AN EVALUATION OF FIREARM EVIDENCE IN THE INVESTIGATION OF MURDER AT PIET RETIEF POLICE STATION, SOUTH AFRICA

By

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I declare that this research dissertation is my own work and sources that I used have been indicated and acknowledged using complete reference.

I also declare that I submitted this dissertation for further checking through the required steps and it falls within the stipulated standards for originality.

Signature

30 November 2025

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DEDICATION

This dissertation is dedicated to the Almighty God, who granted me strength and wisdom to complete this task, and to my family.

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ABSTRACT

South Africa continues to face high levels of violent crime, with many murders involving firearms. Effective collection and utilisation of firearm evidence are therefore essential for successful investigations and prosecutions. However, investigative challenges often limit its effective use, affecting case resolution and conviction rates.

Firearm evidence is a crucial element in murder investigations, linking suspects, weapons, and crime scenes. This study evaluated its utilisation at Piet Retief Police Station, South Africa. The study addressed the problem that, despite the frequent use of firearms in murder cases, the practical utilisation and management of firearm evidence by investigators often face operational and procedural challenges that may undermine investigative outcomes. The aim was to identify current practices, operational challenges, and strategies to enhance investigative effectiveness.

Guided by nine research objectives, a qualitative phenomenological design was employed with 20 purposively selected detectives. Data were collected through semi-structured interviews and document analysis, and were analysed thematically to uncover patterns, challenges, and best practices. The study was framed by Locard's Exchange Principle, which posits that every contact leaves a trace, providing a basis for understanding the transfer and evidential value of physical evidence.

Findings show that firearm evidence is pivotal for reconstructing crime scenes, corroborating witness statements, and linking suspects to offences. Key challenges include limited access to specialised equipment, insufficient forensic training, inconsistent procedures, and logistical constraints, which impact case resolution. The study recommends inter-agency collaboration, targeted training, standardised protocols for evidence handling, and improved resource allocation. It contributes both theoretically, by applying Locard's Principle to rural policing, and practically, by offering strategies to strengthen forensic investigations.

Keywords: Firearm evidence, murder investigations, forensic science, Piet Retief Police Station, Locard's Exchange Principle

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LIST OF ABBREVIATIONS AND ACRONYMS

Abbreviation / Acronym	Meaning
CSIs	Crime Scene Investigators
DNA	Deoxyribonucleic Acid
FCA	Firearms Control Act
FSL	Forensic Science Laboratory
FTK	Forensic Toolkit
GPS	Global Positioning System
GSR	Gunshot Residue
IBIS	Integrated Ballistic Identification System
IP	Internet Protocol (address)
ISP	Internet Service Provider
LCRC	Local Criminal Record Centre
LEA	Law Enforcement Agencies
NCACC	National Conventional Arms Control Committee
NCPS	National Crime Prevention Strategy
OAU	Organisation of African Unity
RQs	Research Questions
SA	South Africa
SADC	Southern African Development Community
SAPS	South African Police Service
SIM	Subscriber Identity Module (card)
SOP	Standard Operating Procedures
UNISA	University of South Africa
UNODC	United Nations Office on Drugs and Crime

CHAPTER 1

GENERAL ORIENTATION

1.1 INTRODUCTION

Firearm-related evidence is a cornerstone of forensic science, providing the objective data necessary to link suspects to crime scenes, identify specific weapons, and reconstruct the events surrounding a crime (Saferstein, 2024:61). In the South African context, where the incidence of murder is significantly high relative to other African nations, the effective utilisation of such evidence is critical for the pursuit of justice. At the Piet Retief Police Station, firearm evidence is central to the investigation of murder cases; however, persistent challenges in its practical application often hinder case resolution and undermine efforts to provide closure to victims' families (Bertino & Bertino, 2021:46).

Existing scholarship by Saferstein (2018:123) underscores how ballistic material generates vital leads and establishes connections between offenders and scenes. Yet, as Doherty and Saulsbury (2016:764) observe, the effectiveness of this evidence is frequently limited by investigator training, resource constraints, and procedural lapses. Murder investigations are inherently demanding, requiring a coordinated approach to ascertain the perpetrator's identity, the weapon employed, and the underlying motive (Robertson, Roux & Tahtouh, 2021:104). In cases involving lethal force, forensic analysis serves as the primary mechanism for answering these critical questions and corroborating testimonies (Lamb, 2018:42).

Despite its importance, empirical research within the Piet Retief jurisdiction remains underdeveloped, leaving a notable gap in the understanding of how firearm evidence is operationally managed in resource-restricted settings (Hill, Mofokeng & Khosa, 2024:26; Mutsavi & Meintjes-van der Walt, 2020:6). This deficit raises concerns regarding the alignment of local practices with emerging forensic standards (Bantjes et al., 2020:8). Consequently, this study addresses this gap by evaluating the collection, interpretation, and investigative value of firearm evidence at the Piet Retief Police Station. By bridging the divide between frontline realities and scholarly theory,

the research provides contextually grounded recommendations to enhance the integrity and accuracy of murder investigations within the local community.

1.2 PROBLEM STATEMENT

Firearm-related murders remain a serious concern within the Piet Retief Police Station area; however, a clear gap exists between the frequency of these crimes and the number of cases successfully solved. Recent statistics from the South African Police Service (SAPS) show that the station recorded 27 firearm-related murders in 2023 (SAPS Annual Crime Report, 2023). Despite the urgency and severity of these incidents, investigators continue to experience substantial difficulties in using firearm evidence effectively, resulting in low case-closure and conviction rates for such offences. This disconnect forms the core of the research problem: forensic evidence alone does not guarantee successful prosecution unless it is properly collected, processed, and interpreted within specific operational constraints.

The necessity of defining this issue is supported by Strydom (2016:38), who notes that a research problem serves as the driving force behind any research endeavour. By narrowing the broad concern of violent crime into the specific focus of firearm evidence at Piet Retief, this study adheres to the requirement that a research problem must be manageable and specific (Thomas, 2017:108; Bertino & Bertino, 2021:98). As Vandrstoep and Johnston (2018:45) describe the research problem as the central axis of a study, the low conviction rates identified here form the core around which all subsequent research activities revolve.

Physical evidence recovered at the scene can play a crucial role in identifying the perpetrator in firearm-related murder cases. Cartridge cases, for instance, can often be linked directly to a specific firearm. The positions of cartridge casings, bullet holes, bullet fragments, and shotgun pellet patterns all require precise measurement and documentation (Rondinelli, 2017:59). These data support incident reconstruction and help assess the accuracy of statements made by suspects and witnesses. Therefore, firearm evidence must be handled with the utmost care to prevent contamination or damage (Dempsey, 2017:268). Its value diminishes significantly when it is improperly

collected or processed, contributing to the low conviction rates observed in firearm-related murder cases.

1.3 RESEARCH AIM

Aligned with Houck and Siegel's (2015:56) view that a research aim should encapsulate the core purpose of a study, this investigation sought to evaluate comprehensively how firearm evidence was utilised in the investigation of murder cases. This enabled a systematic assessment of the processes followed, the challenges encountered, and the investigative value of firearm-related forensic material. Such a framing supported a nuanced understanding of how this evidence contributes to case outcomes within the studied policing context of the Piet Retief Police Station.

A research aim is the defining framework for a study, specifying the research scope and the intended scholarly contributions (Denscombe, 2017:7). Without such clarity, it becomes challenging to assess methodological choices or determine whether the available resources are adequate. Hammond and Wellington (2017:84) similarly note that a research aim provides a concise, operational statement that directs the overall trajectory of an investigation. By placing the evaluation of firearm evidence at the centre of this trajectory, the study remains aligned with both the research problem and the professional requirements of forensic investigation.

1.4 PURPOSE OF THE STUDY

The purpose of this study was to evaluate how firearm evidence is examined and utilised in murder investigations at the Piet Retief Police Station, South Africa. This evaluation aimed to identify current practices and develop practical recommendations to improve investigative effectiveness, while simultaneously enhancing investigators' awareness and skills in the handling of firearm evidence. By focusing on these operational realities, the research sought to provide actionable insights that support more effective forensic outcomes in the local context.

The purpose of a study serves as its core rationale and forms the foundation for the entire research process. Denscombe (2017:25–27) emphasises that, without a clear

and compelling justification for undertaking a study, the substantial investment of time, resources, and effort cannot be warranted. Research is, therefore, typically driven by the need to address a problem, refine existing practices, or generate solutions that lead to meaningful and practical improvements. Welman, Kruger, and Mitchell (2015:23) further argue that research extends beyond simple description; its broader aims include defining, explaining, and predicting phenomena to support the informed management of organisational processes and significant events. In this way, research functions as a systematic means of understanding, interpreting, and responsibly shaping the world.

Building on this foundation, Creswell and Poth (2018:92) identify three core purposes of research: exploration, description, and explanation. Each of these purposes carries distinct implications, influencing how the research is framed, structured, and conducted. For instance, the choice between exploratory, descriptive, or explanatory research significantly impacts the study's design, methodology, and scope. As Harris and Lee (2019:11) further emphasise, the specific purpose of a research project plays a crucial role in determining the appropriate methods for data collection and analysis. Consequently, the research purpose serves as a guiding force, shaping every aspect of the study, from methodology to interpretation.

1.5 RESEARCH OBJECTIVES

Research objectives serve as definitional sub-components that translate the broader research aim into specific, actionable steps the study must accomplish. They differ from the overarching aim, which captures the research's central purpose. Bryman (2016:50) identifies four primary types of objectives, namely: exploratory, descriptive, explanatory, and predictive. The cited scholar explains that these four types of objectives these can be employed concurrently within a single research design. Dempsey (2017:101) supports this view, describing objectives as the framework that guides the investigator by defining both the scope and direction of the study.

Therefore, objectives are essential for articulating the operational focus of the research and ensuring clear alignment with the overarching aim. In this study, the objectives were structured to break down the central aim into manageable, coherent components

that collectively supported a systematic evaluation of the utilisation of firearm evidence in murder investigations.

Accordingly, the specific research objectives of this study, aimed at addressing the research aim, were as follows:

1. To establish the role of forensic science in the investigation of crime.
2. To uncover the role of forensic science in the investigation of murder.
3. To determine how firearm evidence can be utilised in the investigation of murder.
4. To ascertain the nature and extent of murder at Piet Retief Police Station.
5. To evaluate the conviction rate of murder at Piet Retief Police Station.
6. To identify the primary challenges encountered by investigators in effectively utilising firearm evidence in murder investigations.
7. To analyse how the identified challenges affect investigative outcomes and case resolution in firearm-related murder cases.
8. To examine how firearm evidence is collected at the crime scene.
9. To unearth best practices for processing firearm evidence to ensure admissibility in court.

1.6 RESEARCH QUESTIONS

Research questions (RQs) are the central focus of any study. They shape key components, including the research type, design, sampling approach, data collection, analysis, and ultimately the presentation of findings (Hammond and Wellington, 2017:71). Denscombe (2017:31) adds that research questions define the specific issues to be examined, guiding observation, measurement, and analysis to illuminate the broader topic. Similarly, Bryman (2016:3) notes that research questions articulate what captures the researcher's curiosity and clarify the precise focus of the inquiry.

Well-formulated RQs guide the researcher to relevant literature and establish a clear framework for data collection. According to Hammond and Wellington (2017:127), RQs encapsulate what the researcher seeks to uncover, providing both direction and structure for the study while underpinning methodological decisions. Gerard (2018:36)

cautions that preliminary research questions must be formulated at the outset, as an appropriate design can only be constructed once these are in place. Otherwise, the process risks becoming mere data gathering rather than actual research.

Therefore, formulating research questions provides essential structure to the data-gathering process. RQs guide decisions about data collection and analysis procedures. The following research questions, aligned with the study's objectives, were developed to address the research problem.

1. What is the role of forensic science in the investigation of crime?
2. What is the role of forensic science in murder investigation?
3. How can firearm evidence be used in the investigation of murder?
4. What is the extent of murder cases being reported at the Piet Retief Police Station?
5. What is the conviction rate of murder at Piet Retief Police Station?
6. What primary challenges do investigators encounter when utilising firearm evidence in murder investigations within the South African jurisdiction, particularly at Piet Retief Police Station?
7. How do the identified challenges impact the utilisation of firearm evidence in murder investigations at Piet Retief Police Station, and what are the implications for investigative outcomes and case resolution?
8. How is firearm evidence collected at the crime scene?
9. How should firearm evidence be processed during the investigation of a crime scene to be admissible in court?

1.7 JUSTIFICATION/RATIONALE/SIGNIFICANCE OF THE STUDY

An evaluation of how firearm evidence is employed in murder investigations at Piet Retief Police Station, South Africa, is both timely and necessary. Understanding the strengths, limitations, and operational realities of handling firearm evidence provides critical insight into the effectiveness of investigative practices (Hill and Mofokeng, 2024:18). This section outlines the broader justification and significance of the study. The section demonstrates the importance of the study regarding investigative practice,

community safety, resource allocation, academic advancement, policy development, and the forensic industry.

1.7.1 Enhancing Investigative Effectiveness

This study focuses on how firearm evidence is currently used in murder investigations at Piet Retief Police Station and explores the challenges investigators face in applying it. By understanding these practices, the research aims to suggest ways to make investigations more effective and efficient. Better use of firearm evidence can help solve more cases and support successful prosecutions. This aligns with calls to improve the overall effectiveness of murder investigations (Bertino and Bertino, 2021:894).

1.7.2 Community Safety and Security

Proper use of firearm evidence can play a key role in identifying and apprehending offenders, directly contributing to the safety and security of the community. By highlighting gaps and challenges in current investigative practices, this study offers insights on how to curb firearm-related murders and help alleviate fear of crime within the Piet Retief community (Bryman, 2016:98).

1.7.3 Allocation and Use of Resources

Understanding the difficulties investigators face when handling firearm evidence can help law enforcement agencies allocate resources more effectively. The study can guide the distribution of essential resources, such as training, personnel, and equipment, so that investigative teams are better equipped and existing resources are used more effectively (Bryman, 2016:679).

1.7.4 Academic Contribution

The findings of this study advance scholarly understanding by providing empirical evidence on the utilisation of firearm evidence in murder investigations in South Africa. Notably, the study offers insights into how such evidence is handled and applied in

resource-constrained contexts, where limitations in personnel, equipment, and forensic infrastructure can pose significant challenges (Bantjes et al., 2020:7).

By documenting practical strategies and operational realities, the research highlights both the potential and the constraints of forensic practice under these conditions. This way, the study serves as a valuable resource for academics, students, and researchers in forensic science, criminal justice, and law enforcement methodologies. It offers theoretical insights and practical application.

