

# Regulating Forensic Sciences in Southern Africa



Joe H Smith<sup>1\*</sup> and Juanida S Horne<sup>2</sup>

<sup>1</sup>School of Criminal Justice, University of South Africa, South Africa

<sup>2</sup>Professor, Department of Police Practice, School of Criminal Justice, College of Law, University of South Africa, South Africa

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\*Corresponding author: Joe H Smith, School of Criminal Justice, College of Law, University of South Africa, South Africa. Email: thejhsmit@gmail.com

## Abstract

Forensic trace plays a vital role in criminal investigations; this evidence must be reliable and accurate. Fundamentally, forensic sciences are a branch of science with practical and instrumental value as its primary focus. Forensic laboratories must be adequately equipped and staffed by trained, qualified personnel, adhere to established procedures and protocols and have adequate resources help to prevent errors, biases, and inconsistencies that can lead to wrongful convictions, injustices, and the erosion of public confidence in the criminal justice system. Conformance to the benchmarking standards developed in forensic sciences is mostly a voluntary process. However, the potential consequences of not regulating forensic sciences are dire, including the risk of wrongful convictions, injustices, and the erosion of public confidence in the criminal justice system. We argue that a statutory regulatory authority in each country is crucial for preserving forensic practice quality, uniformity, and standards. International standards such as those established by the Forensic Science Regulator in the United Kingdom for England and Wales, emphasize the importance of oversight in standardization, accreditation, professional standards, and ethics. The experiences in Southern Africa underscore the challenges in standardizing and regulating forensic sciences by emphasizing the ongoing importance of the efforts for discipline integrity and public trust in the criminal justice system.

**Keywords:** Forensic Deoxyribonucleic acid (DNA); Forensic evidence; Forensic sciences regulation

## Introduction

In 1996, a pivotal symposium in the North West province of South Africa marked a significant milestone in advancing forensic DNA technology in Africa. The gathering of forensic biologists from various organizations, including public and private DNA laboratories in Southern Africa and the corporate sector, was a crucial platform for discussing the standardization of forensic DNA analysis in the region. The outcomes of this symposium, which included recommendations for quality management, standardization of DNA markers, safe operating procedures, proficiency tests, and review processes, paved the way for the establishment of the African Society for Genetic Profiling (ASGEP) in the same year. ASGEP, a key player in standardization and symposium organization, played a pivotal role in advancing the field. However, its activities gradually ceased in 2010, highlighting the need for its revival and the continuation of its important work [1].

The Natural Scientific Professions Act (No. 27 of 2003) regulated forensic scientists in South Africa. It established the South African Council for Natural Scientific Professions (SACNASP) in 2003, which governs natural science professions, including forensic scientists [2,3]. However, the sitting Minister of the Department of Science and Technology exempted government employees from mandatory registration as forensic scientists. Moreover, only a few forensic scientists in the private and public sectors are registered with the SACNASP, possibly owing to the lack of incentives, which is not a promotion requirement or a non-mandatory requirement for government forensic scientists to be registered. In 2016, the requirement for forensic sciences scientist registration with the SACNASP was removed, a move criticized by some as a step backwards in regulating forensic sciences in South Africa [3-5].

To address the lack of regulation, a group of dedicated scientists established the South African Academy of Forensic Sciences (SAAFS) in 2018 [4,6]. Through its Constitution and Code of Ethics, the SAAFS voluntarily upholds best practices, minimal requirements, and scientific processes. The SAAFS seeks to maintain professional dignity, restore empirical integrity, and enhance public trust in the legal system. Establishing SAAFS is a promising step towards a more credible forensic science sector in South Africa. However, the absence of an official regulatory authority for forensic sciences in South Africa remains a concern [4].

