

Strengthening Forensic Science in Bangladesh's Criminal Justice System: Challenges, Opportunities, and Strategies for Improvement

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ABSTRACT

Forensic science is integral to enhancing the accuracy, efficiency, and credibility of criminal investigations and legal proceedings. In Bangladesh, where the criminal justice system grapples with issues such as delayed trials, limited resources, and an overwhelming backlog of cases, the application of forensic science presents a critical opportunity for reform. This study explores the current role and potential of forensic science in Bangladesh's criminal justice system, highlighting key forensic disciplines such as DNA analysis, fingerprinting, digital forensics, and toxicology. Through a comprehensive review of these disciplines, the research underscores their contribution to more reliable investigations, fairer trials, and enhanced public confidence in the justice system.

Additionally, the study identifies several challenges hindering the effective implementation of forensic science, including inadequate infrastructure, a shortage of trained personnel, and low public awareness. Drawing on a combination of literature review, case studies, stakeholder interviews, and public surveys, the research evaluates the effectiveness of forensic science in law enforcement and judicial processes. The study proposes a series of recommendations to address these challenges, focusing on modernizing forensic capabilities, capacity-building, and fostering greater collaboration among forensic experts, law enforcement agencies, and the judiciary. Ultimately, the study aims to strengthen the role of forensic science in ensuring justice, by improving criminal investigation processes and reinforcing public trust in Bangladesh's legal system.

Keywords: Forensic science, Deoxyribo Nucleic Acid (DNA) analysis, Fingerprinting, Digital Forensics and Toxicology.

INTRODUCTION

Forensic science has become a cornerstone of modern criminal justice systems globally, offering scientifically sound methods to solve crimes, identify perpetrators, and substantiate legal proceedings. In Bangladesh, a country grappling with a complex criminal justice landscape marked by slow legal processes, overcrowded courts, and inadequate evidence handling, the relevance of forensic science has become increasingly evident. As criminal activities evolve, forensic techniques such as Deoxyribo Nucleic Acid (DNA) analysis, fingerprinting, and digital forensics have emerged as vital tools to ensure fair, transparent, and just outcomes in criminal investigations (Simmons, 2012; Jackson, 2014).

This study delves into the significance of forensic science in Bangladesh, exploring its role in addressing systemic challenges, enhancing investigative reliability, and contributing to legal reforms. Furthermore, it assesses the obstacles preventing the full potential of forensic science from being realized and proposes actionable strategies for improvement. In doing so, the research aims to provide a comprehensive understanding of the current state of forensic science in the criminal justice system and its growing importance in safeguarding justice.

Objectives of the Study

The objectives of this study are to:

Assess the current state of forensic science: Investigate forensic technologies, tools, and methods in criminal investigations, and identify key disciplines such as Deoxyribo Nucleic Acid (DNA) analysis, fingerprinting, and digital forensics.

Examine challenges and limitations: Analyze infrastructure issues, such as poorly equipped forensic labs, and explore the shortage of skilled professionals and delays in evidence processing.

Evaluate the impact of forensic science on the criminal justice process: Examine its contribution to solving criminal cases, particularly high-profile ones, and assess its role in supporting fair trials and influencing witness testimonies.

Explore the awareness and integration of forensic science: Investigate the understanding of forensic science among police, judges, and legal professionals, and evaluate its integration into police training and judicial decision-making.

Highlight the role of forensic science in enhancing system credibility: Assess its potential to reduce wrongful convictions, improve investigation reliability, and strengthen public trust in the justice system.

Recommend strategies for improvement: Propose solutions to address infrastructure, resource, and training gaps, and enhance collaboration between law enforcement, forensic scientists, and the judiciary.

METHODOLOGY OF THE STUDY

The methodology of this study is designed to provide a comprehensive evaluation of forensic science's role and relevance in the criminal justice system of Bangladesh. The approach combines both qualitative and quantitative research methods to capture a nuanced understanding of the subject.

Literature Review: A thorough review of existing literature will be conducted to analyze previous studies, reports, and academic articles related to forensic science and its integration into the criminal justice system in Bangladesh. This will include an exploration of historical developments, current practices, and the challenges faced by law enforcement and legal professionals.

