procedure for forensic expert testimony presentations, necessitating thorough justification of methods and conclusions to improve transparency and intelligibility.

Empirical Studies and Challenges

While the legislative intent is clear, current literature highlights a gap between the legal mandate and its practical implementation, which forms the basis for potential empirical studies.

Lack of Standardization

The absence of uniformity among forensic labs is one of the main issues facing forensic science in India. Many labs use antiquated equipment and do not follow a standard procedure for forensic analysis. As a result, the caliber of forensic evidence offered in court varies. To guarantee consistency and legitimacy in forensic procedures, the Bureau of Police Research and Development (BPRD) has underlined the necessity of forensic lab accreditation by organizations such as the National Accreditation Board for Testing and Calibration Laboratories (NABL).

Delay in Forensic Reports

Substantial congestion of cases affects Indian forensic labs, frequently triggered by a lack of personnel and resources. The justice system may be jeopardized by these delays since they may hinder crucial cases that need prompt forensic proof. These delays are made worse by insufficient financing and improper handling of case systems. Modernizing forensic infrastructure and boosting government funding are necessary to address these problems.

Training and Expertise

The rapid development of forensic science, especially in computer forensics and forensic toxicology, has led to a disconnect between technological needs and currently available knowledge. Due to a lack of skilled forensic experts, India is often forced to use antiquated techniques. Improving education and training for police and forensic staff, as well as partnerships with educational institutions, are crucial to addressing the growing demand for qualified forensic specialists.

Public Awareness

In India, the public frequently has a negative opinion of forensic science, which breeds doubt about its dependability and accuracy. The legal system and police are also impacted by this ignorance, which leads to a lack of use of forensic resources.

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To increase confidence in forensic evidence, awareness-raising initiatives such as seminars, educational events, and training for law enforcement and court personnel are essential. Challenges in Admitting Forensic Evidence Although forensic science has transformed the legal system, many obstacles prevent its smooth incorporation into Indian courts. Different Forensic labs have different standards: The quality and capabilities of Indian forensic labs vary widely. While certain laboratories have modern technology and knowledgeable staff that meet global requirements, others suffer from.

Traditional approaches and inadequate Infrastructure.

Prolonged forensic report production delays result in drawn-out trials. The absence of qualified forensic specialists worsens backlogs worse. The dependability of forensic evidence produced in court may vary because of this lack of consistency. Issues of Human Error and Misinterpretation:Despite its technical foundation, forensic evidence is vulnerable to human mistakes. Unreliable evidence gathering, processing, or interpreting can result in.Disputation in court of scientific findings.

Possible injustices brought on by faulty analysis or Biased judgments. Legal & procedural bottlenecks: Scientific evidence's validity is frequently contested because-Law enforcement and judges are not well informed about modern forensic methods. Absence of precise legal guidelines for incorporating contemporary forensic technologies into court cases, such as technological forensics and AI-based investigations. Inadequate chain-of-custody procedures, which might put doubt on the legitimacy of the data.

Landmark Cases Involving Forensic Science.

In many well-known criminal cases in India, forensic science was essential to achieving justice. These incidents highlight how forensic techniques and instruments can have a profound impact: The Gang Rape Case in Delhi in 2012 (Nirbhaya Case): DNA profiling played a key role in locating and convicting the criminals. Ahter gathering andexamining biological specimens from the crime setting, the forensic team compared them to the accuser's DNA profiles. A swift trial and conviction were guaranteed by the evidence'sscientific and trustworthy quality, highlighting the significance of DNA analysis in serious crimes.

The Murder Case of Aarushi Talwar:

Forensic pathology, DNA analysis, and fingerprint examination were all used.

Notwithstanding the controversy accompanying the inquiry, the case demonstrated the value of forensic procedures in clarifying timeframes and recreating crime scenes. This case demonstrated the negative effects of subpar forensic procedures, including incorrect evidence processing and insufficient analysis, which caused delays and public mistrust.

The Murder Case of Sheena Bora:

Forensic pathology identified the cause of death, while anthropological forensic played a crucial role in discovering the victim's skeletal remains. The case highlighted the lack of access to sophisticated techniques such as skeletal inspection and isotope analysis in all forensic labs, underscoring their significance.