### Materials and Methods

The overarching purpose of this study is descriptive. This research is based primarily on a systematic qualitative descriptive literature review of existing regulatory frameworks for quality assurance and quality control systems, and a peer review of forensic DNA testing laboratories in Southern Africa. The main goal of this study was to examine scholarly work on the regulation of forensic DNA testing. An academic Internet database search ("Google Scholar") was used to obtain information by looking through published publications that are accessible online. With an emphasis on the "regulation of forensic sciences," a themed search word technique was used to retrieve publications. A content-based thematic analysis was then performed on the retrieved publications to ascertain their applicability to the research question. Moreover, the study also used the primary sources (interviews) included in one of the author's DPhil research project [1]. Detective participants (Sample A) (n=30), forensic examiner participants (Sample B) from the South African Police Service (n=4), and international forensic experts (Sample C) (n=4) were interviewed. The University of South Africa granted ethical clearance for this study, a crucial component of an approved PhD research project.

Accreditation of forensic laboratories is voluntary. One of the primary reasons for the necessity of formal regulation of forensic services is ensuring the reliability and quality of forensic analysis. We argue that statutory regulatory authority in each country is crucial for preserving the integrity of forensic sciences' and in ensuring uniformity and mandatory conformance to standards. Codes of conduct and standards, such as those established by the Forensic Science Regulator in the United Kingdom (UK) for England and Wales, emphasize the importance of oversight in standardization, accreditation, professional standards, and ethics. The experiences in Southern Africa underscore the challenges in standardizing and regulating forensic sciences by emphasizing the ongoing importance of efforts for discipline integrity and public trust in the criminal justice system.

### Results

The following question was posed to Sample A, Sample B and Sample C in this study: "Should forensic laboratories, particularly forensic DNA testing laboratories, be formally regulated by a

statutory body?". Samples A, B, and C responded freely according to their experiences and understanding. No options were provided to select possible answers. Based on the responses from Samples A, B, and C, the following conclusions were drawn:

*"Statutory regulating forensic sciences will provide us detectives and even the courts with confidence that the the forensic findings conform to the standardization and minimum requirements",* (Detective participant no. 17, Sample A).

*"Zambia is the only country in Africa that has established statutory regulatory authority for forensic sciences. Surprisingly, forensic sciences in South Africa have no statutory regulatory authority to enforce codes of practice and minimum standards such as what exists for the engineering and medical profession"* (Detective participant no. 25, Sample A).

*"As demonstrated by the UK's Forensic Science Regulator, statutory regulation of forensic DNA facilities is necessary to ensure the quality, accuracy, and ethical standards of DNA analysis. A thorough and flexible oversight system is necessary owing to the complex nature of forensic DNA analysis. Regulatory agencies are essential for maintaining the integrity of forensic DNA evidence and, by extension, the criminal justice system because they set standards, monitor compliance, and build public trust. The necessity for regulatory solid monitoring grows as technology continues to influence forensic practices, underscoring the continued significance of statutory authorities in regulating forensic DNA laboratories",* (Forensic examiner participant no. 1, Sample B).

*"Regulatory oversight is necessary due to the complex nature of forensic DNA analysis. Regulatory agencies are essential to maintain the integrity of forensic DNA trace collection, analysis, and interpretation of trace",* (Forensic examiner participant no. 2, Sample B).

*"Forensic DNA analysis is a dynamic discipline where rapid technological developments occur. Given these developments, a statutory body is better suited to adjusting regulations. This flexibility is essential for incorporating new technology into forensic procedures, while upholding the required level of supervision to avert any potential abuse or misunderstanding. Regulatory agencies can guarantee that forensic DNA laboratories are at the forefront of innovation while maintaining the highest standards of accuracy and dependability by keeping up with technological advancements",* (Forensic examiner participant no. 3, Sample B).

*"Managing DNA evidence requires both scientific know-how and moral accountability. Establishing and enforcing ethical norms by a statutory regulatory body ensures that forensic DNA laboratories are operated with utmost moral and professional standards. These standards cover the responsible use of DNA databases, informed consent, and privacy protection. Furthermore, accountability is encouraged by regulatory control because laboratories are held accountable for any mistakes or deviations from accepted practices, which strengthens public confidence in the criminal justice system,"* (Forensic examiner participant no. 4, Sample B).