Case Study Analysis: High-profile criminal cases in Bangladesh where forensic science played a crucial role (e.g., murder, sexual assault, and cybercrime) will be examined. These case studies will offer insight into the practical application of forensic methods in criminal investigations and legal proceedings.

Interviews with Key Stakeholders: Semi-structured interviews will be conducted with key stakeholders, including forensic experts, law enforcement officers, judges, and legal professionals. These interviews will help gather qualitative data on the challenges, effectiveness, and integration of forensic science in criminal investigations.

Survey of Public Awareness: A survey will be administered to assess the level of public awareness and understanding of forensic science in Bangladesh. The survey will target a diverse group of respondents, including legal professionals, law enforcement officers, and the general public, to gauge their perception of forensic science's role in solving crimes and supporting the judicial process.

Data Analysis: Qualitative data from interviews and case studies will be analyzed using thematic analysis, identifying key trends, challenges, and opportunities for improvement in forensic practices. Quantitative data from surveys will be analyzed to determine the level of public awareness and the impact of forensic science on the criminal justice system.

Recommendations: Based on the findings from the literature review, case study analysis, interviews, and surveys, the study will propose actionable recommendations for improving the infrastructure, training, and public awareness of forensic science in Bangladesh. These recommendations will be aimed at enhancing the

effectiveness of forensic science in criminal investigations, reducing delays, and improving overall trust in the legal system.

By employing a multifaceted research methodology, the study aims to provide a holistic view of forensic science's current status, its impact on the criminal justice system, and the steps needed to address existing challenges for a more just and efficient legal process in Bangladesh.

Historical Background of Forensic Science in Bangladesh's Criminal Justice System

Forensic science, the use of scientific methods to solve criminal cases, has gradually integrated into Bangladesh's criminal justice system. Its development has been relatively recent compared to other regions of the world (Smith,2018). Initially, after Bangladesh's independence in 1971, investigations relied heavily on traditional methods, which lacked the precision and efficiency of modern forensic techniques (Rahman,2016). The growth of forensic science in Bangladesh has been influenced by socio-political changes, technological advancements, and a growing recognition of the need for scientific evidence in criminal investigations (Ahmed & Hossain,2020).

Pre-Independence Era (Before 1971)

Before 1971, the region was part of British India and later East Pakistan. Forensic science was not widely practiced, with investigations relying on eyewitness testimony and basic methods like fingerprinting (Chowdhury,2015). While the British colonial legal system influenced some forensic practices, they were not central to criminal justice at the time (Rahman,2015).

Post-Independence Era: The Early Years (1971–1980s)

Following independence, Bangladesh faced many challenges in rebuilding its institutions. The criminal justice system lacked resources for modern forensic investigations (Mannan,217). During the 1970s and 1980s, forensic science was underdeveloped, and investigations were based on traditional methods like eyewitness accounts and confessions (Jahan & karim,2019). The first steps towards improvement came with the establishment of the Forensic Medicine Department at Dhaka Medical College in the late 1970s and early 1980s (Islam,2014).

The Emergence of Forensic Science (1990s)

In the 1990s, there was a shift toward modernization in Bangladesh's criminal justice system.

Forensic Institutions: The Bangladesh Institute of Forensic Medicine (BIFM) was established in Dhaka to enhance forensic capabilities, offering services such as forensic autopsies, toxicology reports, and DNA analysis.

Crime Scene Investigation (CSI): In 1996, the Bangladesh Police introduced the Crime Scene Investigation Unit to improve evidence collection and preservation. This marked the start of more systematic crime scene investigations.

Advancements in Forensic Science (2000s–2010s)

By the 2000s, forensic science gained more prominence in criminal investigations.

DNA Profiling: The use of DNA testing revolutionized investigations, particularly in serious crimes like sexual assault and murder. It also helped exonerate wrongly convicted individuals.

Forensic Laboratories: Bangladesh expanded its forensic laboratories, adopting new technologies in ballistics, toxicology, and digital forensics. The laboratories also played a key role in cybercrime investigations.

International Collaboration: Bangladesh strengthened its forensic capabilities through collaboration with international organizations like the United Nations Office on Drugs and Crime and Interpol, which provided financial and technical support.