1.7.5 Implications for Policy

The findings of this study also offer valuable guidance for policy development and reform initiatives aimed at enhancing forensic and investigative methodologies. By highlighting operational challenges and recommending feasible interventions, the research provides policymakers with evidence-based strategies. The findings can help to reinforce investigative frameworks and improve the overall efficacy of the criminal justice system, in line with the ideas of Hammond and Wellington (2017:369).

1.7.6 Industry Impact

The outcomes of this study can also play a valuable role in forensic science by guiding the establishment of best practices and standards for the gathering, examination, and application of firearm-related evidence. Forensic laboratories, professionals, and companies that produce forensic tools can use these insights to improve the accuracy, reliability, and overall effectiveness of forensic investigations (Saferstein, 2024:321).

By examining the use of firearm evidence in murder investigations at Piet Retief Police Station, South Africa, this study has wide-reaching significance. It contributes to more effective investigations and improved community safety and informs efficient resource management. The study also expands academic knowledge, informs policy-making, and enhances forensic industry practices.

1.8 PRELIMINARY LITERATURE REVIEW

A preliminary review of relevant literature is essential for establishing the scholarly foundation of this study. The literature review not only clarifies what is already known about the use of firearm evidence in murder investigations but also highlights the gaps and unresolved issues that justify the need for the present research. This section begins by outlining the general purpose and function of a literature review, then synthesises existing knowledge on firearm evidence, crime scene management, and investigative challenges in the South African context, with a specific focus on Piet Retief Police Station.

1.8.1 Purpose and Function of a Preliminary Literature Review

A literature review deepens understanding of the research problem, showing how the topic has been studied and how the current study contributes to scholarly discourse (Creswell and Creswell, 2018:123). It positions the research within the broader academic landscape, identifying gaps, refining the research problem, clarifying variables, reviewing methodologies, and strengthening conceptual and operational definitions (Dempsey, 2017:19–20; Thomas, 2017:58).

By systematically searching, screening, and synthesising published material, a literature review guides the researcher in addressing research questions (Bryman, 2016:132). This approach provides insight into methodological developments and theoretical debates and enables critical evaluation of prior studies (Hammond and Wellington, 2017:127; Denscombe, 2017:60). Crucially, a literature review clarifies the rationale for conducting a study (Mayan, 2023:96).

This study also reviewed literature on the handling and application of firearm evidence in resource-constrained policing contexts. This focus highlights practical challenges and strategies that shape investigative outcomes.

1.8.2 Overview of Firearm Evidence in Murder Investigations

Firearm evidence is central to murder investigations, providing objective, physical data that can link a suspect, weapon, and crime scene. Elements such as bullets, cartridge

cases, gunshot residue, and the firearm itself offer critical clues through ballistic examination. Saferstein (2024:765) notes that ballistic analysis identifies unique markings on bullets and cartridge cases, which can be matched to a specific firearm. The precision and reliability of such analysis are therefore crucial for establishing connections between a suspect and a crime.

Despite its importance, firearm evidence is vulnerable to errors. Contamination, deterioration, improper handling, and environmental factors can all compromise its integrity. Watkins (2018:654) cautions that inaccuracies in firearm analysis may result in serious consequences, including wrongful convictions or unjustified acquittals. Empirical research further underscores the value of robust protocols. For instance, James, Nordby, and Bell (2019:205) found that police stations with clear operational procedures and well-trained personnel achieve significantly higher success rates in firearm-related murder investigations.

1.8.3 Key Themes Emerging from Existing Literature

The review of literature on firearm evidence in murder investigations reveals several recurring themes that are central to understanding the nature, application, and challenges of this type of evidence. These themes highlight both the technical and operational aspects of firearm-related investigations, as well as their broader legal, social, and community implications. Synthesising these themes allows for a clearer understanding of the current state of knowledge, the practical and procedural challenges faced by investigators, and the gaps that justify the present study. The following subsections discuss each of these key themes in detail.

a) Nature of Physical and Firearm Evidence

Physical evidence refers to tangible items directly linked to the commission of a crime (Watkins, 2018:59). Such evidence is distinguished from forms of inference-based or testimonial evidence because it provides concrete, observable information. Within the context of this study, the relevant physical evidence includes cartridge cases, bullets, the firearm itself, and primer residue recovered from murder scenes.

Van Rooyen (2016:260) explains that the forensic examination of these components can determine whether a particular firearm discharged a bullet or cartridge case, identify the type of weapon used, and establish the specific ammunition fired. Buttressing the point, Palmiotto (2017:20), highlights that the systematic examination of firearm evidence can answer crucial investigative questions and establish reliable connections among the weapon, suspects, victims, and scene.

b) Crime Scene Management and Evidence Integrity

A crime scene represents the initial and most critical point of information gathering. James et al. (2019:121) observe that effective crime scene management provides investigators with essential clues that allow them to reconstruct events and identify potential suspects. Therefore, proper documentation, preservation, and collection of evidence are fundamental to ensuring its integrity.

However, poor handling practices, including contamination, improper storage, or delays in collection, can significantly compromise the reliability of firearm evidence (Silva et al., 2021:6). Literature consistently highlights that evidence integrity is foundational to the success of any forensic investigation (Lamb, 2018:42; Rao, Pandey, and Tharmavaram, 2020:56). Thus, any deviation from best practice may reduce the strength of the evidential link between suspect and crime (Hill and Mofokeng, 2024;17).

c) Utilisation of Firearm Evidence in Investigations

Existing research stresses that firearm evidence is instrumental in reconstructing crime scenes and confirming or challenging the accounts of suspects and witnesses. As espoused by Guyll et al. (2023:5), courts frequently rely on firearm-related evidence because it offers factual and objective indicators that can support or contradict testimonies. The effective utilisation of such evidence often determines whether investigators can establish a coherent narrative of events, identify the role of each participant, and provide reliable evidence for prosecution (Lamb, 2018:45; Van Rooyen, 2016:260).

d) Challenges in Firearm-Related Investigations

Despite its importance, the analysis and use of firearm evidence are fraught with challenges. Harris and Lee (2019:71) point out that investigators frequently encounter significant obstacles, particularly in managing complex crime scenes and ensuring that firearm evidence is collected, documented, and stored appropriately. However, errors in handling may introduce doubt into the forensic process and ultimately influence the outcome of judicial proceedings (Lamb and Warton, 2025:16). Additionally, the lack of specialised equipment, insufficient training, and limited access to modern forensic technologies can further weaken the effectiveness of firearm-related investigations (Mbonambi and Olutola, 2024:12). Such challenges are common in rural police stations such as Piet Retief – hence the current study.

e) Local Case Examples: The Piet Retief Context

A review of firearm-related murder cases in Piet Retief reveals several incidents that illustrate the complexity of firearm investigations within this locality. One high-profile case involved the tragic killing of an entire family, including children, reportedly by a relative (SABC News, 2023). Another case concerned a group of suspects who surrendered a firearm at the police station, claiming it had been used in self-defence; this prompted a detailed forensic investigation, eventually leading to arrests. These examples highlight both the human impact and procedural intricacies inherent in firearm-related crimes in this region (Hill and Mofokeng, 2024:27; Mlambo, 2021:3).

f) Legal and Social Implications of Firearm Evidence

Firearm-related crimes have profound social and legal implications. Dawud and Abdulkadir (2021:476) highlight that such cases place considerable pressure on the criminal justice system to ensure fairness, accuracy, and accountability. Communities often respond to firearm-related murders with heightened anxiety and diminished trust in law enforcement, particularly when cases remain unresolved (Guyll et al., 2023:18). The literature further indicates that firearm evidence is crucial role in determining legal outcomes and in shaping public perceptions of safety, justice, and the credibility of policing institutions (Rao et al., 202:61; Bantjes et al., 2020:9).

Table 1.1. Summary of Key Themes from the Preliminary Literature Review

Theme	Description / Focus	Key Sources	Relevance to Current Study
Purpose and Function of Literature Review	Explains why a literature review is conducted, its role in situating the study, identifying gaps, and refining research objectives	Creswell and Creswell (2018:45), Dempsey (2017:88), Thomas (2017:102), Hammond and Wellington (2017:67)	Establishes scholarly framework; justifies research focus
Nature of Physical and Firearm Evidence	Includes bullets, cartridge cases, firearms, primer residue; importance of ballistic analysis and linking evidence to suspects	Fisher and Fisher (2022:145), Houck and Siegel (2015:35), Van Rooyen (2016:39), Watkins (2018:120)	Highlights the types of evidence central to murder investigations
Crime Scene Management and Evidence Integrity	Importance of proper collection, preservation, and documentation; challenges include contamination and deterioration	Robertson et al. (2021:175), Girard (2016:152), Rondinelli (2017:249), Palmiotto (2017: 154), Schwikkard and Van der Merwe (2016:272)	Ensures reliability and admissibility of evidence
Utilisation of Firearm Evidence	Reconstruction of crime scenes, verification of witness accounts, and supporting prosecution	Guyll et al. (2023:16), Van Rooyen (2016:56), Saunsbury and Doherty (2016:132), Robertson (2021:183)	Demonstrates practical importance in investigations and judicial outcomes

Investigation Challenges	Operational, technical, and procedural difficulties; lack of equipment or training	Harris and Lee (2019:63), Lamb and Warton (2025:16), Robertson et al. (2021:104), Dawud and Abdulkadir (2021:476),	Identifies barriers to effective use of firearm evidence
Local Case Examples (Piet Retief)	Specific cases illustrating complexity and challenges	Hill and Mofokeng (2024:27), Mutsavi and Meintjes-van der Walt (2020:33), Mlambo (2021:3), Mbonambi and Olutola (2024:12)	Provides contextual relevance; shows real-life implications
Legal and Social Implications	Broader societal, judicial, and public safety impacts of firearm-related crimes	Guyll et al. (2023:18), Dempsey (2017:92), Rao et al. (202:61), Bantjes et al. (2020:9)	Shows significance beyond technical investigation
Identified Gaps	Areas needing further study: rural policing, resource allocation, link to case outcomes	Bertino and Bertino (2021:894), Lamb (2018:45), James et al. (2019:205)	Directly justifies the rationale for the current study

1.8.4 Identified Gaps in the Literature

The review of existing literature reveals several gaps that justify the need for the current study:

- Limited research focuses specifically on firearm evidence management in rural South African police stations (Welman, 2020:205).
- There is a scarcity of empirical studies examining firearm evidence practices at Piet Retief Police Station.
- Few studies investigate the link between firearm evidence utilisation and murder case-resolution rates in the South African context (Hill et al., 2024:31).
- Operational challenges experienced by investigators, such as inadequate resources, training deficiencies, and environmental limitations, have not been sufficiently documented (Mutsavi and Meintjes-van der Walt, 2020:4).
- The complexity of firearm-related murders in small-town environments remains an underexplored area of forensic and criminal justice research (Henning et al., 2016:119).

These gaps highlight the need for an in-depth, contextually grounded investigation into how firearm evidence is collected, examined, and utilised at Piet Retief Police Station.

1.9 DEFINITION OF KEY CONCEPTS

Defining key concepts prevents ambiguity or misunderstanding (Welman and Kruger, 2015:119). In this study, defining the following concepts is crucial.

1.9.1 Forensic investigation

A forensic investigation is a scientifically grounded process aimed at determining the causes, methods, and circumstances of a crime at a specific location (Schwikkard and Van Der Merwe, 2016:98). It employs technological tools to reconstruct the crime scene and produce reliable evidence for identifying and prosecuting offenders. The

primary objective is to analyse evidence scientifically to support prosecution in a court of law.

More broadly, forensic investigation applies scientific methods to support judicial proceedings, whether criminal, civil, or quasi-judicial. It helps answer questions arising from unresolved crimes or legal disputes. Beyond traditional criminal cases, it is also essential in examining computer-related offences, fraud, corruption, embezzlement, money laundering, and other forms of white-collar crime (Schwikkard and Van Der Merwe, 2016:98).

1.9.2 Criminal investigation

A criminal investigation is a structured process for uncovering the truth behind a criminal act. It involves collecting, organising, analysing, and presenting evidence to clarify what transpired and identify those responsible (Thomas: 2017:978). It is a reconstructive process that relies on deductive reasoning. The process draws logical conclusions from factual evidence, such as fingerprints or ballistic markings, to establish whether a suspect is guilty of an offence (Van Rooyen, 2016:765). Illustrating the point, Vanderstoep and Johnson (2018:564), state that Vanderstoep and Johnson (2018:564) state that if a suspect's fingerprints are discovered at a murder scene, this serves as factual evidence linking them to the location. However, it remains the suspect's responsibility to give a credible explanation for their presence at the scene of the crime.

1.9.3 Firearm

The Firearms Control Act of 2000 (Act 60 of 2000) states that a firearm is any tool designed or made to shoot a projectile through a barrel using an explosive force, and it must have a muzzle energy greater than eight joules. Welman and Kruger (2015:754) further define a firearm as any lethal weapon equipped with a barrel from which a shot, bullet, or other projectile may be discharged. This definition also includes any component or accessory designed to reduce noise or flash produced during firing. However, antique firearms are explicitly excluded from this classification.

Rondinelli (2017:2) describes a firearm as a lethal, barrelled weapon of any kind capable of discharging a shot or other missile. Saunsbury and Doherty elaborate on this definition by emphasising that the term “lethal” pertains to objects intended to cause significant harm or specifically designed to inflict death or serious bodily injury.

1.9.4 Crime Scene

A crime scene refers to any area where a crime has taken place. This includes the immediate surroundings, the scene, entry and exit points or any location where evidence connected to the crime may be found (Dempsey, 2017:47). It serves as the primary source of physical evidence that enables investigators to reconstruct events, identify suspects, and determine the sequence of criminal actions (Saferstein, 2018:149). Watkins (2018:114) concurs, explaining that a crime scene refers to any location where a crime has taken place, as well as any site where evidence connected to a crime committed elsewhere or at a different time may be discovered.

1.9.5 Murder

Murder is defined as the illegal act of killing another person with a deliberate intention to cause harm or death (Bertino 2020:356). For a murder case to hold, there must be intent: either to cause death or to inflict serious bodily harm, accompanied by knowledge that such actions could likely result in death. According to Descombe (2017:276), an individual is deemed to have committed murder when, in carrying out an act, they intend to kill or inflict serious bodily harm, are aware that their actions are likely to result in death or injury to another person, or engage in a violent act while attempting to commit a forcible offence other than voluntary murder.

1.9.6 Physical evidence

Physical evidence is defined as any object that has been used, discarded, removed, altered, or contaminated during a criminal act by either the offender or the victim (Gerard, 2018:254). Physical evidence encompasses various types of objects linked to the investigation; however, it is typically a tangible item, in contrast to other kinds of evidence that may arise from sensory observations or deductions (Descombe, 2017:276). Harris (2019:26) echoes Rondinelli (2017:59), noting that physical

evidence provides tangible indications about a crime and typically consists of real objects that are directly connected to the criminal act.