*“Forensic DNA analysis requires uniformity to ensure the consistency and comparability of results between laboratories. Standardized protocols and guidelines can be mandated by governmental agencies for laboratories to adhere to, guarantee fairness, and reduce methodological disparities. This standardization helps forensic entities collaborate more effectively, exchange data and improve the reproducibility of outcomes. In the UK, for example, the Forensic Science Regulator is essential in establishing national guidelines and encouraging a unified method of forensic DNA analysis”* (International forensic expert participant no. 1, Sample C).

*“Forensic DNA analysis is overly complex and requires attention to every detail. Implementing statutory monitoring authorities, such as the UK’s Forensic Science Regulator, ensures that laboratories will follow strict quality control protocols. These regulatory authorities ensure the accuracy and dependability of the results by setting standards for the testing processes, proficiency testing, and validation methods. Enforcing these standards helps to maintain the overall integrity of forensic investigations by minimizing the possibility of mistakes, contamination, or misinterpretation of DNA evidence”,* (International forensic expert participant no. 2, Sample B).

*“The public must have faith in the criminal justice system. Cases involving DNA evidence can have significant ramifications, and any uncertainty regarding the reliability of forensic procedures can damage public trust. A statutory regulatory body offers a clear and transparent system to ensure the highest level of integrity in forensic DNA laboratories. To promote accountability and openness, the UK’s Forensic Science Regulator, for example, releases yearly reports about its operations and how laboratories adhere to set standards,”* (International forensic expert participant no. 3, Sample C).

*“As forensic DNA analysis provides unmatched precision in identifying persons and connecting them to crime scenes, it has become an essential tool in criminal investigations. Forensic DNA laboratories must be strictly monitored through oversight and regulated* (International forensic expert participant no. 4, Sample C).

### Literature Study

Maintaining trust in forensic results necessitates adherence to ethical conduct and high benchmarking standards [7-11]. Historically, forensic sciences have relied on voluntary standards owing to limited public investment and a lack of government regulations [11]. Practical standards balance judicial expectations and achievable goals by considering factors such as technology and safety [12]. Although standards provide a shared language for quality and safety, they do not replace laboratory procedures, methods, or policies. The International Organization for Standards places strong emphasis on standardizing quality management and practice in forensic sciences [13]. However, the specific implementation details are delegated to best-practice manuals, standard operating procedures, and national regulations.

Accepting benchmark standards depends on stakeholder ownership (i.e., experts, advisory bodies, academia, and the industry).

The lack of standardization and formal regulation of forensic services can pose significant risks to the administration of justice [10,14]. Appropriate resources, equipment, and personnel must be articulated within a regulatory framework to conduct accurate and reliable analyses. A lack of management commitment and resources can lead to errors, biases, and inconsistencies, resulting in wrongful convictions or acquittal of guilty defendants. Manipulation or distortion of traces, presentation of biased or unreliable testimony, and erosion of public confidence in the criminal justice system must be prevented.

The absence of detailed statutory regulations governing the validity and reliability of forensic services necessitates self-regulation by forensic science laboratories in Southern Africa [5], as professionalizing forensic science practice and committing to expert witness integrity are essential for justice [4]. Overall, there is a need for effective changes to different forensic examination types to enhance the reliability of forensic evidence in legal proceedings. The call for more substantial criticism of the quality of forensic sciences and statutory regulations underscores the importance of addressing challenges in this field [3-6,14-17].

### Reasons for questionable forensic science

Forensic science faces credibility challenges owing to perceived shortcomings in the measurement accuracy and reliability of findings [15-18]. The absence of uniform standards and regulatory measures across forensic sciences in the private and public sectors complicates efforts to ensure scientific validity and prevent errors or manipulation of evidence. Specific methods such as bite mark analysis and hair microscopy have been criticized for their inadequate scientific basis and substantial error rate [15,19,20]. The scientific foundation of single-source DNA evidence is acknowledged. Still, concerns about data supporting the validity of other pattern comparisons and DNA mixture result interpretation have been raised, thus emphasizing the need for research in these areas [5,14].