Current State of Forensic Science in Bangladesh (2020s–Present)

By the 2020s, forensic science had become essential in criminal investigations. Bangladesh has made substantial progress in areas like DNA analysis, toxicology, and digital forensics. However, challenges remain, including limited resources and outdated equipment in some laboratories. Despite these hurdles, forensic science continues to improve the accuracy and fairness of criminal investigations. The Bangladesh government is committed to expanding forensic infrastructure to meet growing demands.

Forensic science now plays a key role in ensuring justice, reducing wrongful convictions, and enhancing the overall effectiveness of the criminal justice system. Although progress has been made, further development is needed to fully realize the potential of forensic science in Bangladesh's legal system.

Conceptual Framework of the study

The conceptual framework of forensic science in Bangladesh's criminal justice system focuses on applying scientific principles to aid criminal investigations, prosecutions, and adjudications. Forensic science bridges law and science by providing objective, scientifically validated evidence, reducing reliance on assumptions or eyewitness testimony.

Forensic science in Bangladesh operates within a multi-dimensional legal framework that encompasses scientific principles, investigative processes, legal context, and institutional support. Key components include:

Scientific Principles and Techniques:

Forensic science in Bangladesh involves specialized sub-disciplines critical to solving crimes:

Forensic Pathology: Determines cause and manner of death in homicide investigations.

Forensic Toxicology: Identifies poisons, drugs, and harmful substances in the body.

Forensic DNA Analysis: Identifies perpetrators and links biological samples to crime scenes.

Forensic Ballistics: Analyzes firearms, ammunition, and gunshot residues.

Digital Forensics: Examines digital evidence from devices like computers and mobile phones.

Forensic Odontology: Uses dental records for victim identification and bite mark analysis.

Forensic Anthropology: Identifies skeletal remains and determines cause of death.

These techniques provide scientifically validated evidence in criminal trials, ensuring more accurate and fair outcomes.

Forensic Investigation Process:

Forensic science is integrated into the criminal justice process through several key steps:

Crime Scene Investigation: The police and specialized units collect physical evidence, ensuring proper handling to maintain integrity.

Forensic Laboratory Analysis: Evidence is analyzed in labs like the National Forensic Science Laboratory (NFSL) and Bangladesh Institute of Forensic Medicine (BIFM).

Expert Testimony in Court: Forensic experts testify on their analyses to assist the court in interpreting complex evidence.

Legal Interpretation and Adjudication: Forensic evidence supports legal decisions, helping to prevent wrongful convictions and ensuring proper application of the law.

Institutional and Legal Framework:

The effective use of forensic science relies on key institutions and legal provisions:

Forensic Science Laboratories: Laboratories like NFSL conduct scientific analysis and ensure legally admissible results.

Law Enforcement Agencies: The police and specialized units secure crime scenes and collect evidence.

Judiciary: Courts use forensic evidence to make informed legal decisions.

Legal Framework: The Criminal Procedure Code (CrPC) and Evidence Act of 1872 govern the use of forensic science, though updates are needed to address emerging challenges like cybercrime.

Inter-institutional Coordination: Effective collaboration between law enforcement, forensic labs, and the judiciary is essential for proper forensic evidence use.

Integrating forensic science enhances the accuracy, fairness, and reliability of criminal investigations and trials. However, addressing challenges like limited resources, insufficient training, and outdated legal provisions is key to maximizing its impact in Bangladesh's criminal justice system.

Relevance of Forensic Science in the Criminal Justice System in Bangladesh

Forensic science is becoming increasingly vital in Bangladesh's criminal justice system, helping to improve the accuracy of investigations, ensure fair trials, and enhance public trust. As crime becomes more complex, especially with the rise of cybercrime, forensic science provides reliable, scientifically validated evidence that supports law enforcement and the judiciary. Below are key points highlighting its role and the challenges Bangladesh faces:

Key Aspects of Forensic Science in Bangladesh's Criminal Justice System:

Improved Accuracy and Reliability in Investigations

Forensic science offers objective evidence, such as DNA analysis, fingerprinting, and toxicology, which helps identify perpetrators and confirm or challenge witness statements. DNA analysis links suspects to crime scenes. Fingerprints identify individuals based on physical evidence. Toxicology determines the presence of poisons or drugs in criminal cases. These techniques ensure investigations are based on facts, reducing the risk of wrongful convictions.