1.9.7 Exhibit

An exhibit is any item, document, or piece of evidence collected, recorded, and analysed during an investigation (2017:68). Exhibits play a crucial role in forensic investigations, as they provide tangible evidence that can help solve crimes. The term may also describe an object or reference presented as evidence or proof in a legal context, such as during a court proceeding (Welman, 2015:278). According to Strydom (2016:756), an exhibit can include documents, photographs, physical objects, digital media, or other materials formally introduced as evidence in legal proceedings. It may also refer to attachments accompanying legal instruments such as motions, contracts, or pleadings.

1.10 THEORETICAL FRAMEWORK

This study is underpinned by Locard's Exchange Principle, a foundational theory in forensic science proposed by Dr Edmond Locard in the early twentieth century. The principle asserts that *"every contact leaves a trace,"* meaning that whenever two objects come into contact, a mutual transfer of material occurs between them (Locard, 2008:17). In criminal investigation, this theoretical concept explains how physical evidence can link a suspect, a victim, and a crime scene, thereby providing the scientific basis for reconstructing criminal events (Dash, Elkins, and Al-Snan, 2023:137).

Given that the present study explores how investigators and forensic practitioners experience and understand the utilisation of firearm evidence in murder investigations, Locard's theory offers a logical and coherent lens. It provides the conceptual foundation for understanding both the scientific potential of physical evidence and the professional responsibilities associated with its proper recovery, handling, and interpretation (Borgeson, Kendall, and Cappadona, 2025:118). A detailed discussion is presented in Chapter 2 (Section 2.4).

1.11 METHODOLOGICAL FRAMEWORK OF THE STUDY

The present study was situated within the interpretivist research paradigm, which emphasises understanding human experiences from the perspectives of those directly involved. Interpretivism recognises that reality is socially constructed, and that knowledge emerges through individuals' interpretations of their lived experiences (Vanderstoep & Johnston, 2018:165).

In contrast to the positivist paradigm, which assumes that reality exists independently of human perception and can be objectively measured, interpretivism acknowledges that human behaviour and social phenomena are context dependent. Quantitative methods, typically associated with positivism, are suited to analysing controlled, measurable variables and establishing generalisable cause-and-effect relationships (Leavy 2023:109). However, the focus of this study (investigators' experiences and perceptions in firearm-related murder cases) required understanding the meanings and interpretations that participants attach to their professional practice.

Thus, the interpretivist paradigm shaped the study's overall orientation by informing how knowledge was conceptualised, how data were generated, and how findings were interpreted. It enabled a flexible, participant-centred, and context-sensitive inquiry (Mayan, 2023:196). This was critical for understanding the participants' investigative experiences on firearm-related murder cases. To ensure that these philosophical commitments were reflected consistently in the methodological choices that followed, the study adopted Saunders' Research Onion as a guiding framework, as outlined in the next section.

1.11.1 Application of Saunders' Research Onion

The Research Onion developed by Saunders, and Thornhill (2019:102), provided a practical framework to guide methodological decisions in this study (see Figure 1.1). This framework ensured that each layer, from philosophy to data collection, aligned with the research objectives.

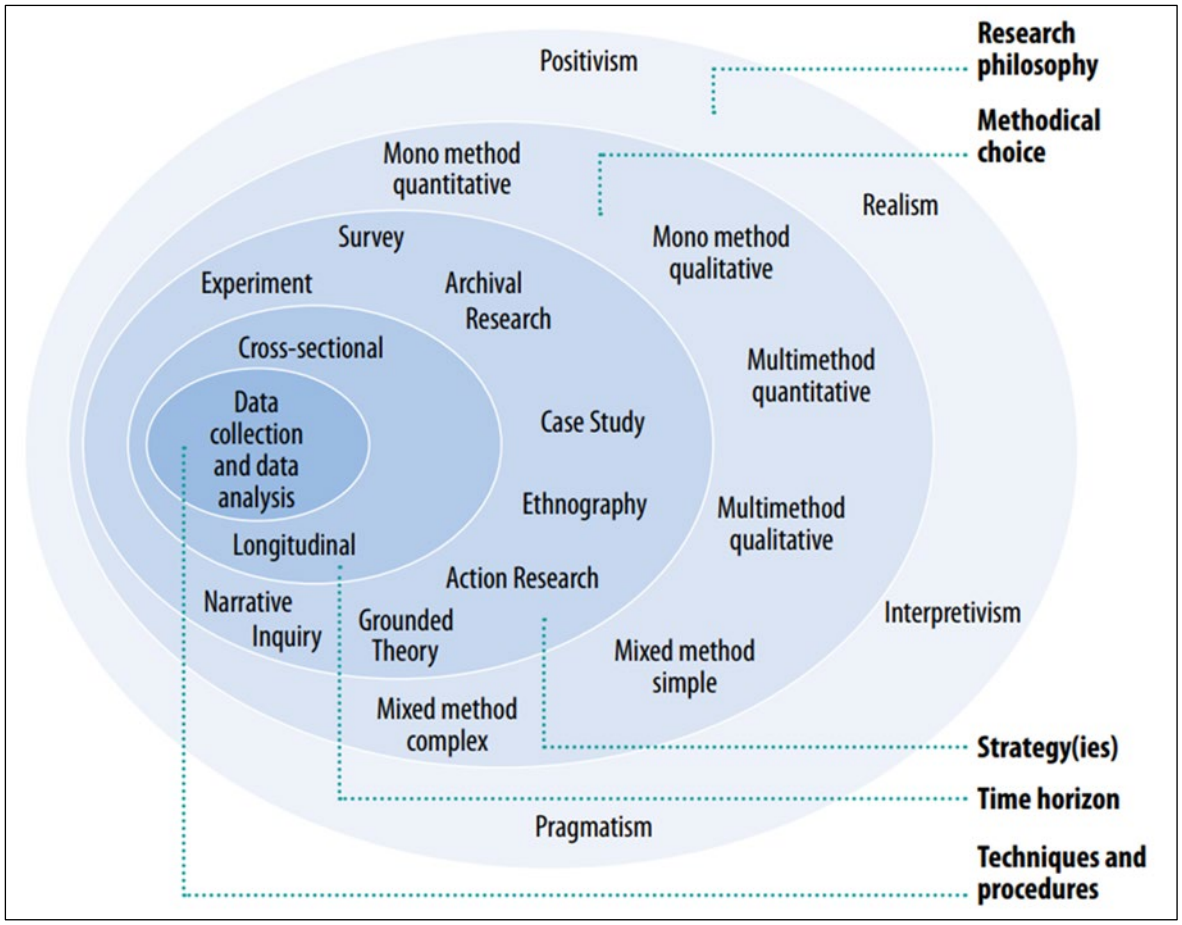

Figure 1.1 The Research Onion (adopted from Saunders et al., 2019:102)

At the outer layer, the interpretivist philosophy reinforced the focus on the participants' *lived experiences* in firearm investigations. The approach layer supported the use of inductive reasoning (Tisdell, Merriam, and Stuckey-Peyrot, 2025:182), allowing insights and patterns regarding investigative practices to emerge from the data rather than being pre-imposed.

Within the methodology layer, a qualitative approach was selected to explore complex social phenomena (Saunders et al., 2019:104). The strategy layer identified phenomenology as the most appropriate design to capture the meanings participants attach to their professional practices. At the core of the Onion, the study employed semi-structured interviews and a focused literature review, enabling collection of rich, contextually grounded data directly relevant to understanding firearm investigative processes.

Following Saunders' framework ensured coherence across the study's philosophical stance, research approach, design, and data collection methods. This approach enhanced methodological rigour and alignment with the research objectives.

1.11.2 Research Approach: Qualitative Inquiry

Building on the interpretivist paradigm, the study adopted a qualitative research approach. Qualitative research is inherently subjective and exploratory, prioritising participants' perspectives and the meanings they attach to their experiences (Creswell and Creswell, 2018:46). This approach is particularly suitable for investigating complex social phenomena, where understanding *lived experiences*, perceptions, and contextual factors is critical (Mayan, 2023:194).

Qualitative methods allow for interactive engagement with participants, providing flexibility to adapt to the natural dynamics of the research setting (Tisdell et al., 2025:43). As espoused by Hammond and Wellington (2017:107), qualitative inquiry is an inductive and flexible process, which is designed to uncover insights, generate theory, and explain phenomena as they naturally occur.

In the context of this study, qualitative inquiry enabled an in-depth exploration of how firearm evidence is utilised in murder investigations. This way, authentic insights were elicited from participants with direct, first-hand experience on the phenomenon (Thomas, 2017:58). The approach facilitated rich, contextually grounded data through semi-structured interviews. This was complemented by a comprehensive review of relevant literature to situate the findings within broader investigative and forensic knowledge.

By foregrounding participants' voices, the qualitative approach ensured that the research generated meaningful, actionable insights grounded in data (Leavy, 2023:205). Such insights are critical for understanding investigative challenges and developing a firearm policing model to improve outcomes.

1.12 RESEARCH DESIGN: PHENOMENOLOGY

Aligned with the qualitative approach, the study employed a phenomenological research design. Phenomenology is concerned with understanding and interpreting individuals' *lived experiences*, focusing on the meanings they attribute to specific phenomena (Houck & Siegel, 2015:110).

This design was particularly appropriate for exploring firearm investigations, as it prioritises the perspectives of those directly involved in the investigative process. By collecting first-hand accounts from detectives, forensic analysts, and command personnel, the study captured the nuances of their professional experiences (Mayan, 2023:174). The rich narratives covered challenges encountered, strategies employed, and perceptions of existing legislation and procedures.

This approach provided both common themes and individual variations (Tisdell et al., 2025:164). Overall, the phenomenological design ensures that the study is coherently aligned and rigorous.

1.12.1 Location of the Study

The study was conducted at the Piet Retief Police Station, situated within the Mpumalanga Province of South Africa. Mpumalanga comprises 94 police stations, with eight falling under the Piet Retief policing jurisdiction. The researcher selected Piet Retief because it represents the specific site where the research problem was first observed and offered a practical, accessible setting for data collection. The station was further prioritised for inclusion following a review of the 2022/2023 crime statistics, which indicated an increase in murder cases within this specific cluster.

1.12.2 Target Population

A population refers to the entire group of individuals relevant to a study (Strydom, 2016:162; Thomas, 2017:173). In most cases, it is not possible to involve every member of this group due to time, cost, and logistical constraints (Van Rooyen, 2016:172). Therefore, researchers identify a target population—the specific group from which a sample is drawn and to whom findings will apply (Babbie, 2010:199).

In this study, while the ideal population would include all SAPS investigators involved in murder investigations, the target population was narrowed to those operating within the Piet Retief jurisdiction. This population consisted of detectives at the Piet Retief Police Station, forensic practitioners at the Piet Retief Local Criminal Record Centre, and senior officers who supervise investigative operations (see Section 1.12.3). These individuals were selected because they work directly with murder investigations and firearm evidence; their professional experiences are central to this phenomenological inquiry into lived investigative realities (Leavy, 2023:108).

The target population consisted of detectives at Piet Retief Police Station, forensic practitioners at the Piet Retief Local Criminal Record Centre, and senior officers who supervise investigative operations (see Section 1.12.3). These individuals were chosen because they work directly with murder investigations and firearm evidence. Their experience made them well-suited to a phenomenological study that seeks to understand lived professional realities.

1.12.3 Sampling

Sampling involves selecting a smaller group from a larger population so the researcher can study it in depth (Dempsey, 2017:241). In qualitative research, the goal is insight, not representativeness.

Since this study followed a phenomenological design, it required participants who had direct experience with the phenomenon. Phenomenology depends on individuals who can describe what they have lived and explain the meanings they attach to those experiences (Denscombe, 2017:165). For this reason, the study used purposive sampling. This technique allows the deliberate selection of people with specialised knowledge and relevant experience (Ahmad and Wilkins, 2025.:1462). It focuses on depth rather than breadth.

Accordingly, participants were chosen because they work with firearm evidence, murder investigations, or forensic decision-making. Their expertise allowed the researcher to collect rich, detailed accounts of investigative practice as emphasised by Rao et al. (2020:56). This ensured that each participant contributed meaningfully

to understanding how firearm evidence is handled and interpreted in real investigative contexts.

1.12.4 Sampling Criteria

Sampling criteria refer to the characteristics or conditions that individuals must meet to be eligible for participation (James et al., 2019:135). The study used purposeful sampling to ensure that participants possessed direct operational knowledge of murder investigations and firearm evidence. This method enabled the researcher to engage with information-rich participants who could provide experiential insights into crime scene handling, forensic processing, and investigative decision-making (Van Rooyen, 2016:81).

Participants were drawn from three key groups

- **Sample A:** Detectives at Piet Retief Police Station
- **Sample B:** Crime scene experts (LCRC)
- **Sample C:** Ballistics and senior forensic specialists

The selection of these groups provided a holistic, multi-level perspective on firearm evidence handling, from the crime scene to the laboratory and strategic supervision. This approach aligns with the layered sampling logic recommended in qualitative forensic studies (James et al., 2019:135). To ensure rigour and consistency, clear criteria guided participant selection (see Table 1.1).

Table 1.2 Inclusion and Exclusion Criteria

Inclusion Criteria	Rationale	Exclusion Criteria	Rationale
SAPS members employed at Piet Retief Police Station or Ermelo LCRC	Ensures relevance to the geographical and operational scope of the study	SAPS staff not directly involved in murder investigations (e.g., clerks, HR, CSC personnel)	Lack operational exposure to firearm evidence
Minimum of one year of experience in murder investigation or forensic work	Ensures sufficient exposure to investigative processes	Members with less than one year in service	Insufficient experience to contribute meaningful data
Direct involvement in handling, processing, analysing, or supervising firearm evidence	Ensures phenomenon-specific expertise	Officers not performing investigative or forensic duties	Experience too limited for phenomenological contribution
Ability and willingness to give informed consent	Ethical requirement	Individuals unwilling or unavailable for interviews	Ensures voluntariness and ethical compliance
Availability during the data-collection period	Practical requirement	Officers on leave, training, or suspension	Unavailable to participate

The inclusion and exclusion criteria guided the identification of suitable participants for this study. Accordingly, the sampling frame in Table 1.3 presents the final composition of participants who met these criteria and were purposefully selected for in-depth phenomenological engagement.