VII. Tamper Problem

A major issue with forensic investigations is whether the evidence collected, even if it's processed quickly, is actually authentic. Cases of manipulation are enough to cause concern. Mucking around with evidence can happen at the level of cops or labs. Some prominent cases:

- In the Pune Porsche case, the accused teen's blood sample was binned. Police arrested two doctors at Govt.-run Sassoon Hospital who discarded the 17-year old's blood sample and switched it with another individual's.
- An India Today sting-op in Feb.2023 revealed scientists at Varanasi's FSL offered to manipulate forensic reports for a bribe. The FSL chief demanded Rs.10 lakh to remove all signs of poison from the record in a case the undercover reporters had sought to fudge.

The lab need even offered to fudge DNA samples in a Lucknow lab, against cash. In Agra, a scientist was ready to tamper with a viscera report in a dowry death case.

- Forensic probe of a set of video clippings of the Feb. 9, 2021, JNU event found two videos were manipulated where voices of persons not present in the clips had been added. F the seven videos sent to the Hyderabad-based Truth Labs, two were found to be tampered with while the rest were authentic.
- In 2019, CBI filed a case against former deputy directors of Delhi's FSL for tampering with evidence in multiple rape cases.

A state-by-state report of India's Forensic Investigation Capacity. Forensic investigation started during the reaj. The first Lab was in Chennai (then, Madras), followed by Kolkata, Agra and Mumbai (Bombay).

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Forensic investigation now has a three-tier structure- Central Forensic Science Labs (CFSLs), State FSLS, and Regional FSLs aided by mobile forensic units. There are 117 functional FSLs, of which eight are CFSLs. New criminal Laws-2023 demand much more forensic investigation. But most forensic labs across the county face crippling staff shortages. A state-by-state report of India's forensic investigation capacity described below.

ANDHRA PRADESH-7 :

One step below Karnataka and Kerala in forensic capacity. It has around 500 personnel working in FSls. But it needs 300 to 400 additional forensic experts, to meet BNSS demands. FSL, Joint director (admin.) V Eswaramma said forensic labs examine 15,000 to 20,000 cases every year. He expects the number to go up under BNSS. She says FSLs have solved cases of rape, murder, and poisoning when witnesses have turned hostile. V Suresh Babu, a retired DCP, said the state doesn't have a sufficient number of forensic teams or testing kits.

ASSAM-8 :

At 30% staff vacancy, it does better than many big states, and govt. says recruitment is on. The directorate of forensic science in Khilipara, Guwahati, has 11 full-fledged divisions and a DNA testing unit. There are three fully functional regional labs and two more will be ready shortly. Special forensic labs are planned in hilly districts like Karbi Anglong to deal with NDPS cases. Director of forensic science. Athang Sing-son, said they have state- of- the- art equipment. Police personnel say they are confidential they can meet the BNSS's forensic investigation demand.

BIHAR-9:

Forensic staff shortage is at 78%. Even under old laws, it needed huge recruitment. The new laws, cops say, is something they can't even think about. There are just three functional FSLs- in Patna, Muzaffarpur and Bhagalpur. Nine more are under construction. But each of the 38 districts need one. Even the worst crimes don't get prosecuted quickly: the 2012 acid attack on two Dalit sisters, the 2018 Muzaffarpur shelter home rape case, the 2013 Patna blasts case. "We don't have adequate infrastructure to handle cases as per the new crime laws. Most labs lack modern equipment and technology, such as DNA analysis machines. The state FSL has only one cyber expert. This unit is over loaded with work, "acknowledged a top FSL, official.

CHHATISGARH-10:

Does better than its bigger neighbor, MP. The state has 325 sanctioned FSL posts, 60 are vacant. There are 178 personnel and recruitment is on for 40 vacancies. Approval for more posts is expected, said TL Chandra, joint director, SFSL. The state has labs in Raipur, Jagadalpur, Durg, Bilaspur and Ambikapur, and is awaiting the Centre's nod for labs in Raigarh and Rajnadagaon. There's no forensic report pending for more than a month, but a spurt in tests is expected with the new law , said Chandra, adding that the lab handles 23,800 exhibits on an average per year.