Facilitating Fair Trials

Forensic science aids courts in making informed decisions by providing expert testimony from pathologists, toxicologists, and digital forensic specialists. Forensic pathology determines cause of death in murder investigations. Digital forensics aids in cybercrime cases, providing crucial evidence from electronic devices. By clarifying complex evidence, forensic science reduces reliance on unreliable witness testimony or coerced confessions.

Enhancing Public Trust

When the justice system relies on objective, scientifically validated evidence, it builds public confidence. In Bangladesh, where delays, case backlogs, and resource limitations are challenges, forensic science ensures investigations and trials are based on credible, transparent evidence.

Addressing Emerging Crimes

Forensic science is crucial for tackling modern crimes, especially cybercrime. Digital forensics helps investigate crimes like hacking, fraud, and identity theft. With the rise of technology, Bangladesh needs to strengthen its digital forensic capabilities to address these evolving threats.

Challenges in Forensic Science Implementation:

Inadequate Infrastructure

Bangladesh's forensic infrastructure lacks modern labs and equipment, hindering the use of advanced forensic techniques like DNA testing and digital forensics.

Shortage of Skilled Personnel

There is a shortage of trained forensic experts, and many law enforcement officers lack proper training in evidence handling. This limits forensic science's effectiveness.

Public and Institutional Awareness

There is limited public understanding of forensic science's role in justice. Additionally, some law enforcement and legal professionals are not fully aware of available forensic techniques.

Outdated Legal Frameworks

Laws like the Code of Criminal Procedure (CrPC) and the Evidence Act of 1872 need to be updated to address modern challenges, particularly in digital forensics and emerging crimes like cybercrime.

Recommendations for Enhancing Forensic Science:

Modernize Forensic Infrastructure: Invest in updating forensic labs and establishing regional centers to improve access to modern forensic techniques like DNA testing and digital forensics.

Training and Capacity Building: Develop specialized forensic education programs and conduct regular workshops for law enforcement, forensic scientists, and judicial officers on proper evidence handling and forensic methods.

Public Awareness Campaigns: Raise awareness about the importance of forensic science in ensuring justice and preventing wrongful convictions, thereby fostering public support.

Strengthen Legal Frameworks; Update laws to ensure compatibility with modern forensic technologies and address emerging crime types, particularly in cybercrime and digital evidence.

Promote Inter-Institutional Collaboration: Enhance cooperation between law enforcement, forensic labs, the judiciary, and the legal community to ensure forensic science is effectively integrated into criminal justice processes.

Forensic science has great potential to transform Bangladesh's criminal justice system, improving investigation accuracy, trial fairness, and public confidence. To unlock this potential, Bangladesh must address challenges

like infrastructure gaps, a shortage of skilled professionals, and outdated laws. By modernizing forensic practices and strengthening the criminal justice system, Bangladesh can move toward a more efficient, transparent, and just legal system.

Importance of the Study

Forensic science is crucial to Bangladesh's criminal justice system, enhancing the accuracy of investigations, ensuring fair trials, and upholding the rule of law. As the country modernizes its legal and law enforcement infrastructure, integrating forensic science into criminal proceedings becomes essential for delivering justice. Below are key reasons why forensic science is vital:

Improving Criminal Investigations: Forensic science enhances the accuracy of investigations by relying on objective evidence like DNA analysis, fingerprinting, and toxicology testing. This reduces reliance on flawed eyewitness testimony or confessions. DNA profiling helps identify perpetrators or exonerate the innocent in serious cases like murder and sexual assault. Forensic toxicology detects poisons, drugs, or alcohol, vital in cases like poisoning or overdose.

Ensuring Fairness in Trials: Forensic evidence provides unbiased, scientifically validated information, helping the court make informed decisions based on facts, not unreliable testimony. Expert testimony in fields like pathology and ballistics enables judges and juries to understand complex scientific findings, promoting fair trial outcomes. It helps prevent miscarriages of justice, especially in cases involving false confessions or circumstantial evidence.

Preventing Wrongful Convictions: Forensic science plays a critical role in preventing wrongful convictions by providing objective evidence. DNA testing has helped exonerate wrongly convicted individuals based on faulty eyewitness testimony or coerced confessions. Re-examining evidence through advanced forensic techniques can correct judicial errors and deliver justice to the innocent.