Table 1.3 Summary of Purposive Sample Composition (n = 20)

Sample	Population Group	Number Included	Rationale for Inclusion
A	Detectives at Piet Retief Police Station	8	Direct involvement in murder case investigations and evidence handling
B	LCRC Crime Scene Experts (Piet Retief)	7	Responsible for firearm evidence collection and scene processing
C	Ballistics / Firearm Analysts	5	Provide expert analysis linking firearms, bullets, and cartridges

The sample composition in Table 1.3 is consistent with qualitative research principles, which prioritise depth over representativeness (Mayan, 2023:207). The sample reflects multiple layers of investigative practice; operational, scientific, and managerial. The sampling approach targeted information-rich participants who could articulate challenges, practices, and procedural realities (De Vos et al., 2016:174). Purposeful selection ensured the study generated deep, nuanced, and contextually grounded insights from participants. This enhances the credibility of the findings.

1.12.5 Sample Characteristics

The final study sample comprised 20 participants drawn from three key groups involved in firearm investigations at Piet Retief Police Station. Table 1.4 summarises their demographic characteristics, including role category, gender, age range, highest qualification, and years of professional experience. This composition provides diverse perspectives, ensuring that the study captures both practical and strategic insights into the utilisation of firearm evidence in murder investigations.

Table 1.4 Participant Demographic Data

ID	Role Category	Gender	Age Range	Highest Qualification	Years of Experience
A1	Detective	Male	35–39	Diploma in Policing	8
A2	Detective	Female	32–36	Diploma in Policing	7
A3	Detective	Male	30–34	Certificate in Crime Investigation	5
A4	Detective	Male	38–42	Diploma in Investigative Practice	11
A5	Detective	Female	33–37	Diploma in Policing	6
A6	Detective	Male	40–44	BA Police Science	12
A7	Detective	Female	31–35	Diploma in Forensic Investigation	6
A8	Detective	Male	34–38	Diploma in Policing	9
B1	Forensic Analyst (LCRC)*	Female	29–33	BSc Forensic Science	5
B2	Forensic Analyst (LCRC)*	Male	31–35	BTech Forensic Investigation	6
B3	Forensic Analyst (LCRC)*	Female	34–38	BSc Applied Biology	9
B4	Forensic Analyst (LCRC)*	Female	28–32	BSc Chemistry	4
B5	Forensic Analyst (LCRC)*	Male	30–34	BTech Forensic Investigation	7
B6	Forensic Analyst (LCRC)*	Female	35–39	Honours in Forensic Science	10
B7	Forensic Analyst (LCRC)*	Male	33–37	BSc Physics	8
C1	Station Commander	Male	45–49	BA Police Science (Hons)	20
C2	Detective Branch Commander	Male	42–46	BA Criminal Justice	18
C3	Senior Crime Intelligence Officer	Female	40–44	BA Public Administration	15
C4	Operational Commander	Male	50–54	SAPS Executive Management Programme	22

Notes:

* (LCRC = Local Criminal Record Centre; forensic analysis may be conducted at centralised provincial or national laboratories supporting local stations such as Piet Retief.)
† Sample Groups:

- Sample A: Detectives (operational investigative officers)
- Sample B: Forensic Analysts (LCRC / scientific support)
- Sample C: Senior management and leadership (Station Commanders, Branch Commanders, Operational and Crime Intelligence officers)

The participants selected for this study were well-suited to addressing the research objectives, given their expertise, experience, and roles within the criminal justice system. Sample A comprised eight detectives from the Piet Retief Police Station, directly involved in investigating criminal cases, including murders, and experienced in collecting and handling firearm evidence. Their educational backgrounds in policing, forensic investigation, and crime investigation, combined with 5 to 12 years of professional experience, equipped them with the technical knowledge and operational insight necessary for the study. This ensured that their perspectives reflected both practical and procedural aspects of investigative work.

Sample B included seven forensic analysts from the Piet Retief Local Criminal Records Centre (LCRC)*, whose roles focused on examining and interpreting forensic evidence. With qualifications ranging from BSc and BTech degrees in forensic science, chemistry, physics, and applied biology, as well as 4 to 10 years of hands-on experience, these participants brought specialised scientific expertise essential to analysing firearm evidence. Their inclusion ensured that the study captures laboratory-based perspectives, which are critical to interpreting evidence and making investigative decisions.

Sample C comprised four senior officers, including Station Commanders, Detective Branch Commanders, and Senior Crime Intelligence Officers, responsible for oversight, strategic planning, and policy implementation in serious crime investigations. Their extensive professional experience, spanning 15 to 22 years, provides a comprehensive understanding of operational challenges, resource management, and investigative processes in murder cases.

Collectively, the participants offered a balanced and contextually rich sample, combining practical investigative experience, forensic analytical skills, and strategic leadership. This diverse composition ensured that the study could generate in-depth

insights into the utilisation of firearm evidence in murder investigations, reflecting multiple perspectives within the criminal justice system.

1.13 METHODS OF DATA COLLECTION

Data collection involves systematic procedures to obtain the information necessary for a study. As a central component of methodology, Creswell and Creswell (2018:189) note that it requires clearly defining the research scope and purposefully selecting suitable techniques, such as semi-structured interviews, contextual observations, and analysis of written or visual materials. For this study, an extensive literature review and interviews were the primary data collection methods, enabling triangulation by integrating multiple sources of evidence (Tisdell et al., 2025:114). These methods were chosen to provide comprehensive and reliable data that directly addressed the research objectives and enhanced the credibility of the findings.

1.13.1 Literature Review

The literature review involved examining national and international data sources to identify theoretical frameworks relevant to the research topic and questions. Literature was selected according to the study's core thematic areas, including policing, forensic science, investigative procedures, criminal investigation, firearms, evidentiary exhibits, law enforcement, murder, and firearm-related evidence. This ensured a comprehensive, contextually grounded understanding of the subject.

A wide range of peer-reviewed journals, scholarly textbooks, and reputable organisational websites were consulted, consistent with Tisdell et al. (2025:174). To maintain methodological rigour, a document checklist (Annexure D) was used to assess the relevance, credibility, and thematic alignment of each source. This strategy ensured that high-quality, authoritative, and methodologically sound materials were included.

These structured procedures provided a robust evidentiary foundation, informing the study's conceptual framework and supporting reliable findings linked to the research objectives. The literature review was complemented by semi-structured interviews. This approach enabled data triangulation, as outlined by Thomas (2017:87) and

Vanderstoep and Johnston (2018:105). Integrating multiple sources allowed comparison and corroboration of information, reducing bias and enhancing the depth and credibility of the results.

1.13.2 Interviews

The researcher conducted 20 individual semi-structured interviews using an open-ended interview schedule (Annexure E). This format allowed clarification of ambiguous questions and probing of incomplete responses (Brayman, 2016:159). Questions were developed from existing research related to the study topic and problem. Interviews were arranged in quiet, private settings within participants' workplaces, and written informed consent was obtained from all participants (Annexure C).

Interviews followed Mayan's (2023:147–149) guidelines. For instance, at the beginning of each interview, time was dedicated to building rapport, creating a comfortable and trusting environment as suggested. The same interview plan was consistently applied to enhance credibility. Moreover, interviews focused on participants' actual experiences rather than hypothetical scenarios, capturing authentic perspectives (Leavy, 2023:148).

The researcher remained neutral and non-directive. Responses were audio recorded while allowing participants to express their views freely (Tisdell et al., 2025:192). To maintain confidentiality, all materials were coded to replace personal identifiers (Strydom, 2016:134). The same interview schedule was applied across all participant groups to ensure consistency. These measures strengthened the credibility of the data collected.

1.14 DATA ANALYSIS

Data analysis involves breaking down a dataset and examining the emerging patterns (Hammond and Wellington, 2017:9). The objective is to interpret the information and extract meaningful insights (Creswell and Creswell, 2018:195). Similarly, Flick (2018:52) emphasises that analysis converts raw data into responses addressing the research questions. In this study, all raw data were systematically recorded, reviewed,

and organised into categories, with thematic patterns identified to facilitate deeper understanding (Babbie, 2010:143–144).

The study employed thematic analysis (see Figure 1.1) as outlined by Braun and Clarke (2024). Thematic analysis is a rigorous qualitative method for identifying, analysing, and reporting patterns or themes within data (Mayan, 2023:276). This approach organised rich, complex information into meaningful themes that captured participants' experiences and perspectives. Thematic analysis allowed interpretation of both explicit and implicit meanings in participants' accounts of firearm investigation practices.

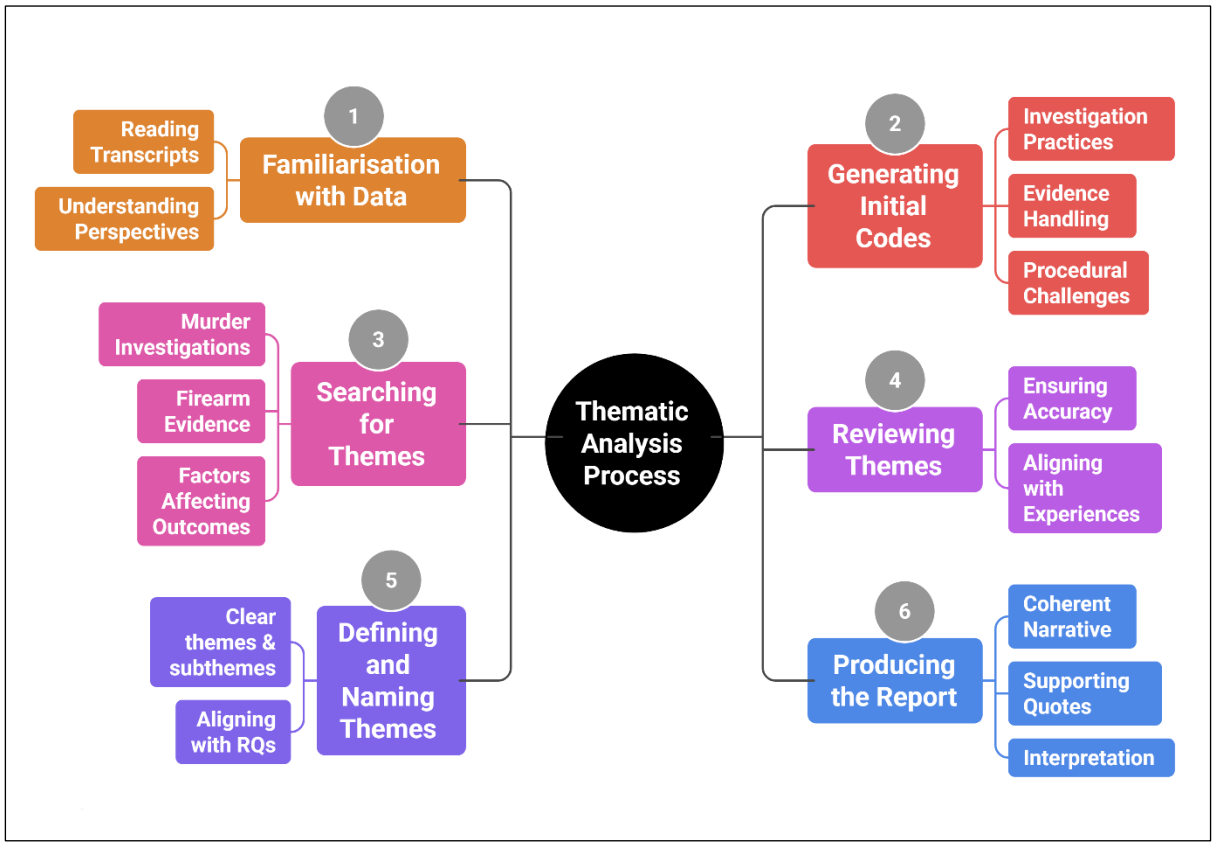

Figure 1.2 Thematic Analysis Process

As illustrated in Figure 1, the researcher began by organising and preparing the data. This stage involved transcribing field notes and interview recordings. According to Bryman (2016:34), preparing field notes and transcripts entails transforming initial notes into readable, analysable written accounts that can be reviewed and refined.

To become familiar with the data, the researcher engaged in repeated readings of the transcripts to develop a holistic understanding of the content, discern general meanings, and capture the core ideas expressed by participants. Mouton (2017:342) emphasises that immersion in the data is a crucial early phase of qualitative analysis. During this stage, the researcher thoroughly reviews the collected material to form a comprehensive mental image of the dataset and begins conceptualising potential groupings.

Subsequently, the data were divided into meaningful sections or clusters that share common attributes (coding). Henning et al. (2016:342) describe as coding, as systematically organising data into smaller, manageable parts by fragmenting transcripts and classifying these fragments into different categories to derive meaning. Following Braun and Clarke's six-step approach, initial codes were generated, reviewed, and refined, allowing coherent themes to emerge that represent participants' *lived experiences* and the key issues in firearm investigations.

Once themes were determined, the researcher integrated and summarised the findings. The analysis is presented through descriptive narratives, tables, and thematic maps to communicate the results clearly (Braun and Clarke, 2024:315).

1.15 TRUSTWORTHINESS

Ensuring trustworthiness is essential in qualitative research, demonstrating the rigour, credibility, and integrity of findings (Leavy, 2023:61). It is achieved through credibility, dependability, confirmability, and transferability, all of which were systematically implemented in this study.

1.15.1 Credibility

Credibility ensures that findings accurately reflect participants' experiences and perceptions. This was achieved through triangulation and member checking, as suggested by Tisdell et al. (2025:317). Triangulation compared data from multiple sources, including interviews across investigative ranks and analysis of literature, to provide a coherent understanding of operational challenges. On the other hand, member checking allowed participants to review synthesised findings from their

interviews. Participants that the researcher's interpretations reflected their intended meaning and ensuring the authenticity of conclusions (Mouton, 2017:258). These measures eliminated researcher bias.

1.15.2 Dependability

To ensure dependability, a comprehensive audit trail was maintained. This entailed documenting every procedural step—from sampling strategy and participant selection to data analysis (Welman and Kruger, 2015:635). Raw data, including verbatim interview transcripts, field notes, and a detailed codebook, were systematically archived and cross-referenced (Mayan, 2023:291). Regular peer debriefing with the research supervisor provided external scrutiny, challenging and refining methodological decisions and preliminary interpretations (Leavy, 2023:249). These measures ensured that the study's findings remained consistent, logical, and traceable throughout the research process.

1.15.3 Transferability

Transferability was addressed by providing rich and detailed contextual information about the research setting, participant roles, investigative procedures, and operational environment at Piet Retief Police Station (see Sections 1.83 [e] and 1.12.4). Thick descriptions of participants' experiences, investigative practices, and document analysis were included to enable readers and future researchers to determine whether the findings can be applied or adapted to similar policing and forensic contexts (see Table 1.4). This approach ensures that insights regarding the utilisation of firearm evidence and investigative practices have broader relevance beyond the immediate study setting.