DELHI-11:

FSL staff vacancy is around 17-18%. There are 500 forensic personnel. 100 posts are unfilled. Recruitment is on, and FSL, experts the staff vacancy situation to ease soon. There are 10 FSL divisions. Cops say all laboratory divisions are well equipped. To expedite forensic sample processing, an annex building with upgraded laboratories was constructed last year. Deepa Verma, FSL, director, told TOI that forensic teams are now deployed in all 15 police districts, And that these teams received comprehensive training on the new laws and on proper evidence collection procedures at crime scenes.

HARYANA-12:

Haryana FSL is battling service a staff shortage, say officials, especially cyber forensics and DNA technicians. Recruitment of 135 assistant's scientific staff is pending. There is a nearly 50% vacancy for lab assistants in FSL Madhuban. Officials, when asked, give the standard answer: we need more equipment and more personnel.

JHARKHAND-13:

Negligible, is how officers describe the forensics staff strength in Jharkhand. Each of the 24 districts needs at least four scientists. Even the SL centre in Ranchi has 40 officers against 66 sanctioned posts, and it receives 40-45 'exhibits' for analysis every day. DG-CID Anurag Gupta said, "The FSL must be strengthened". FSL, director and special secretary (home) T Kandaswamy, said the govt "hopes" to increase personnel strength by at least 20x.

KARNATAKA-14:

One of the success stories, With 230 scientists, 206 scene-of-crime officers (SOCO) sand state–of-the art equipment, the Karnataka FSL is perhaps the best-staffed and equipped lab in the country. Well before the new laws came in.

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SOCO personnel along with police and collect evidence. According to police, the staff strength is almost full and they are looking for a few vacancies to be filled in 'mobile forensic and audio-video' units. They have enough to handle the newly introduced laws, senior police officers say.

KERALA-15:

Not in Karnataka's class, but getting there. There are 168 FSL officers and govt recently sanctioned 28 more posts, out of which 17 have been filled. Recruitment is on for the remaining Police have asked the govt for 98 more posts. There are 18 FSLs. But the current capacity was good enough to ensure no major case was delayed, say cops. This, despite the number of forensic exhibits doubling from 6,506 in 2018 to 13,273 in 2022. Good forensic capacity has helped solve tough cases, like the rape and murder of a Dalit law student in Perumbavoor in Ernakulum district in 2016. A fluid sample collected by the forensic team from the victim's body cracked the case.

MAHARASTRA-16:

In 2022, Maharashtra's main forensic laboratory in Kalina, Mumbai, received 32,109 cases, but only 50% were examined. The bulk of the rest (44%) were carried forward to the nest year. This is a regular practice. Of the 47,362 cases examined in 2021, 16,608 were old cases that had been "carried forward". "The pendency of cases for forensic examination directly impacts the time taken and quality of investment of cases, "said a report by Praja, an NGO that had filed an RTI on the issue. There is 39% vacancy in Kalina FSL. As of March 2023, it had only 260 of the 426 sanctioned staff. Navi Mumbai DCP (crime) Amit Kale said, "Post-mortem reports of more than 800 cases of accidental deaths were pending at Kalina FSL, for two years."

MADHYA PRADESH-17:

MP's forensic department has 200 sanctioned posts but 47% vacancy. Only 17 officers are assigned for crime-scene examination and they have to cover 53 districts. CFSL (Bhopal) director Shashikannt Shukla told TOI the state needs 876 more trained officers, including scientists, and that 508 posts have been approved. However, as the said, it will take years to get up to adequate capacity. In most parts of MP, there is typically only one scientific officer responsible for overseeing two or more districts within a particular division. This arrangement significantly delays response times to crime scenes.

MP HC recently took up, suo motu, delays in presenting forensic and DHA reports in criminal cases. A stratus report submitted by govt said such reports are pending in over 2.500 cases.

ODISHA-18:

FSLs have 60% vacancy. Broken down by function, it's 55% for scientific officers, 65% for assistant scientific officers, and 60% for lab attendants> of the combined sanctioned strength of 250, there are at least 150 vacancies. DGP Arun Kumar Sarangi told TOI police have asked for more personnel. Retired SP Santosh Jena said one of Odisha's problems is that forensic staff there get headhunted by other states with better offers.