Combatting Emerging Crimes: Forensic science is essential in tackling complex crimes like cybercrime, terrorism, and organized crime. Digital forensics aids in investigating cybercrimes, while forensic techniques such as explosive residue analysis and ballistic testing are vital in terrorism-related cases.

Building Public Trust: Forensic science strengthens public trust in the justice system by ensuring decisions are based on reliable, scientific evidence. Public awareness campaigns can promote support for law enforcement and the legal system, while transparent forensic practices discourage corruption.

International Cooperation and Standards: Forensic science supports Bangladesh's compliance with global criminal justice standards, enhancing cooperation with international agencies like Interpol. It helps combat transnational crimes such as human trafficking, drug trafficking, and terrorism, improving the country's international legal standing.

Improving Law Enforcement Efficiency: Forensic science equips law enforcement agencies with advanced tools for more efficient investigations, addressing challenges like limited resources and high caseloads. It aids in accurately documenting and analyzing crime scene evidence, solving cases that might otherwise remain unsolved.

In summary, forensic science plays a pivotal role in Bangladesh's criminal justice system by improving the accuracy of investigations, ensuring fairness in trials, preventing wrongful convictions, and enhancing law enforcement effectiveness. Its continued development through better training, resources, and legal frameworks is essential for strengthening justice and promoting a safer society.

Challenges of Forensic Science in the Criminal Justice System in Bangladesh

The integration of forensic science into the criminal justice system in Bangladesh has faced several challenges. Below is an analysis of the key challenges and recent developments in forensic science in Bangladesh's criminal justice system.

Limited Forensic Infrastructure

One of the primary challenges in Bangladesh is the lack of well-equipped forensic laboratories and facilities. The existing forensic infrastructure is often inadequate to handle the growing demands of criminal investigations. Many law enforcement agencies and legal bodies do not have access to advanced forensic technologies or modern equipment needed to conduct thorough and accurate investigations.

Insufficient Facilities: Many forensic science labs in Bangladesh are underfunded and lack the necessary equipment, which hampers the quality of analysis and testing. For instance, DNA testing, which is a cornerstone of modern forensic science, is not widely accessible, and only a few specialized labs are equipped to carry out these tests.

Lack of Trained Personnel

Another challenge is the shortage of well-trained forensic experts. While Bangladesh has a growing number of forensic science students graduating from academic institutions, the number of skilled professionals required for hands-on roles in law enforcement and the judicial system is insufficient.

Skill Gap: Many forensic professionals in Bangladesh lack advanced training in specialized fields like digital forensics, forensic pathology, toxicology, and ballistics. This shortage of trained personnel impedes the ability of law enforcement agencies to conduct high-quality investigations and impacts the judicial process.

Overburdened Legal and Judicial Systems

The justice system in Bangladesh is often overburdened with a high volume of cases, long trial durations, and delays in investigations. This, combined with limited forensic resources, results in prolonged case resolutions and can undermine the effective application of forensic science.

Case Backlog: The sheer number of pending cases, often resulting in significant delays, also means that forensic evidence may not be processed or presented in a timely manner, which can delay justice or even result in miscarriages of justice.

Reliance on Outdated Methods

Despite advancements in forensic science worldwide, law enforcement in Bangladesh still often relies on traditional investigative methods that may not be as reliable as modern forensic techniques.

Slow Adoption of New Technology: Emerging fields like digital forensics (which plays a crucial role in investigating cybercrime) are still underdeveloped in Bangladesh, limiting the ability to address the growing challenges posed by technology-related crimes.

Corruption and Lack of Accountability

Corruption within the law enforcement agencies and the judicial system remains a significant barrier to the effective use of forensic science in Bangladesh. In some cases, forensic evidence may be manipulated, or investigations may be influenced by external factors, leading to miscarriages of justice.

Manipulation of Evidence: The credibility of forensic evidence can sometimes be undermined by systemic corruption, resulting in wrongful convictions or the failure to apprehend actual criminals.

Public Awareness and Trust

While forensic science is gradually becoming recognized for its role in ensuring justice, public awareness about its importance remains limited. Many people still view forensic science as a foreign or technical field, which can hinder its acceptance and proper application.