1.15.4 Confirmability

Confirmability ensures findings are shaped by participants' experiences rather than researcher bias. Reflexivity was employed, with the researcher critically examining personal assumptions and their potential influence on data interpretation (Mayan 2023:296). Triangulation and member checking further verified that interpretations

accurately reflected participants' perspectives. In line with Tisdell (2025:191), these measures ensure transparency and objectivity in the study's conclusions.

By systematically applying these measures, the study ensured that its findings are credible, dependable, confirmable, and transferable, providing a robust and trustworthy account of how firearm evidence is utilised in murder investigations at Piet Retief Police Station.

1.16 ETHICAL CONSIDERATIONS

Ethical conduct in research is founded on mutual trust, respect, cooperation, and adherence to established norms among all parties involved. As Vanderstoep and Johnston (2018:128–129) note, research ethics concern the degree to which a researcher's behaviour aligns with accepted professional standards and moral codes. The primary purpose of research ethics is to safeguard participants from harm and to ensure that studies are conducted responsibly (Mayan, 2023:98). Participants must always be treated with dignity, sensitivity, and fairness. Leavy (2023:287), emphasises that, although researchers have the right to pursue investigations, this must never supersede or compromise participants' rights and welfare.

Thus, ethics can be understood as a set of moral guidelines, developed by individuals or professional organisations and widely accepted to guide proper behaviour. These guidelines set clear standards for how researchers should act towards participants, employers, sponsors, colleagues, research assistants, and students. Strydom (2016:128) emphasises that it is the researcher's responsibility to carefully consider ethical issues, particularly when human participants are involved. The credibility and integrity of research depend upon the researcher's commitment to protecting participants' rights and maintaining openness and honesty throughout the study.

Moreover, Strydom (2016:113–114) asserts that ethical research must be grounded in mutual trust, cooperation, and respect among all stakeholders, with ethical guidelines serving as a moral compass to ensure appropriate conduct and accountability in all interactions. In this study, the researcher strictly adhered to the University of South Africa (UNISA) Policy on Research Ethics (University of South

Africa, 2007:7), familiarising themselves with all relevant institutional requirements and ensuring full compliance throughout the research process. The principles outlined by Welman and Kruger (2015:487) guided ethical practice by ensuring respect for participants, confidentiality, informed consent, and integrity in data collection and reporting.

1.16.1 Voluntary Participation

Participation in the study was entirely voluntary, ensuring that no individual was coerced or influenced to take part. Participants were informed that they would not face any negative consequences should they choose to decline participation or withdraw from the study at any stage, thereby safeguarding their autonomy and rights (Strydom, (2016:114). Before data collection, each participant was provided with comprehensive information about the study. This including details about the study's purpose, procedures, expected duration of participation, and potential benefits and risks (see Annexure C). This careful process reinforced ethical rigour, promoted trust between the researcher and participants. It also ensured that all data were collected with respect for individual rights, dignity, and personal choice – as emphasised by Thomas, 2017:204).

1.16.2 Informed Consent

Before data collection, each participant was provided with detailed information about the study, including its purpose, the procedures to be followed, the expected duration of involvement, and the potential benefits and risks (see Annexure D). Participants were also allowed to ask questions and seek clarification on any aspect of the research, in line with Leavy (2023:152). Informed consent was obtained from all participants, confirming that they fully understood the study and had voluntarily agreed to participate. This process promoted trust, transparency, and ethical rigour, ensuring that all data were collected with respect for individual rights, dignity, and choice.

1.16.3 Confidentiality and Annonymity

To protect participants' identities, each was assigned a unique code (ID), as presented in Table 1.4. Detectives were coded A1–A8, forensic analysts B1–B7, and senior

command staff C1–C4. These codes were used throughout all stages of data collection, analysis, and reporting, ensuring that no personal identifiers appeared in any records, transcripts, or publications.

All digital data were stored on a password-protected computer, encrypted, and backed up securely to prevent unauthorised access. Physical documents were stored in a locked cabinet accessible only to the researcher (Henning et al., 2027:104). By combining coding with robust storage measures, participants' identities and sensitive information were fully protected, thereby enhancing the confidentiality and credibility of the research findings.

1.16.4 Right to Privacy

Participants' privacy was maintained. All interviews and data collection activities were conducted in private settings, ensuring that discussions could take place without interruption or observation. Participants were only asked to provide information relevant to the research objectives, and no extraneous personal data were collected (Vanderstoep and Johnston, 2018:231). The use of coded IDs (see Table 1.4) further ensured that even during analysis and reporting, individual participants could not be identified, reinforcing their right to privacy.

1.16.5 Reducing Risks and Avoiding Harm

The study was conducted with a strong emphasis on reducing potential risks or harm to participants (Tomal, 2015:3). Sensitive or potentially distressing topics were approached with care, and participants were informed that they could skip any question or withdraw from the study at any time without penalty. Support services were made available if required.

By following these ethical principles, this investigation into the analysis of firearm evidence in the context of murder at the Piet Retief Police Station ensured the safety, rights, and well-being of all participants, while maintaining the integrity, validity, and credibility of the research findings. The combination of voluntary participation, informed consent, coding of participant data, secure storage, and adherence to established ethical guidelines demonstrates full compliance with the University of

South Africa (UNISA) Policy on Research Ethics (2007:7) and accepted professional standards (Welman & Kruger, 2015:487; Strydom, 2016:106–114).

1.17 DISSERTATION STRUCTURE

Chapter 1: This chapter provides an overview of the study, including the problem statement, background, rationale, research objectives, research questions, and the significance of the study. Key concepts and terms used throughout the research are also clearly defined to ensure a common understanding.

Chapter 2: This chapter explores the relevant literature on murder investigation, forensic investigation, criminal investigation, murder, physical evidence, and deoxyribonucleic Acid (DNA). The review synthesises existing knowledge and identifies gaps that the current study seeks to address.

Chapter 3: This chapter examines the legal frameworks governing murder investigations, with a focus on legislation regulating firearms in South Africa. It also considers the statutory requirements and procedures for policing firearms and ensuring compliance during criminal investigations.

Chapter 4: The final chapter presents the findings of the study, provides recommendations based on the analysis, and offers a concluding discussion that summarises the study's contributions, implications, and potential areas for future research.

1.18 CHAPTER SUMMARY

Improving police discipline within the SAPS requires more than just regulatory amendments. The daily experiences of police officers play a critical role in shaping discipline, and these experiences are heavily influenced by the behaviour and attitudes of managers at all levels. Positive behaviours and attitudes are reinforced when managers are recognised and supported, while negative behaviours must be addressed through accountability measures. These managerial factors directly affect the conduct and mindset of lower-ranking members, ultimately influencing the overall organisational culture of the police service.

However, lasting changes in police culture are unlikely without a robust, effective disciplinary system that holds all police members and managers accountable. Without such a system, efforts to transform the SAPS into a professional, ethical, and accountable organisation will remain limited. Encouragingly, the presence of dedicated and ethical officers within the SAPS indicates that meaningful transformation is still achievable. The disciplinary system, therefore, represents a vital instrument in the broader effort to foster professional conduct and organisational change.

This chapter has provided a detailed overview of the research design and methodology underpinning this study. The phenomenological research design, including its origins, relevance to the study, and key characteristics, was explored in depth. The subsequent chapters build upon the methodological foundation established here by applying the proposed approaches to the presentation, analysis, and interpretation of qualitative data.

CHAPTER 2

LITERATURE REVIEW AND THEORETICAL FRAMEWORK

2.1 INTRODUCTION

Murder is characterised as the unlawful killing of one person by another (Van Rooyen, 2016:164). The investigation of such crimes requires considerable effort from law enforcement officials, who must address critical questions including the identification of the offender, the weapon or method utilized, and the specific attributes of the offense (Rondinelli, 2017:379).

In cases involving firearms, evidence typically recovered at the crime scene comprises cartridge cases, discharged bullets, and the firearms themselves. The recovered firearm can be subjected to examination to determine its operational status. Concurrently, bullets and cartridge cases may be analysed for rifling patterns, which yield vital information such as the calibre, ammunition type, manufacturer, and model of the firearm employed (Tomas, 2017:156). To maximise the evidentiary value of firearm-related materials, it is imperative to ensure proper identification, preservation, and packaging, alongside strict maintenance of the chain of custody from the crime scene to the courtroom.

This chapter addresses the study's second research question, which investigates the utilisation of firearm evidence in murder investigations. The discussion will cover essential aspects including the crime scene, the nature and classification of firearm evidence, protocols for evidence collection, the role of firearm evidence in murder inquiries, and the significance of crime scene reconstruction.

2.2 THE USE OF FIREARM EVIDENCE IN MURDER INVESTIGATIONS

Firearm evidence constitutes a pivotal component in the resolution of murder investigations by facilitating the identification of the weapon type employed, establishing connections between suspects and criminal acts, and reconstructing the events surrounding the offense. Principal categories of such evidence encompass bullets, cartridge casings, gunshot residue (GSR), and ballistic markings. Through

meticulous forensic examination, law enforcement agencies can associate firearms with specific crime scenes and individuals, thereby providing essential information for both investigative and prosecutorial processes.

The dependability of firearm evidence is largely contingent upon adherence to rigorous collection and preservation protocols. Investigators must exercise caution when handling bullets and casings to prevent contamination. Watkins et al. (2017:145) advocate for the use of gloves during the collection of these items, which should subsequently be stored separately in paper envelopes or plastic bags to mitigate the risk of damage or cross-contamination. Additionally, firearms are transported in secure containers to maintain the integrity of potential fingerprints, DNA, or other trace evidence.

Investigators at a crime scene record where cartridge cases land and where bullet damage appears, since these details help indicate the shooter's position and the path the projectile followed. Houck and Siegel (2015:172) note that tools such as laser trajectory systems and photogrammetry software are often used to recreate shooting events by analysing the angles of bullet impacts. A key part of analysing firearm evidence is forensic ballistics, which involves examining bullets and cartridge cases to see if they came from a particular gun. This process depends on microscopic assessment of striation marks; the distinctive patterns left on a bullet as it travels through a firearm's barrel.

The Integrated Ballistics Identification System allows forensic experts to match these marks with those stored in a national database of weapons linked to earlier offences (James et al., 2019: 212), helping investigators tie separate murder cases to the same firearm. Additionally, firearms leave unique firing pin impressions and extractor marks on cartridge cases, which examiners study under comparison microscopes Hill et al. (2024:31) explain that when these marks match those on a suspect's weapon, they can provide strong evidence linking the firearm to the offence.

Gunshot residue is made up of tiny particles from burnt gunpowder released when a gun is fired. These particles can land on the shooter's hands, clothing and nearby objects. Bertino (2020:229) notes that forensic analysts identify elements such as lead,

barium and antimony using scanning electron microscopes and specialised chemical tests. Although gunshot residue can indicate that a person recently discharged a firearm, it is not conclusive proof of involvement in a crime, as residue may transfer through contact with other surfaces or people. Thus, investigators treat residue results as supporting evidence rather than stand-alone proof (Harris, 2019:134).

In court, firearm-related findings are often presented to establish a connection between a suspect and a murder. Ballistics experts describe bullet paths, identify weapons, and interpret gunshot residue results. While courts generally regard ballistic evidence as dependable, defence lawyers may question it by scrutinising handling procedures or the qualifications of the expert giving testimony (Dempsey, 2017:190).

Technological developments, including 3D imaging and artificial intelligence tools, have boosted the accuracy of ballistics work. Even so, the reliability of the results depends heavily on investigators following proper forensic protocols (Gardner, 2016:98).

Henning and Smit (2016:98) highlight the critical role of firearm evidence in criminal investigations. They elucidate that distinctive markings, such as firing pin impressions, rifling patterns, and barrel imperfections, serve as unique identifiers that can assist in determining the specific weapon involved. Upon recovery of a firearm, test-firing enables the comparison of bullets and cartridge cases with those recovered from the crime scene. Girard (2016:260-261) further notes that cartridge cases can provide insights into the firearm type, distinguishing among automatic, semi-automatic, bolt-action, slide-action, or single-shot weapons. Firearm-related fatalities typically leave physical evidence on the victim's body, which aids investigators in reconstructing the weapon used and the circumstances surrounding the death (DiMaio and DiMaio, 2019:112).

Houck and Siegel (2015:169) emphasises the necessity of collecting firearm residue from the victim's body or hands prior to removal. Rondinelli (2017:169) elaborates that gunshot wounds can yield valuable information regarding the ammunition type, as well as the distance, angle, and trajectory of the shot. Entry and exit wounds are often distinguishable. For instance, ricocheted or tumbling bullets tend to produce irregular,

jagged openings, while bullets traversing the body may cause rough lacerations resembling knife wounds (Guyll et al. 2023:8). Additionally, high-velocity projectiles generate shock waves that damage adjacent tissues, and associated bone fractures can help map the bullet's path through the body (Robertson, Roux, and Tahtouh, (2021:204).

2.3 ROLE OF FORENSIC SCIENCE IN CRIMINAL INVESTIGATION

Forensic science refers to the use of scientific knowledge within the legal system, essentially applying scientific methods to resolve legal disputes (Thomas, 2017:58). Although it is often associated only with laboratory work, the discipline covers much broader activities that begin at a crime scene. It involves bringing scientific principles and discoveries into legal processes (Saferstein, 2024:98). In practice, forensic science is used far more frequently in criminal matters than in civil ones (Dawud and Abdulkadir, 2021:475). The branch of forensic science dedicated to analysing physical evidence in criminal cases is known as *criminalistics* (Houck and Siegel, 2015:35).

Criminalistics examines physical traces to connect individuals to objects or other people with whom they interacted. Beyond basic identification, forensic work can reveal important details such as chemical compositions, quantities of substances or the timeline of events surrounding an incident. Murder cases tend to be complex and unclear. According to Mlambo (2021:3), murders are often committed privately and without witnesses, which makes solving them difficult through investigative interviews alone. For this reason, physical evidence becomes central to uncovering what happened.

Overall, forensic evidence is vital in investigations and courtroom proceedings, as it supports both identifying a suspect and proving the alleged offence. Forensic science is primarily employed to investigate serious crimes such as murder, robbery, and assault. By studying evidence like fingerprints, blood, fibres, weapons, and hair, forensic specialists help reconstruct the events surrounding a criminal act (Saferstein, 2018:98). One of their major roles is linking individuals to criminal behaviour by comparing items recovered from a crime scene with those associated with a suspect. This may include DNA, gunshot residue, fingerprints, or chemical traces found on

personal belongings (Saferstein, 2024:87). When these pieces of evidence align with a suspect's known characteristics, forensic analysts can establish associations between them and the crime (Houck and Siegel, 2015: 35)

Another critical function of forensic science is determining what occurred during an incident, including the order of events. In murder cases, this may involve determining the time of death using post-mortem techniques or identifying chemicals that contributed to the cause of death (Lamb and Warton (2025:16). DNA analysis is one of the strongest tools available; it can be obtained from bodily fluids, skin cells, hair, or saliva, enabling investigators to identify individuals with high precision. (Rondinelli, 2017: 67). Fingerprints, which are unique to every person, serve a similar purpose and can link a suspect to specific objects or locations (Saferstein, 2018: 98).