Operational deficiencies in forensic laboratories, inadequate numbers, and incompetent forensic analysts can lead to incorrect sample findings, trace contamination, and degradation. Additionally, some examination types may lack objectivity, independence, and impartiality, making them susceptible to bias [15,21-23]. Skepticism about the validity of evidence arises due to forensic scientists’ and expert witnesses’ potential for errors and mistakes, ranging from human fallibility to corruption and incompetence [15,25]. Institutional procedures and funding arrangements may distort sound science, affecting the reliability of forensic testing results [15,24,25].

Communication failures and varying admissibility standards in courts contribute to challenges in presenting and understanding

scientific trace evidence. In several Southern African cases, such as *Bokolo v. State* [26], *S v Maqhina* [27], *Tshantsani v S* [28], *S v Van der Vyver* [29] and *State vs Rapagadie* [30], issues with forensic evidence were identified during the court proceedings. Moreover, Olckers [31] highlights the typical issues with forensic evidence in court cases, like methods not validated for DNA evidence, contradictory witness statements during cross-examination, and the poor quality of DNA evidence and its testimony. In some cases, there is concern about expert witness partiality towards prosecution, emphasizing the need for ethical testimony and authentic DNA evidence in Southern African courts [31]. Addressing these challenges through appropriate systems is crucial for maintaining the credibility and reliability of forensic science in the pursuit of justice.

The accreditation of forensic laboratories is not mandated by legislation and required in South African courts [5]. Moreover, accreditation (independent peer review) of forensic laboratories alone does not necessarily lead to improved compliance with forensic standards. Accreditation is a peer review of the laboratory's competency and conformance to the standards and QMS. It is a sample of the laboratory processes at a given time. The quality of peer review audits depends on the technical competence and thoroughness of auditors from accrediting bodies, especially regarding their exhaustive technical competency, proficiency, and experience in the audited examination type. Auditors often only focus on ISO 17025 without considering the accreditation and international forensic bodies' forensic guidelines and additional forensic standards. Additional forensic standards and guidelines have been developed to address the shortcomings of ISO 17025, a generic standard for the competency of laboratories, by providing more specific competency standards for forensic sciences. Furthermore, individuals working in forensic laboratories often fail to practice good science and adhere to quality management systems [32]. Risk assessments and validation studies conducted by laboratories to ensure the reliability of forensic methods and equipment are often cursory. A case in point is the accredited forensic laboratories in Queensland, Australia, which were discovered deficient in using DNA methods supported by science and lacked conformance with benchmarked standards [32]. Statutory bodies have been implemented in the United Kingdom for England and Wales, Queensland in Australia, and Zambia [33-35].

Zambia implemented a legal structure to address the current deficiencies in forensic practice by establishing the National Forensic Authority [35]. This statutory body has jurisdiction over the country's forensic sciences and pathology practices and the legal power to impose standards and rules for forensic facilities. The aim is to ensure that public and private forensic institutions in Zambia comply with the minimal quality requirements and adhere to rules [35].

### Forensic science regulator of the United Kingdom

The Forensic Science Regulator (FSR) for England and Wales

in the UK was established in 2007 and became a statutory body in 2023 to prioritize high-quality standards for forensic sciences [33]. The FSR for England and Wales mandates accreditation for specific forensic analyses and adherence to international standards such as ISO/IEC 17020 [36], ISO 17025 [37], and ISO 15189 [38] as an alternative for units assessed according to this standard. In England and Wales, accreditation is linked to conformance with the Forensic Regulator's Codes of Practice and Conduct. These codes establish the scientific and professional criteria required of forensic scientists.

The FSR's conduct for forensic scientists involved in forensic sciences' activities emphasizes duties to the court, honesty, integrity, and compliance with legal obligations [33]. Forensic scientists must prioritize professional competence, continuously develop their skills, disclose conflicts of interest, and maintain the integrity of items/exhibits. Additionally, forensic scientists should use valid methods, review casework report concerns about potential miscarriages of justice, and preserve confidentiality unless they are legally obliged or authorized not to do so. A statutory-regulating authority is crucial for guiding and enforcing ethical and professional standards in forensic science practice [39].