Lack of Public Awareness: The general public may not always understand the role that forensic science plays in criminal justice, leading to a lack of trust in its outcomes. Moreover, people may be unaware of the importance of forensic evidence in ensuring fair trials and preventing wrongful convictions.

Recent Developments of Forensic Science in the Criminal Justice System in Bangladesh

Recent developments indicate positive steps toward improving its effectiveness. Despite these challenges, Bangladesh has seen notable advancements in the integration and application of forensic science within its criminal justice system. These recent developments highlight the government's commitment to improving forensic capabilities and addressing some of the persistent challenges.

Establishment of Modern Forensic Laboratories

In recent years, the government of Bangladesh has made efforts to modernize the forensic infrastructure. The establishment of new, state-of-the-art forensic labs has significantly enhanced the country's ability to conduct complex forensic analyses.

New Forensic Science Laboratory: The Bangladesh Government has launched initiatives to set up modern forensic science laboratories that can conduct DNA analysis, toxicology tests, and other advanced forensic procedures. These laboratories are expected to improve the quality and speed of investigations, particularly in serious criminal cases.

Introduction of Digital Forensics

As cybercrime has become a growing concern, Bangladesh has started to make strides in the field of digital forensics. Digital forensics plays a critical role in investigating crimes related to technology, such as hacking, online fraud, and cyberbullying.

Cybercrime Units: The introduction of specialized cybercrime units within law enforcement agencies has facilitated the investigation of crimes involving computers, mobile phones, and digital platforms. Training law enforcement officials in digital forensics is helping Bangladesh stay ahead of the curve in dealing with tech-related crimes.

Training and Capacity Building

Recognizing the need for skilled professionals, the Bangladesh government and non-governmental organizations have started investing in training programs for forensic scientists, law enforcement officers, and legal professionals.

Forensic Training Programs: Collaborations between local universities, international organizations, and government agencies have helped increase the number of forensic experts trained in specialized fields such as toxicology, digital forensics, and forensic pathology. This is helping bridge the gap in skilled forensic personnel.

International Partnerships: Bangladesh has been collaborating with international organizations like the UNODC (United Nations Office on Drugs and Crime) and INTERPOL to improve the capacity of its forensic professionals through training and knowledge exchange programs.

Legal Reforms and Policy Initiatives

Bangladesh has also started revising and strengthening its legal framework to better accommodate forensic science in criminal justice processes. New legal provisions have been introduced to ensure that forensic evidence is given due importance in criminal investigations and trials.

Strengthening Legal Frameworks: The inclusion of forensic evidence in the Criminal Procedure Code and other laws related to criminal investigations has made it easier for investigators and courts to rely on scientific evidence in criminal trials.

Public Awareness Campaigns

To increase public trust in the criminal justice system, Bangladesh has undertaken public awareness campaigns to inform citizens about the role of forensic science in ensuring justice.

Awareness Programs: The government, along with non-governmental organizations, has initiated campaigns to educate the public on the importance of forensic science in preventing wrongful convictions and solving crimes. These initiatives aim to promote greater public cooperation with law enforcement and encourage individuals to come forward with forensic evidence in criminal cases.

Adoption of International Forensic Standards

Bangladesh has made efforts to bring its forensic practices in line with international standards to enhance the credibility and reliability of forensic evidence used in the legal system.

International Accreditation: Forensic laboratories are working towards obtaining international accreditation, which ensures that their procedures meet global standards for quality and accuracy. This will further enhance the trustworthiness of forensic evidence used in trials.

While the integration of forensic science into the criminal justice system in Bangladesh faces significant challenges, recent developments demonstrate a clear commitment to improving the infrastructure, training, and legal frameworks necessary for effective forensic applications. Continued investment in modern forensic technology, specialized training, and international collaborations will be crucial in addressing the current challenges and ensuring that forensic science can play a key role in ensuring justice and preventing miscarriages of justice in Bangladesh. By overcoming these obstacles, Bangladesh can build a more effective, transparent, and reliable criminal justice system.

Recommendations for Enhancing Forensic Science in the Criminal Justice System in Bangladesh

The integration of forensic science into Bangladesh's criminal justice system has made significant progress, but challenges persist that hinder its full potential. To ensure that forensic science plays a more central and effective role in criminal investigations, trials, and the overall justice system, a series of targeted recommendations can be implemented. These recommendations aim to improve forensic infrastructure, enhance the quality of forensic expertise, and build public trust in the justice system.