Ballistics and Firearms Evidence are also crucial. Specialists study bullets, firing patterns, and gunshot residue to connect a person to a shooting and to rebuild the events of the incident (Houck and Siegel, 2015:35). Trace evidence, such as hair and fibres, can offer further clues, particularly when more direct forms of evidence are absent. Toxicology analysis, which looks at bodily fluids for drugs, alcohol, or poisons, can also clarify whether substances influenced the crime or contributed to the victim's death (Hill and Mofokeng, 2024:27).

In courtrooms, forensic evidence is especially valuable when eyewitness accounts are missing or questionable. Because it is rooted in scientific procedures, this type of evidence provides objective support that can either strengthen or challenge testimonies (Mbonambi and Olutola, 2024:12). DNA and fingerprints, for instance, can decisively confirm or rule out a suspect's involvement. Although detectives lead criminal investigations, they usually do not handle evidence collection. This task is performed by trained forensic personnel, including crime scene investigators (CSIs), forensic technicians, or specialists in specific areas such as ballistics or toxicology. These professionals follow rigorous procedures to preserve and analyse materials correctly, while detectives coordinate the investigation, conduct interviews, and collaborate with forensic experts (Van Rooyen, 2016: 89).

Overall, forensic science is indispensable in criminal investigations. It provides reliable, scientific evidence linking suspects to crimes and assists in reconstructing events, especially when eyewitness information is lacking. The accuracy and usefulness of this evidence depend on the expertise of the specialists who gather and analyse it, ensuring its reliability in court (Lamb and Warton (2025:18).

Researcher's Insight

From a professional perspective, the literature underscores a scientific ideal that is often challenged by operational realities within South African policing. While the role of forensic science is to provide objective links between suspects and scenes, its efficacy in a setting like Piet Retief depends heavily on the 'front-end' of the process: the first responders and detectives. The researcher observes that even the most advanced ballistic or DNA analysis (as described by Saferstein and Houck) is rendered moot if the initial preservation of the scene is compromised. Therefore, the role of forensic science is not merely a laboratory function but a continuous chain of professional integrity that begins the moment a murder is reported.

2.3.1 Significance of Forensic Science

Forensic science plays a crucial role in identifying offenders by examining physical traces such as DNA, fingerprints, fibres, hair, and firearms. Through these materials, forensic specialists can link an individual to a victim or a crime scene, which is especially important when eyewitnesses are absent or unreliable. For instance, DNA profiling offers highly accurate identification and is particularly valuable in violent or sexual offence cases (Rondinelli, 2017: 67).

Another significant contribution of forensic science is its ability to clear innocent people who were wrongly accused or convicted. By re-evaluating physical evidence, forensic experts can uncover information that contradicts earlier conclusions. The development of advanced techniques, especially DNA testing, has helped overturn convictions based on mistaken identity or flawed evidence (Mbonambi and Olutola, 2024:16)

Forensic science also strengthens the justice system by providing objective, scientifically tested evidence that supports or challenges claims in a criminal case. Its

objectivity ensures that court decisions rely on facts rather than speculation or bias. When no eyewitness accounts exist, evidence such as toxicology findings or ballistic patterns can help reconstruct what happened and clarify how a crime unfolded (Saferstein, 2024: 98).

In investigations, forensic science guides detectives by offering concrete details that can direct the inquiry. The scientific analysis of materials from a crime scene helps identify suspects, eliminate others, and reveal the tools or substances used during the offence. Trace materials such as fibres or gunshot residue may point investigators toward a suspect or generate new leads (Houck and Siegel, 2015:35).

Forensic science contributes to accurate legal processes by supplying verified scientific data that both defence and prosecution can rely on. It reduces uncertainty and supports fair decision-making. Techniques such as post-mortem interval analysis, for example, help determine the time of death in murder cases, which can be essential for understanding the sequence of events (Strydom, 2016: 234).

Thus, forensic science is crucial to the criminal justice system because it supports suspect identification, prevents wrongful convictions, strengthens investigations, upholds justice, and provides dependable scientific evidence. Without it, many cases would lack the solid foundation needed to reach fair and just conclusions (Strydom, 2016: 234)

Researcher's Insight

In the researcher's professional view, the significance of forensic science in the South African context, and specifically at the Piet Retief Police Station, cannot be overstated. In many local murder investigations, 'community silence' or the intimidation of witnesses often hinders traditional investigative methods. In such a climate, forensic evidence serves as an indispensable, impartial 'witness' that remains immune to fear or bias. Therefore, the significance of these scientific methods lies in their ability to provide the courts with objective facts that ensure the justice system remains functional even when human testimony fails.

2.3.2 Crime Tracing

Computer forensic science assists investigators in tracing a suspect's digital activity by examining devices such as computers, mobile phones, and email accounts. Each device that accesses the internet is assigned a unique Internet Protocol (IP) address. During an investigation, forensic specialists analyse server logs and network records to identify the IP address used by a suspect when visiting websites or committing online offences (Bertino, 2020:86).

By studying these logs, they can determine the approximate geographic area where the device was used and track the individual's movements across different online platforms. This is particularly important in cases involving hacking, online fraud, or unlawful downloads, where investigators can link the suspect to a specific internet service provider and timestamped activity (Bertino and Bertino, 2021:113). An IP address can reveal the geographical location or the internet service provider (ISP) used to access the network. This information is typically corroborated with additional digital evidence, including login timestamps, device identifiers, and the specific actions performed during the alleged offence (Saferstein, 2018:98).

Mobile phone forensics also plays a key role. When a device is confiscated, experts can extract communication data from its internal storage, Subscriber Identity Module (SIM) card, or cloud backups. When a mobile phone is seized, forensic analysts can extract data from the device's internal memory, SIM card, or associated cloud backups to retrieve communication records (Bertino and Bertino, 2021:144). This may include call logs, text messages, app-based conversations, and other metadata that support the reconstruction of user activity. This may include call logs, text messages, contacts, and other communication records. Even deleted logs and messages can be retrieved using specialist tools, helping investigators establish links between the suspect and other individuals involved in the crime (Watkins, 2018:67). Such information can confirm or disprove alibis and reveal communication patterns relevant to the investigation.

One of the critical functions of computer forensics is the recovery of deleted digital material. Items such as emails, browsing history, documents, and text messages often

remain on a device until overwritten. Using advanced recovery tools, investigators can reconstruct these files, even when a suspect tries to erase evidence (Fisher and Fisher, 2022:95). Software programmes such as EnCase or Forensic Toolkit (FTK) enable experts to recover hidden or deleted information, allowing them to piece together a suspect's digital behaviour (Houck and Siegel, 2015: 35). Through this process, investigators can track digital footprints, reconstruct online activity, and uncover incriminating communications.

Computer forensics is also valuable in murder investigations, especially when analysing call records and text messages. By examining timestamps, communication patterns, and location data, forensic analysts can determine whether a suspect contacted the victim before or at the time of the crime (Fisher and Fisher, 2022:209). Frequent communication near the time of the incident may suggest planning or intent (Van Rooyen, 2016:234). Text messages can reveal threats, arguments, or other information relevant to motive.

Communications sent shortly before or after the murder can provide insight into the suspect's mindset or actions (Du Plooy, 2016:89). Text messages shared between a suspect and a victim may include threats, planning information, or other revealing content that ties the suspect to the offence. For example, a message sent shortly before or after a killing can shed light on the suspect's mindset or actions around the time of the incident (Houck and Siegel, 2015:35).

Mobile phones also capture location data from calls and messages, either through Global Positioning System (GPS) signals or cell tower triangulation. If records show that the suspect's device was near the crime scene at the critical moment, this can place them in the area (Rondinelli, 2017:234). Investigators can match such digital traces with physical findings to build a stronger case. Where texts or call logs include threats or admissions, they may help establish motive. For instance, a string of messages expressing hostility or issuing threats shortly before the offence can demonstrate the suspect's intent to harm the victim, directly connecting their communications to the crime (Schwikkard and Van der Merwe, 2016: 67).

In murder cases, computer forensics plays a vital role in recovering call logs, text messages, and other digital records that may directly connect a suspect to the offence. Through the lens of Locard's Exchange Principle (see Section 2.4 for details), every digital interaction leaves a trace (whether metadata, message content, or location information) that can link a suspect to a victim or a crime scene. By analysing communication patterns, timestamps, and device data, forensic analysts can uncover interactions that complement physical trace evidence, reinforcing connections between people, objects, and locations. This integration of digital and material evidence strengthens the evidential chain and provides a more comprehensive reconstruction of the crime.

Researcher's Insight

In the researcher's professional experience, while the literature focuses on advanced recovery tools like EnCase, the practical application at a local station like Piet Retief often faces unique hurdles. For instance, the station's proximity to the Eswatini border means that suspects may switch between different network service providers, complicating cell tower triangulation and IP tracing. Furthermore, while the 'ideal' forensic process (as described by Fisher and Fisher) suggests immediate digital extraction, the reality often involves significant delays while devices are transported to provincial hubs for analysis. Therefore, the significance of digital traces at Piet Retief lies in the investigator's ability to secure the device immediately to prevent remote wiping before it reaches a specialist laboratory.

2.4 THEORETICAL FRAMEWORK

This research is guided by Locard's Exchange Principle, a cornerstone of forensic science first articulated by Dr Edmond Locard in the early 1900s. The principle posits that "every contact leaves a trace," indicating that whenever two objects or individuals interact, there is an inevitable transfer of material between them (Saferstein, 2024:96). Put simply, anyone entering or leaving a crime scene leaves behind some form of trace evidence, which may include fibres, hair, skin cells, or other microscopic particles (Mistek et al., 2018:643).

In the context of criminal investigations, this principle underlies the scientific rationale for linking suspects, victims, and crime scenes, thereby enabling the reconstruction of criminal events. For this study, which investigates how firearm evidence is used in murder cases, Locard's principle provides a conceptual framework for interpreting both the scientific significance of trace evidence and the practical responsibilities of investigators in its collection, preservation, and analysis.

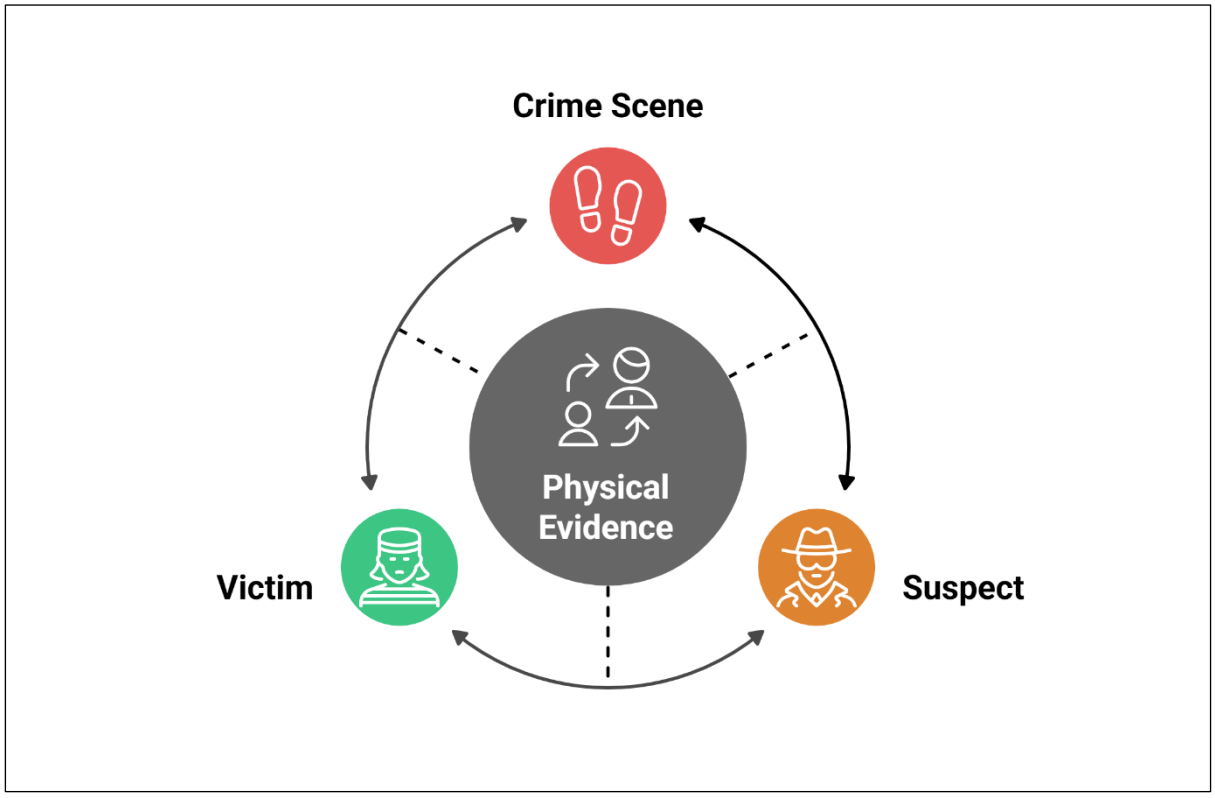

Figure 2.1 Locard's Exchange Principle

2.4.1 Fundamental Principles and Tenets

At its core, Locard's Exchange Principle rests on the notion that contact between two entities inevitably results in the **exchange of trace materials**. This concept has evolved into several key tenets that guide forensic practice:

1. **Mutual Transfer**

   When an interaction occurs between a person and an object, or between two objects, each transfers material to the other. In firearm-related incidents, this

may involve GSR on a shooter's hands, unique ballistic markings on spent cartridges, or trace blood on a weapon's surface (Robertson et al., 2021:309).

2. **Uniqueness of Traces**

   The exchanged material carries characteristics unique to its source, allowing forensic experts to identify or compare items (e.g., matching bullets to a particular firearm barrel through striation patterns) (Lee et al., 2016: 93).

3. **Persistence and Detectability**

   Although traces may be microscopic or transient, they persist long enough to be recovered and analysed scientifically. Their detectability depends on investigative diligence, environmental conditions, and laboratory capabilities (Hazelwood and Burgess, 2016: 202).

4. **Chain of Custody Integrity**

   The evidential value of trace evidence relies on its preservation and proper documentation from recovery to presentation in court. Breaks in this chain compromise admissibility and probative strength (Houck and Siegel, 2009).