### The South African perspective

The Criminal Law (Forensic Procedures) Amendment Act (Act 37 of 2013), known as the DNA Act, came into operation in South Africa in 2015 and regulates the collection, processing, and DNA analysis of forensic traces. The DNA Act established the National Forensic DNA Database and the National Forensic Oversight and Ethical Board (NFOEB). The DNA Act empowers the Minister of the Police to set forth regulations supporting its implementation. The Act covers buccal sample collection, amongst other things the DNA profile retention process, access to the National Forensic DNA Database, and complaint procedures [40,41].

The DNA Act requires authorized persons managing forensic services to develop standards for forensic science laboratories aligned with the South African National Accreditation Service (SANAS) and various international ISO standards [36]. The NFOEB monitors the Act's implementation, proposes improvements, oversees processes related to DNA sample handling, and assesses complaints. Recent amendments to the Act [The Criminal Law (Forensic Procedures) Amendment Act 8 of 2022] allow for the collection of buccal samples from convicted offenders before their release or parole [41].

However, disagreements persist over whether the DNA Act mandates forensic science laboratory accreditation. The defense argues for accreditation, while the laboratory contends that adherence to a quality system based on technical guidelines and ISO/IEC standards is sufficient [42]. The ISO 17025 standard covers laboratory competency, including technical and management/administrative requirements. In *Tom v S*, it was noted that deviating from the management/ administrative

requirements for accreditation does not affect the reliability and correctness of the forensic results [42].

The current situation of unregulated and lack of independent auditing of public forensic science laboratories must be revised to uphold justice [3,5]. There is a need to professionalize forensic science practice and for forensic science professionals to remain committed to the role of expert witnesses who uphold integrity [4,5]. Hence, the authors of this paper argue for regulated independent peer review auditing of forensic science laboratories by competent technical experts to uphold the justice of the laboratory results and findings.

### Adversarial system

Forensic findings presented in court rely on the adversarial system of the courts as gatekeepers who assess the validity and reliability of the forensic evidence [1,43-46]. Although effective in focusing on critical factual disputes, the adversarial system has also been deemed sufficient for identifying flawed forensic evidence. Validated forensic examinations and conforming to ISO 17025 support judicial decision-making [44]. Defense lawyers who do not engage with state prosecutors and forensic science laboratories during pre-trials to analyze evidence, request information, and ensure compliance with quality management systems are of great concern [41-43]. However, despite a lack of engagement the adversarial process remains vital for DNA evidence validity in court. The need for impartial, certified forensic scientists in Africa, particularly Southern Africa, is acknowledged, highlighting the ongoing challenges in improving forensic science practices for legal proceedings [4].

### Discussion

The participant interviews in this study clearly illustrated and confirmed the necessity of regulatory oversight for forensic DNA analysis because of its complexity. Statutory regulatory bodies are essential for maintaining the integrity of forensic DNA evidence and, by extension, the criminal justice system because they set standards, monitor conformance, and help foster public trust.

When forensic scientists testify in court, they must elucidate the standards employed in the forensic process [46-48]. Adhering to these standards can assist laboratories in establishing a robust quality management system and enhancing the dependability of its outcomes. Many forensic laboratories are subject to voluntary accreditation and conformance to ISO standards [5,49-53]. Although conformance to ISO standards provides a good foundation, laboratory accreditation and conformance must be more comprehensive and prescriptive. The standards need to address the shortcomings identified by reliance on forensic testing for criminal proceedings.

Mandatory accreditation of conformance in forensic laboratories must be subject to specific standards that ensure that detailed records of laboratory operations, including procedures, equipment, personnel, and results, are maintained [5,54,55].

Regulatory bodies should enforce regular audits and reviews of laboratories against ISO standards, processes, and information to ensure compliance with established standards and protocols. Furthermore, auditors in the regulatory assessment body must have technical expertise in the area under audit. The outcomes of conformance audits must be readily available to judiciary officers and through public records.