Upgrade and Expand Forensic Infrastructure

A key recommendation is the establishment of modern, well-equipped forensic laboratories and the expansion of existing facilities to meet the growing demands of criminal investigations. Upgrading forensic infrastructure will ensure that law enforcement agencies can effectively process and analyze evidence in a timely and accurate manner.

Establish Regional Forensic Laboratories: To address the disparities between urban and rural areas in terms of access to forensic resources, regional forensic laboratories should be established in key areas across Bangladesh. This will help reduce the backlog of cases and provide law enforcement with quicker access to forensic results.

Invest in Advanced Forensic Technology: Bangladesh should invest in cutting-edge forensic tools and technologies, such as automated DNA sequencing, advanced fingerprint analysis equipment, digital forensics tools, and toxicology testing equipment. These technologies will improve the accuracy and efficiency of forensic analyses.

Strengthen Crime Scene Investigation Units: Specialized crime scene investigation units should be equipped with modern tools and trained in best practices for preserving and collecting evidence, ensuring that forensic material is properly handled from the moment a crime is discovered.

Increase Training and Capacity Building for Forensic Professionals

Forensic science relies heavily on the expertise of trained professionals. Therefore, it is crucial to invest in the training and continuous development of forensic scientists, law enforcement officers, and legal professionals.

Create Specialized Forensic Training Programs: Establish dedicated forensic science institutes or partnerships with international organizations to offer specialized training in areas such as DNA analysis, forensic toxicology, ballistics, digital forensics, and forensic pathology. This will ensure that forensic professionals have the necessary skills to handle complex cases.

International Collaboration and Exchange Programs: Bangladesh should strengthen partnerships with international forensic organizations (such as INTERPOL, UNODC, and forensic institutes in countries with advanced forensic systems) to allow for knowledge exchange, joint research, and capacity-building opportunities. This will expose Bangladeshi forensic experts to best practices and the latest developments in the field.

Provide Ongoing Professional Development: Forensic scientists and law enforcement officers should have access to continuous professional development through workshops, seminars, and conferences to stay updated on new technologies, methodologies, and legal frameworks.

Strengthen Legal and Policy Frameworks

Forensic science is most effective when it is integrated into the legal and judicial process. Strengthening legal and policy frameworks will ensure that forensic evidence is properly handled and given due weight in criminal trials.

Revise the Criminal Procedure Code: The legal framework surrounding forensic science should be updated to explicitly outline the use and admissibility of forensic evidence in court. For example, guidelines for the collection, preservation, and presentation of forensic evidence should be standardized to ensure consistency and fairness in the justice system.

Mandate the Use of Forensic Evidence in Serious Crimes: Legislation should be enacted that mandates the use of forensic science, such as DNA testing, in serious criminal cases like murder, sexual assault, and terrorism. This would help ensure that justice is based on reliable, scientific evidence, rather than solely on eyewitness testimony or circumstantial evidence.

Improve the Protection of Forensic Experts: Legal protections should be put in place to ensure the safety and impartiality of forensic experts. This could involve creating laws to protect forensic scientists from external pressures, including threats or attempts to influence the outcome of investigations.

Increase Public Awareness and Engagement

Public understanding and trust in forensic science are essential for its effective use in the criminal justice system. Efforts should be made to increase awareness of the role that forensic science plays in ensuring justice and fairness.

Public Awareness Campaigns: Government agencies, NGOs, and civil society organizations should launch public education campaigns to inform citizens about the importance of forensic science in solving crimes and preventing wrongful convictions. These campaigns should also highlight how forensic science contributes to the fairness and integrity of the justice system.

Engage the Media: The media can play a vital role in raising public awareness about the benefits of forensic science. The media should be encouraged to cover forensic developments, advancements in forensic technology, and notable cases where forensic science played a critical role in solving crimes or exonerating the innocent.

Encourage Citizen Cooperation: Public education campaigns should also emphasize the importance of citizens' cooperation in criminal investigations. For example, encouraging the reporting of suspicious activity or sharing information that may lead to the recovery of forensic evidence could greatly enhance criminal investigations.