These tenets collectively underscore that forensic success depends on careful recognition, recovery, and preservation of trace evidence. Lapses such as contamination, poor scene management, or delayed submission to the laboratory compromise investigative outcomes.

2.4.2 Application and Relevance to Firearm Evidence

Firearm evidence provides a particularly vivid illustration of Locard's principle in action. When a firearm is discharged:

- The shooter leaves fingerprints, sweat, and biological residues on the weapon.
- The firearm leaves ballistic impressions on the projectile and cartridge casing.

- Combustion gases deposit gunshot residue on nearby surfaces and clothing (Watkins, 2018:23).

Each of these exchanges creates potential links between the suspect, the weapon, the victim, and the crime scene. Accurate identification and interpretation of such traces are crucial to reconstructing the sequence of events and establishing criminal responsibility.

In this study, participants' reflections on collecting and analysing firearm evidence, such as experiences with contaminated scenes, missing exhibits, or delayed forensic reports, are interpreted through the lens of Locard's principle. Their narratives reveal how practical realities, including limited resources, inadequate training, and poor inter-agency coordination, often disrupt the ideal of continuous trace exchange. Thus, the principle provides a framework for contrasting the scientific ideal of trace transfer with the lived realities of forensic investigation.

2.4.3 Locard's Principle as an Interpretive Lens in a Phenomenological Study

Although Locard's principle originated as a scientific theory, it also holds interpretive value in qualitative research. In a phenomenological context, the principle is not used to test hypotheses but to illuminate meaning, to understand how investigators experience the process of preserving traces. Through this lens, the study examines:

- How practitioners conceptualise the importance of firearm evidence.
- How they perceive and respond to risks of losing or contaminating traces.
- How institutional procedures support or hinder the realisation of forensic ideals.

By anchoring participants' perceptions in a well-established forensic theory, the study ensures that qualitative findings remain scientifically and conceptually grounded.

2.4.4 Relevance to the Current Study

The relevance of Locard's Exchange Principle can be summarised in three dimensions:

1. **Conceptual Relevance:** It provides the scientific justification for examining firearm evidence as a critical investigative tool, clarifying why the recovery of ballistic and trace materials is central to murder investigations (Mistek et al, 2018:645).
2. **Analytical Relevance:** It serves as a lens for interpreting participants' experiences, highlighting where and why the theoretical ideal of "every contact leaves a trace" fails in practice, such as through poor evidence handling or delayed laboratory analysis (Saferstein, 2024:91).

3. **Practical Relevance:** It informs policy and procedural recommendations, identifying areas for training, capacity building, and procedural reform within law enforcement agencies to improve the handling and utilisation of firearm evidence (Robertson et al., 2021:317).

Through these dimensions, Locard's Exchange Principle bridges theory and practice, connecting micro-level actions of investigators to broader forensic standards and institutional outcomes.

In summary, Locard's Exchange Principle provides the theoretical backbone for this study. It articulates the scientific expectation that every physical interaction leaves recoverable traces, while the phenomenological design allows exploration of how this expectation is experienced and understood by investigators. The principle's enduring relevance lies in its ability to connect scientific objectivity with human practice, making it a coherent framework for evaluating the lived realities of firearm evidence management in murder investigations at Piet Retief Police Station.

2.5 SUSPECT IDENTIFICATION

Criminals usually leave some form of physical trace at a crime scene, whether fingerprints, DNA, or other biological or material evidence. By examining these traces, forensic experts can accurately determine who was involved in the offence (Saferstein, 2018: 98).

2.5.1 Linking of Crimes to the Suspects

Linking crimes to a suspect involves examining trace evidence, minute particles or materials that can be transferred between people, objects, or locations during interactions. These tiny remnants are crucial in forensic investigations as they can connect a suspect, a victim, and a crime scene. Trace evidence can take various forms, such as fibres, hair, soil, paint, glass, gunshot residue, and bodily fluids (Saferstein, 2018:233).

These small particles, which may be transferred during human contact, environmental exposure, or the handling of objects involved in a crime, are essential in linking individuals to criminal activity. Common examples include fibres, hairs, glass shards, and paint chips. By analysing these materials, forensic scientists can establish associations between people and crime scenes, thereby providing substantial support for investigations (Houck and Siegel, 2015:35).

Materials such as fibres, paint, glass, and gunshot residue are central to criminal investigations because they are frequently exchanged during the commission of a crime. The careful examination of trace evidence can link a suspect directly to a crime scene or provide important clues about how the crime occurred. Advanced laboratory techniques, including microscopy and chemical analysis, are often required for the proper evaluation of such evidence (Saferstein, 2018:98).

According to Fisher and Fisher (2022:145), trace evidence plays a vital role in establishing a link between a criminal act and the individual responsible. Because these particles are microscopic, they can be unintentionally transferred across surfaces, and evidence collected from crime scenes can offer critical leads for investigators. During the commission of a crime, trace evidence may be exchanged between people, objects, and the surrounding environment. This concept is explained by the Locard principle, formulated by Dr. Edmond Locard, who stated that there will be a material exchange when two objects come into contact.

2.6 DETERMINING THE CAUSE AND MANNER OF DEATH

Forensic science plays a critical role in determining both the manner and cause of death, primarily through the conduct of autopsies or post-mortem examinations. During these procedures, forensic pathologists perform detailed analyses of the deceased's body, seeking evidence of trauma, disease, toxic substances, or other contributory factors (Saferstein, 2024:125). To enhance the comprehensiveness of such investigations, forensic pathologists frequently collaborate with specialists such as anthropologists and entomologists, whose expertise provides valuable insights into specific elements of the case.

Forensic anthropologists are especially indispensable when dealing with remains that are decomposed, charred, or reduced to skeletal form. Their proficiency in osteological analysis enables them to ascertain critical information about the decedent, including identity, age, sex, ancestry, and stature (Robertson et al., 2021:175). Moreover, they can identify skeletal trauma indicative of the cause of death, such as injuries inflicted by blunt or sharp instruments. Therefore, anthropologists are vital in cases where the body is significantly decomposed or lacks distinguishing soft tissue features. They can also contribute to estimating the post-mortem interval through examination of bone condition.

The integration of anthropological and entomological expertise in death investigations aims to ensure a meticulous and accurate interpretation of all relevant evidence. Forensic pathologists may not possess the specialised knowledge required to analyse certain types of evidence, such as skeletal remains or insect activity (Girard, 2016:152). Consequently, interdisciplinary collaboration facilitates a more holistic understanding of the circumstances surrounding death, which is essential for law enforcement agencies in resolving cases. Forensic science, therefore, relies on the combined efforts of pathologists, anthropologists, and entomologists to elucidate the cause and manner of death, particularly in complex or challenging scenarios (Saferstein, 2018:138, 365).

2.6.1 Identifying Alcohol Components

Forensic science can analyse biological tissues to identify the presence of narcotics, as well as determine the quantities of these substances and their metabolites (Palmiotto, 2017: 154). This process is usually carried out by examining biological samples such as blood, urine, or other materials collected from the suspect. In some cases, biological materials like saliva or sweat may be gathered at the scene of a crime if there is a suspicion that the individual left behind traces of narcotics during the commission of the offence (Rondinelli, 2017:249). However, these types of samples are less commonly used for drug testing than those collected later.

The most typical time for gathering biological samples for narcotic testing is when a suspect is arrested. During this time, law enforcement may obtain a search warrant to collect blood, urine, or other samples for forensic analysis (Schwikkard and Van der Merwe, 2016:272). At this stage, officers may apply for a warrant to gather bodily samples, such as blood or urine, for forensic testing. In specific legal systems, suspects may voluntarily provide these samples. However, in other jurisdictions, their collection may require either a court order or the individual's clear and informed consent (Saunsbury and Doherty, 2016:132).

Following an arrest, suspects are usually transported to a medical facility or forensic laboratory. Trained professionals can properly collect blood, urine, and other relevant biological samples from the accused (Watkins, 2018:92). For example, urine testing is frequently employed in investigations involving suspected drug impairment. This is common in cases where the individual is believed to have been under the influence of narcotics while committing an offence, such as impaired driving (Robertson, 2021:183). Blood samples, on the other hand, are often collected when it is necessary to determine the exact concentration of narcotics or their metabolites in the body, which helps establish the level of intoxication or confirm drug use at the time the crime was committed (Rondinelli, 2017:152).

Blood tests are especially valuable for measuring the precise number of drugs present in the body at a given moment. Forensic toxicologists examine the blood to detect specific substances. These include heroin or methamphetamine, along with their

metabolites, which are the byproducts produced when the body metabolises these drugs (Orthmann and Hess, 2017:269). While urine tests can also detect drugs, metabolites often remain detectable in urine for longer than in blood (Harris and Lee, 2019:73). This makes urine testing particularly useful for identifying both recent drug use and longer-term or chronic use.

Following an arrest or during post-arrest procedures, biological specimens (including blood, urine, and other tissues) are obtained from the suspect. These samples are analysed to detect the presence of narcotics and their metabolites, and to determine their concentrations (Palmiotto, 2017:285). These compounds provide essential evidence to support both criminal investigations and subsequent legal proceedings.

2.6.2 Establishing the Guilt or Innocence of Possible Suspects

In the absence of eyewitness accounts, it is challenging to prove that a suspect was involved in a crime to the level of certainty required by law. Fingerprint analysis is a key forensic method that helps confirm whether a suspect was present at a crime scene (Houck and Siegel, 2015:218). Since each person's fingerprints are unique, even partial impressions found at a crime scene can be instrumental in identifying the suspect (James, et al., 2019:172). Experts compare these prints with those of the suspect to determine if they match, which can indicate that the individual had contact with objects at the scene.

As previously mentioned, trace evidence such as fibres, hairs, soil, glass, and gunshot residue can be transferred between a suspect and a crime scene during the commission of a crime (Hazelwood and Burgess, 2016:274). The presence of such evidence on a suspect can show a clear link to the scene. For example, fibres from a victim's clothing found on the suspect's clothing, or hair found on the victim's body, can serve as important evidence of the suspect's involvement. Similarly, gunshot residue found on a suspect's hands could suggest that they fired a weapon, thus connecting them to a shooting incident (Saferstein, 2018:245).

When eyewitness testimony is not available, forensic science is essential in determining whether a suspect is guilty or not guilty. Techniques such as DNA

profiling, fingerprint analysis, trace evidence examination, and toxicological testing allow forensic professionals to link a suspect to the crime scene or to the victim, or alternatively, to rule them out (Marais, 2016:73). These scientific methods are fundamental to the justice system, as they offer trustworthy evidence that can support or challenge the arguments made by the prosecution or the defence (Saferstein, 2018:200).

2.6.3 Narrowing the Range of Possible Suspects

Forensic evidence, especially DNA analysis, is crucial in connecting different criminal acts and helping investigators reduce the number of possible suspects. DNA analysis can be used to identify individuals involved in multiple crime scenes, even when there is no direct eyewitness report or physical evidence linking the suspect to the crime. As Saferstein (2018:365) notes, DNA collected from crime scenes (such as blood, hair, or semen) can be tested to either match a known person or to compare with DNA profiles from other crime scenes. This process allows investigators to determine whether the same person or group is responsible for several offences.

In some instances, a single piece of forensic evidence can link several crimes, reveal patterns, or indicate the presence of a serial offender (Van Rooyen, 2016:190). This allows investigators to focus on a more limited set of suspects. By comparing analogous DNA evidence from multiple crime scenes, investigators can determine whether the same person or group committed a series of crimes. The use of DNA databases enables comparison of crime scene samples with profiles of known offenders, significantly reducing the number of potential suspects (Watkins, 2018:142). Consequently, forensic evidence provides essential support to prosecutors by establishing an objective connection between a suspect and the crime. This strengthens legal cases and aiding investigators in refining the suspect pool for identification and prosecution.

The linkage of crimes through forensic evidence, especially DNA, enables investigators to reduce the number of potential suspects by identifying those accountable for a sequence of related offenses (Schwikkard and Van der Merwe, 2016:114). DNA evidence can directly link a primary suspect to multiple crime scenes,

assisting in identifying individuals responsible for patterns of criminal behaviour. When a suspect's DNA corresponds with samples collected from multiple crime scenes, it constitutes compelling evidence that the same individual committed all connected offenses (Rondinelli, 2017:29).

Van Rooyen (2016:380) asserts that linking crimes via forensic evidence can reveal patterns of offenses committed by the same individual over time. This is particularly pertinent in cases involving serial offenders, such as serial rapists or murderers. For example, DNA collected from multiple crime scenes can indicate the presence of a serial offender, even in the absence of eyewitness accounts or apparent connections between the incidents at the outset. Furthermore, forensic evidence enables investigators to exclude individuals whose DNA does not match the samples, thereby helping eliminate persons not involved in the crimes (Orthmann and Hess, 2017:213). This process allows law enforcement to concentrate on the most probable suspects, reducing the likelihood of wrongful accusations or prosecutions.

2.7 PHYSICAL EVIDENCE

This section provides a critical analysis of the function and application of firearm evidence within murder investigations. The study investigates multiple dimensions, including the characteristics of the crime scene, the classification and nature of firearm evidence, standardised procedures for its collection, its role in murder investigations, and the significance of reconstructing the crime scene.

2.7.1 Concept and Nature of Physical Evidence

Criminal activities invariably involve physical actions, which frequently result in the perpetrator either leaving behind or removing items at the crime scene that may establish a link to the offense (Thomas (2017:5-6). The cited scholar defines physical evidence as tangible, concrete material that is perceptible and identifiable, manifesting in forms such as liquids, objects, prints, or instruments. Such evidence can be quantified, documented photographically, analysed scientifically, and subsequently introduced in court as material proof (Rondinelli, 2017:134).

In a similar vein, Bertino and Bertino (2021:109) describes physical evidence as concrete objects admissible in judicial proceedings to corroborate or refute factual assertions, citing examples such as firearms, fingerprints, bloodstains, and fibre evidence. Rondinelli (2017:83) concurs, characterising physical evidence as tangible items retrieved from crime scenes for purposes of examination, analysis, and presentation in legal contexts. Van Rooyen (2016:110) further elaborates that real evidence consists of objects presented in court that can be perceived through the senses, including sight, touch, and even taste. Strydom (2016:380) emphasises that once such objects are identified, they inherently constitute evidence and thus require meticulous preservation by investigative personnel.

Additionally, Van Rooyen (2016:83) observes that physical evidence is not always discernible to the unaided eye; certain types necessitate instrumental techniques for visualization. Crucially, physical evidence is considered inherently reliable due to its tangible, objective nature. Nevertheless, its evidentiary value depends on investigators' ability to accurately identify, collect, and analyse it. Fisher and Fisher (2022:83) further notes that physical evidence establishes an objective factual framework that informs investigative processes and may significantly influence determinations of guilt or innocence.