TAMIL NADU-19:

FSLs say staffing is adequate. There are 254 scientific staff members in the forensic department, assisted by 144 technical staff in the roles of laboratory assistants and technicians. There is 103 additional staff for other roles. On equipment, too, TN does better than most. FSLs say they have enough. Moreover, the state govt recently sanctioned Rs. 10.13crore for the establishment of a new DNA Division in an RFSL. Govt. has also sanctioned Rs.50 lakh to buy a bullet velocity measurement system to aid in ballistics probe.

RAJASTHAN-20:

As many as 159 (36%) of the 4398 sanctioned forensics posts are unfilled. SFSL has requested an additional 500 posts to deal with the expected surge in workload with the new laws. It's still awaiting state govt approval. Rajasthan FSL, director Ajay Sharma says projections show the new laws will mean forensic examination of about 60,000 crime scenes a year. Recently, Rajasthan HC pulled up the home department for not filling an FSL report in a Posco case. Without forensic the court had to grant bail to the accused.

TELENGANA-21 :

The southern laggard in the forensic capacity league. The state has 66% vacancies. According to a Bureau of Police Research & Development (BPRD) report, there are only 10 scientific officers against 25 sanctioned posts and not a single scientific assistant against 28 sanctioned posts. As for lab assistants, there are 28 posts sanctioned for the RFSLs, but only 10 have been allotted so far. ADG Shikha Goel said the department is preparing an estimate of manpower, infrastructure and equipment needed to meet the provisions under the new laws.

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UTTAR PRADESH-22 :

Staff shortage at FSLs is at 75%. Four of the 12 labs have "limited capabilities". Backlog of untested evidence is at 50,000. It was even higher but a govt effort since 2017 has brought it down to the current number. Cops say they are trying to prepare for new demands. Every district is to have an FSL. Addl. DG- technical services Naveen Arora, told TOI that 30,000-plus police personnel have been trained in collecting, preserving and documenting forensic evidence. But who will test the evidence? Cops say they can't do anything without technicians.

WEST BENGAL-23 :

There are 35 forensic officers. A minimum of 30 more needed. For forensic assistant and lab assistant levels, staff shortage is 50%. A forensic officer told TOI that they are unable to make immediate crime-scene visits. One arson site was investigated 48 hours after the event- as good as not sending a team. Moreover, that is just one case. Six months is the usual delay in submitting reports. Even for high profile cases, reports come in 60-90 days. Bengal FSL, director K Jayaraman is clear. "Without capacity addition, it will be impossible for our small team to manage the volume of work we will soon face."

LABS ON WHEELS-24 :

- Gujurat Forensic Science University recently launched a hi-tech lab-on-wheels.
- It has equipment to process crime scene evidence on the spot.
- Cost per van rs.64 lakh.
- Each van has a DNA sample collection kit, semen detection and collection kit, light source of eight different wavelengths to detect body fluids, latent fingerprints, drugs, gunshot residue and specks of evidence not visible to the naked eye.
- Vans are powered by a 5KV generator.
- They are GPS-enabled.
- Many states have older model mobile forensic units. Upgraded models are being used currently in Delhi, Mumbai, and Gandhinagar.
- Most states have too few mobile units.
- Even better performing state like Karnataka needs 30-35 CSI vans. It was 14 now.
- Kerala has no mobile unit. It needs 19 vans.
- MP, a big state, needs 116 CSI vans.
- Odisha has only one and needs 30.
- Up has only 8, West Bengal only 5, Telengana doesn't have a single CSI van. 7-24-Reporting Abhaya Singh, Nadita Sengupta, Himanshi Dhawan in Delhi, Malathy Iyer in Mumbai, Sanjaya Sahay in Ranchi, Debabrata Mohapatra in Bhubaneswar, Tamaghna Banarjee in Kolkata, Nitesh Sharma in Jaipur, Mukut Das in Guwahati, A Selvaraj in Chennai, Kshitiz in Patna, Rajiv Kalkod in Bengaluru, Krishna Kotwal in Indore, Rashmi Drolia in Raipur, Sai Kiran KP in Thiruvananthapuram.