Peer review audits help promote transparency in the forensic process, allowing for the identification and correcting of errors and inconsistencies and for the provision of a basis for reviewing and evaluating forensic evidence and testimony [5,12,32]. Assessment bodies must pay more attention to effective risk identification and mitigation strategies, the quality of the validation of forensic methods, reviewing equipment performance, and the competency of the laboratory's technical leader, who is ultimately responsible for ensuring that the forensic methods employed are based on sound scientific validations [3,4]. Risk identification and mitigation in laboratory procedures, inputs, and outputs are frequently viewed as a cursory checklist activity. Enhancing the scientific underpinnings of forensic evidence by identifying potential risks and inaccuracies, elucidating the fundamental principles that explain the origins of such inaccuracies, and developing methods to mitigate them in forensic findings. Moreover, improving the transparency throughout the data validation process is crucial [9,11,21,31].

Advocating forensic sciences to aid timely and efficient crime investigation is crucial and should be prioritized in continental political agendas, budgets, legislation, and governance systems. To promote sustainable development and peace in South Africa, restructuring and strengthening policing systems, prioritizing the discovery of forensic evidence, relying on ethical testimony, and ensuring the admissibility of valid DNA evidence in the criminal justice system.

It is advised that the DNA Act be amended to provide the NFOEB more independence by taking direct accountability and responsibility for their oversight responsibilities and approving their oversight documents. The NFOEB must be empowered to perform their inspections or audits or to initiate inspections and/or request audits by a competent authority to check on-site physical conformance to legislation and quality standards competency and application of scientific valid procedures followed, and data management. Moreover, the NFOEB must be empowered to create and publish codes of practice and conduct for forensic science providers and practitioners in the criminal justice system.

An amended DNA Act will empower the existing National Forensic Oversight and Ethical Board, providing extended oversight of these regulations. These additional regulations may include requirements such as the prescription of mandatory accreditation for certain examination types such as forensic DNA analysis; a minimum set of qualifications and specific competency criteria for forensic scientists, technical leaders, and laboratory

managers; compulsory membership to a professional body for ethical oversight; the need for continuous education; compulsory validation of test methods; compulsory periodic servicing and calibration of equipment; laboratory environmental compliance; periodic general maintenance of forensic laboratories; transparent monitoring and publication of customer complaints to the laboratory from judicial officials, investigators, and the public; swift dealing with non-conformance; conducting a root cause analysis from audit findings and complaints received; continuous laboratory-based research and development; governmental funding to sustain forensic analysis; and mandatory compliance with procedures to address non-compliance with the managerial and technical requirements of SANAS and ISO standards [1,37,53-55]. Additionally, non-conformance is compounded by the fact that regulatory frameworks often have no penalties or consequences for laboratories, managers, or forensic scientists who do not conform with the quality system or requirements mentioned earlier.

Forensic evidence must be independent and impartial [32,37,55,56]; therefore, laboratories must be held accountable for managing conflicts of interest and ensure that forensic scientists are objective and unbiased to promote sound scientific methods and practices. The ultimate objective of the forensic sciences is the continuing pursuit of regulation of the forensic science profession, particularly in South Africa. Having a regulatory framework for forensic science will prevent the manipulation of evidence, distortion of results, and presentation of biased or unreliable testimonies. Forensic laboratories that operate within a mandatory framework minimize the misuse of forensic trace, distortion of results, and presentation of unreliable or biased testimony. Forensic services are a critical component of the criminal justice system and must be regulated to ensure the reliability of the results. Maintaining scientific validity and reducing the risk of errors or manipulation can be challenging, particularly given the need for consistent standards and regulatory measures across different forensic disciplines.

## Conclusion

The regulation of forensic sciences vary from country to country. In Southern Africa, the conformance of disciplines to minimum standards and peer reviews must be better regulated. A legal and regulatory framework developed collaboratively by legal professionals, forensic scientists, and interested parties is recommended to ensure the implementation of verified scientific procedures and reported findings that enhance justice and address the lack of understanding in the criminal justice system. Strengthening regulatory efforts is crucial to building public trust and preventing wrongful convictions. The gaps identified in safeguarding these provisions in the Southern African forensic science profession emphasize the ongoing need for improvements in forensic service regulation in South Africa and the continent.

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