Improve Interagency Collaboration and Coordination

Effective forensic science requires close cooperation between various agencies, including law enforcement, the judiciary, forensic laboratories, and public health institutions.

Create a National Forensic Coordination Body: A central coordinating body for forensic science should be established to streamline processes and ensure the proper handling of forensic evidence. This body would facilitate communication between forensic scientists, law enforcement, and the judiciary, ensuring that forensic evidence is used efficiently and effectively.

Promote Multi-Agency Training: Interdisciplinary training programs involving law enforcement, forensic scientists, and judicial officers should be introduced to ensure that all parties are aligned in terms of understanding forensic methodologies, the importance of evidence preservation, and the legal implications of forensic evidence.

Enhance Accountability and Transparency in Forensic Investigations

Ensuring the credibility of forensic science requires high levels of transparency and accountability. Strengthening these areas will reduce the potential for corruption or mishandling of evidence.

Establish Independent Oversight Mechanisms: An independent body should be created to monitor the handling and processing of forensic evidence. This oversight body would investigate allegations of malpractice, corruption, or negligence within forensic institutions, law enforcement, and the judiciary.

Ensure Transparency in Forensic Procedures: Forensic labs and law enforcement agencies should implement transparent practices for the collection, analysis, and reporting of forensic evidence. This could include maintaining clear and accessible records of all forensic procedures, allowing for greater accountability in the use of scientific evidence.

Audit and Quality Control: Regular audits and quality control mechanisms should be put in place to assess the accuracy and reliability of forensic analyses. This would ensure that the results of forensic tests are valid and meet international standards.

Foster Research and Innovation in Forensic Science

To keep pace with the evolving nature of crime and advancements in science and technology, Bangladesh must promote research and innovation in forensic science.

Invest in Forensic Research: Bangladesh should fund research initiatives aimed at improving forensic techniques, particularly in areas like digital forensics, forensic toxicology, and crime scene investigation. Collaboration with universities, international forensic institutes, and research organizations will help develop new methodologies tailored to the country's specific needs.

Develop Local Forensic Solutions: Given the unique challenges faced by Bangladesh, such as resource constraints and high crime rates, local research and development efforts should focus on creating cost-effective and accessible forensic solutions that are suited to the country's context.

The effective integration of forensic science into Bangladesh's criminal justice system requires a multifaceted approach. By upgrading forensic infrastructure, enhancing training for professionals, improving legal frameworks, and increasing public awareness, Bangladesh can develop a more robust, effective, and transparent forensic system. These recommendations, if implemented, will not only improve the quality of criminal investigations but also build greater public trust in the justice system, ultimately helping to ensure that justice is served fairly and accurately.

CONCLUSION

Forensic science holds immense potential to transform the criminal justice system in Bangladesh by enhancing the accuracy, efficiency, and credibility of investigations and legal proceedings. As the study highlights, key forensic disciplines such as DNA analysis, fingerprinting, digital forensics, and toxicology have already demonstrated their significant contributions to solving crimes, ensuring fair trials, and bolstering public trust in the justice system. These technologies offer a promising solution to many of the systemic challenges faced by Bangladesh's criminal justice system, including delayed trials, evidence mishandling, and the backlog of cases.

However, the effective implementation of forensic science is hindered by several challenges, notably inadequate infrastructure, a shortage of trained professionals, and low public awareness. Without addressing these issues, the full potential of forensic science in enhancing the justice system remains untapped. The findings of this study underscore the need for comprehensive reforms, including modernization of forensic infrastructure, investment in capacity-building, and greater collaboration between forensic experts, law enforcement agencies, and the judiciary.

By focusing on these critical areas, Bangladesh can improve the reliability and transparency of criminal investigations, minimize wrongful convictions, and ensure that justice is both fair and efficient. Furthermore, strengthening the role of forensic science in the criminal justice system will help build public confidence and trust in legal processes, fostering a more equitable and just society.

Ultimately, the integration of advanced forensic techniques, supported by strategic investments in training, technology, and infrastructure, will not only enhance the investigative and judicial capabilities of Bangladesh but will also serve as a foundation for broader legal reforms. These steps are essential to address the evolving nature of crime and ensure that the criminal justice system can meet the demands of modern society, ultimately ensuring justice for all.

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