Author's Perspective & Recommendations The authors view the new laws and regulations as a transformative initiative that integrates forensic science into the justice system to promote evidence-based investigations and timely resolutions. They emphasize improving conviction rates and reducing trial delays. However, challenges such as inadequate forensic infrastructure, a shortage of trained experts, and limited awareness among stakeholders persist. To address these issues, the authors recommend establishing advanced laboratories across states, enhancing capacity building though regular training for law enforcement and judicial officers, and integrating forensic education into academic curricula. Additionally, public awareness campaigns are suggested to foster understanding of forensic science's role in justice delivery, ensuring effective implementation of the new legal provisions.

Standardization of Forensic Practices

To guarantee the uniformity of forensic procedures across the country, India requires a single framework. This entails establishing consistent procedures for gathering, preserving, analysing, and submitting evidence. Adoption of global norms like ISO 17025 for forensic laboratories and certification by organizations like the National Accreditation Board for testing and calibration Laboratories (NABL) are essential first steps. Inconsistencies can be resolved and the validity of forensic proof offered in court can be guaranteed with the assistance of acentralized compliance tracking organization.

Use of Advanced Technology

Criminal justice in India could change with the use of cutting-edge technology like blockchain, deep learning, and Artificial Intelligence (AI) . AI and ML can help with complex dataset analysis, automate repetitive forensic operations, and increase the accuracy of DNA and fingerprint examinations. Criminal records can be shared and stored securely and impenetrably thanks to blockchain technology.

These technologies can be incorporated into forensic services through government programs like the digital India Plan. Improvement in Training and Infrastructure To satisfy the increasing demand for forensic assistance, it is imperative to upgrade the structure of laboratory facilities and improve the education of forensic professionals. Specialized training programs can be facilitated through partnerships with international forensic organizations and educational institutions. Furthermore, modernizing labs with state-of-the-art equipment such as DNA sequences, 3D imaging systems, and sophisticated digital forensics software should be a top priority for government spending.

VIII. Discussion

The integration of forensic science into India's criminal justice system through the new laws represents a significant advancement in evidence- based adjudication. By mandating the inclusion of forensic reports in judicial processes, the new laws and regulations reinforce the importance of scientific evidence in ensuring accurate and fair outcomes, particularly in complex cases like sexual offenses, drug abuse, and violent crimes. This move reduces reliance on subjective testimonials and bolsters judicial credibility. Additionally, the focus on training judicial officers and law enforcement personnel in forensic science address critical knowledge gaps, fostering informed decision-making and enhancing trust in scientific methodologies. However, challenges such as the shortage of forensic experts, inadequate infrastructure, and limited accredited laboratories may hinder the timely implementation of these provisions. The integration of advanced tools, including DNA profiling and digital forensic technologies, will further augment the effectiveness of the justice system, ensuring swift and accurate resolution of case.

IX. Conclusion

The Bharatiya Nagarika Suraksha Sanhita, 2023, marks a transformative step in India's Criminal Justice System, aiming to make it more transparent, efficient and victim-centric. Any criminal investigation has to ultimately meet its eventual fate in the court of Law. Every investigator must keep in mind that the forensic clue material collected by then at the crime scene will be the potential aim for investigation and it acts as a supporting evidence in criminal trial. If the forensic findings are not presented properly in the court, the whole process of investigation will be futile. Hence court room forensic management is as important as crime scene management and subsequent laboratory examination and detection.

Every investigator must keep in mind that the forensic clue material collected by them at the crime scene will be the potential aid for investigation and it acts as a supporting evidence in criminal trial. Therefore due care must be given while conducting investigation at the crime scene thereby ensuring that the vital forensic samples are free from contamination and they reach the laboratory expeditiously control protocols are to be strictly implemented to achieve reliable results. By offering scientifically sound evidence, it has improved the legal; system by raising the possibility of correct verdicts and lowering the possibility of injustice. The way investigations into crimes are conducted in India has been completely transformed by the incorporation of forensic technology like toxicology, digital forensic, and DNA profiling. The importance of the forensic field will only increase as India moves closer to upgrading its criminal justice and investigative systems. The legal system is poised for a radical change because of reforms like the new regulations and judges growing acceptance an era where evidence. India can guarantee an era where justice is both prompt and accurate, protecting the rights of all individuals, by giving priority to investment in forensics facilities and encouraging increased cooperation between science and legal specialists.

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