According to the United Nations Office on Drugs and Crime (UNODC, 2024:4), physical evidence encompasses a wide array of items, ranging from macroscopic objects to microscopic particles generated during the commission of a crime and subsequently recovered at the scene. It is deemed indispensable among sources of investigative information, as alternative sources often face credibility issues. When properly identified and managed, physical evidence provides the most reliable and impartial information concerning the criminal event under investigation (Gardner, 2016: 247).

2.7.2 Types and Classification of Physical Evidence

The foundational concept of physical evidence is central to forensic science and criminal justice. It provides the empirical basis upon which investigative conclusions are formed. Bertinon and Bertino (2021:72) formalise this category as demonstrative

evidence, defining it as any object that can be directly perceived by a trier of fact through the human senses.

In practice, physical evidence includes all material items found at a crime scene—ranging from large objects to microscopic traces, such as a single blood droplet. These items hold the potential to establish a material link between the suspect, the victim, and the commission of the offence Harris and Lee (2019:302). Physical evidence differs from testimonial evidence, which relies on verbal accounts. Instead, it consists of tangible objects that yield demonstrable and objective information pertinent to the criminal act (Rondinelli, 2017:26).

The scope of physical evidence is extensive. Houck and Siegel (2015:10) list examples such as documents, hair, blood, fibres, and fingerprints. Bertino (2021:22) and Lyle (2012:23–24) expand this range to include narcotics, paint, glass, tool marks, and impressions. Lee et al. (2015:341) provide a systematic classification of these materials into categories such as trace evidence, biological evidence, and pattern evidence. Pattern evidence is especially important in forensic practice. It is produced through physical contact or mechanical force and results in characteristic impressions or markings (Palmiotto, 2017:244). This category includes fingerprints, questioned documents, tool marks, and weapon-related evidence.

Weapon evidence, which includes firearms, projectiles, and cartridge cases, is critical in murder investigations. These items provide more than intrinsic evidentiary value. They can reveal the sequence of events, indicate firearm operation, assist in determining shooter positioning, and help assess the plausibility of testimonial accounts (Robertson, 2021:248).

Additionally, Bertino (2021:22) observes that, aside from fingerprints, most physical evidence functions primarily to narrow the suspect pool to a more specific subset. Hammond and Wellington (2017:124) differentiate physical evidence as either direct or indirect and define it as any tangible substance that aids in establishing case facts. Such evidence may vary in size and physical state (solid, semi-solid, or liquid) and can be visible, tactile, concealed, or even subject to gustatory examination (Saferstein,

2014:137). It may be located on a suspect or victim or found at a considerable distance from the crime scene.

Since the present study focused specifically on murder investigations, the analysis centres on the operational and forensic utility of firearm-related materials. These forms of physical evidence are critical for reconstructing events involving lethal force and for substantiating the factual accuracy of case narratives.

2.7.3 Importance and Evidentiary Value of Physical Evidence

The probative value of physical evidence is heavily contingent upon its handling immediately after the crime's commission Henning and Smit (2016:1–4). The cited scholars argue that physical evidence is often more reliable than eyewitness testimony. Improper collection and preservation render evidence vulnerable to contamination, degradation, or loss, particularly at unsecured crime scenes. The importance of physical evidence lies in its capacity to clarify the manner, timing, and perpetrator of a crime (Orthman and Hess, 2013:128–129). Saferstein (2018:20) highlights numerous criminal cases marked by wrongful accusations and convictions. These are frequently exacerbated by false confessions and inaccurate eyewitness accounts. Nevertheless, physical evidence enables investigators to establish facts objectively, thereby reducing the likelihood of such errors.

Physical evidence constitutes objective information that is inherently accurate and resistant to fabrication or omission; however, misinterpretations may arise during analysis, and human limitations in detection and evaluation can diminish its evidentiary value (Marais, 2016:6). Schwikkard and Van der Merwe (2016:395) define real evidence as tangible items examined by the court as forms of proof, which, upon proper identification, independently attain evidentiary status. Examples include weapons such as knives or photographs introduced in prosecutions involving crimes against individuals.

2.7.4 Biological and DNA Evidence in Investigations

DNA profiling is widely regarded as one of the most effective forensic methodologies and represents a revolutionary advancement in criminal investigations (Hazelwood

and Burgess, 2016:142; Lee et al., 2016:362). DNA is present in biological materials such as blood, semen, hair, and skin, thereby enabling the scientific and objective verification of physical evidence through DNA analysis.

In cases of sexual assault, reliable physical evidence may consist of stains or torn clothing, abrasions, bruises, and lacerations indicative of a struggle, as well as semen and blood stains (Hazelwood and Burgess, 2016:153). When a suspect is apprehended, photographic documentation should be conducted to record any physical or DNA-related evidence linking the suspect, victim, or crime scene. Where possible, biological samples, including blood, should undergo thorough laboratory testing to detect the presence of drugs or intoxicants (DiMaio and DiMaio, 2019:277).

2.7.5 Crime Scene Preservation and Evidence Management

The preservation and meticulous management of the murder locus delicti (crime scene) form a critical stage in the investigative process. These early actions directly determine the integrity and admissibility of forensic evidence that follows. Maintaining the scene's integrity ensures that critical exhibits, such as DNA, blood spatter, fingerprints, and weapon residues, are safeguarded for laboratory analysis (Osterburg and Ward, 2015:92). The literature consistently emphasises that contamination, misinterpretation, or improper handling of the site can lead to irreversible loss. Such loss not only weakens the evidentiary foundation of the investigation but can also compromise the credibility of the entire judicial process (Saferstein, 2018:200). Preserving the crime scene in the condition in which it was first encountered is therefore essential. This enables investigators to reconstruct events accurately, which is indispensable for corroborating investigative theories.

Murder scenes typically yield a wide range of exhibits. The nature and variety of these depend on the modality of the offence (Marais, 2016:55). Common forms of biological evidence include blood and other bodily fluids. Blood spatter patterns can offer insights into the sequence and mechanism of injury, while saliva or semen may contain DNA. Weapon evidence, such as firearms, knives, blunt instruments, or improvised weapons, is frequently recovered (Rondinelli, 2017:124). Pattern evidence, including fingerprints on weapons or surfaces, assists in identifying persons involved. Clothing

and personal effects near the victim often carry trace materials such as hair, fibres, or gunshot residue (GSR). Even seemingly insignificant items, such as discarded packaging or cigarette ends, may contain latent fingerprints or DNA and can carry significant investigative value.

To maintain the continuity and integrity of the evidence chain, access to the crime scene must be strictly controlled. Only authorised personnel may enter, a necessity underscored by Fisher and Fisher (2022:148). Unauthorised individuals, including bystanders, curious onlookers, and media representatives, must be excluded to prevent contamination or the accidental destruction of exhibits. Investigators must follow established preservation protocols. This entails setting up a secure perimeter and avoiding any disturbance of potential evidence unless required for safety or urgent collection (Saferstein, 2018:98).

Comprehensive photographic documentation must be undertaken before any item is moved or altered. This includes wide-angle shots, mid-range photographs, and close-ups that capture the spatial relationships and contextual details of the scene. These photographs create a permanent visual archive that can be revisited throughout the investigative and judicial process (Saferstein, 2018:96).

Alongside physical evidence management, investigators must identify and initially interview witnesses. These may include individuals who last saw the victim, those who observed unusual activity, or those present in the vicinity at the time of the incident (Saferstein, 2018:99). Such early accounts help contextualise the physical evidence and guide subsequent investigative steps.

Ultimately, the reliability of a murder investigation depends heavily on the methodological rigour applied during crime scene preservation and evidence management. This is especially true for firearm evidence, which is highly sensitive to contamination and environmental disturbance (Saunsbury and Doherty, 2016:204). Strict adherence to established protocols ensures the forensic usefulness of ballistics, GSR, and projectile evidence and strengthens the evidentiary link between the firearm, the offender, and the offence. This procedural precision is essential in supporting the successful resolution of the case.

2.7.6 Individualisation in Forensic Science

In forensic science, individualisation is a foundational concept that underpins the ability to link evidence to a specific source. Saferstein (2024:98) defines it as the process of identifying unique characteristics that distinguish an object, a piece of evidence, or an individual. Through this process, investigators can move beyond general associations to establish definitive connections between a suspect and a crime scene (Van Rooyen, 2016:182). This progression is crucial for the integrity of the investigative and judicial process.

A common example of individualisation is DNA profiling. By analysing distinct genetic markers, forensic scientists can match a sample obtained from a crime scene to a specific individual (Rao et al., 2020:14). Fingerprinting is another widely recognised method, relying on the distinctive patterns present on a person's fingertips to establish identity. Toolmark identification also exemplifies individualisation. It helps investigators to link a particular weapon or implement to a crime by comparing the unique impressions or marks it leaves behind (Watkins et al., 2017:94).

Collectively, these techniques demonstrate how individualisation operates as the cornerstone of forensic identification. By isolating unique characteristics in physical evidence, investigators can definitively connect a person to a crime scene. This strengthens both investigative accuracy and evidentiary credibility.

2.8 CHAPTER SUMMARY

This chapter explored the significance of firearm evidence in murder investigations. Firearms continue to account for a substantial proportion of murders in contemporary society, making their proper handling and analysis a central concern for forensic practitioners. At crime scenes involving firearms, investigators frequently encounter a range of firearm-related evidence, including the weapons themselves, cartridge cases, and discharged bullets. This type of evidence is highly distinctive. Like fingerprints, which are unique to everyone, no two firearms produce identical markings on fired bullets or cartridge cases, enabling precise attribution of evidence to a particular weapon.

Firearm evidence is a critical category of forensic material because it provides insights that can directly support the resolution of a case. At a shooting scene, investigators can determine the number of shots fired, the trajectory of projectiles, and the specific type of ammunition and firearm used. Careful, methodical examination of the scene is essential to reconstruct events accurately. This includes precise documentation of the locations of cartridge cases, bullets, the firearm, and the victim before any evidence is collected. Forensic analysis can then establish the type of weapon involved, the distance between the shooter and the victim, the operational status of the firearm, and, in some cases, the identity of the assailant. The impact of a bullet on a target varies depending on multiple factors, particularly the composition of the target material, which can provide additional investigative insights.

A fundamental role of firearm evidence is its ability to narrow the search for the weapon used in a crime. Investigators aim to determine whether a particular firearm discharged the projectiles recovered. This determination relies on detailed comparison of cartridge cases, ammunition, bullets, gunshot residue, and any wound or bullet damage characteristics. By comparing recovered cartridges and bullets with those stored in the Integrated Ballistic Identification System (IBIS) database, investigators can identify links to other crimes, potentially spanning extended periods.

Firearm evidence is predominantly employed in criminal proceedings, reinforcing the enduring importance of ballistics within forensic science. Its meticulous collection, preservation, and analysis are therefore essential not only for establishing the facts of a case but also for ensuring that justice is served. The subsequent chapter, Chapter 3, focuses on the legislative framework regulating firearms in South Africa.

CHAPTER 3

FIREARM LEGISLATIVE FRAMEWORK IN SOUTH AFRICA

3.1 INTRODUCTION

This section provides the foundational context for understanding South Africa's crime landscape by examining the historical, social, and institutional factors that have shaped current patterns of violence. Situating the discussion within the broader political transition from apartheid to democracy allows for a clearer appreciation of how structural inequalities, weakened social controls, and institutional reform have influenced criminal activity. At the same time, this chapter highlights why an analysis of firearm regulation is essential, given the widespread availability of weapons and their central role in violent crime across the country. By outlining these interconnected dynamics, the section establishes a critical framework for evaluating South Africa's firearm control measures and understanding the broader challenges faced by law enforcement, policymakers, and communities in addressing violent crime.

3.1.1 Socioeconomic, Political and Institutional Drivers of Crime

A considerable body of research has examined the underlying drivers of South Africa's persistently high crime rates, highlighting a constellation of interrelated social, economic, and institutional factors. Mutsavi and Meintjes-van der Walt (2020:33) contend that the surge in criminal activity is closely associated with the country's transition to democracy. While this transition marked a decisive shift away from apartheid and ushered in political freedoms, it also exposed deep structural vulnerabilities Reyneke (2017:52).

Many entrenched economic inequalities remained intact, with large segments of the black population continuing to live in poverty. This ongoing socioeconomic marginalisation created frustration. As Harris and Lee (2019:33) suggest, these conditions contributed to heightened involvement in criminal behaviour. Simultaneously, the erosion of traditional community structures and the rapid pace of urbanisation weakened social controls, placing vulnerable populations at greater risk of criminal engagement (Van Rooyen, 2016:110).

Reforms within the policing sector, previously used as a tool of oppression under apartheid, introduced transitional inefficiencies that further undermined public confidence. Girard (2016:33) argues that reduced trust in law enforcement, coupled with limited institutional capacity during the reform period, created opportunities for criminal networks to expand. High youth unemployment, coupled with the legacy of political violence and urban migration into overcrowded cities, intensified the conditions conducive to crime (Reyneke, 2017:86). Overall, while the transition to democracy advanced human rights and political freedom, it also magnified existing social and institutional weaknesses, thereby contributing to rising crime rates.

3.1.2 Culture of Violence and the Role of Firearms

Researchers further emphasise that the democratic transition disrupted established mechanisms of social and law enforcement control. Hazelwood and Burgess (2016:33) assert that this shift created opportunities for criminal activity to flourish during a period of institutional reconfiguration. Public distrust of law enforcement persisted, reducing community cooperation and limiting crime reporting.

The broader culture of violence that characterises South African society also plays a substantial role. Girard (2016:36) notes that political history has weakened family structures and parental authority, increasing youth involvement in crime. Saunsbury and Doherty (2016:78) argue that violent responses have become normalised within domestic and social environments. Dempsey (2017:58) adds that violence is frequently used to resolve conflicts across personal and workplace contexts. These tendencies are exacerbated by weaknesses in the criminal justice system and the widespread availability of firearms.

Firearms, both legally owned and illicitly acquired, are central to a wide range of violent crimes. Girard (2016:5) cites the observation of a firearm tracing unit superintendent, noting that most weapons entering the illegal market originate from theft and loss by licensed owners, including police, military personnel, and civilians. Dempsey (2017:37) argues that robust national legislation is essential for limiting the diversion of legal firearms into illicit circulation.

3.2 REGULATORY AND CONTINENTAL CHALLENGES

The Firearms Control Act (Act 60 of 2000) was implemented to regulate legal firearms and reduce their proliferation. While aligned with constitutional rights, the success of this legislation depends substantially on effective implementation (Rondinelli, 2017:1). Across Africa, many countries lack adequate policy frameworks to track and control firearm movement, with some still relying on manual registries that impede timely tracing (Reyneke, 2017:210).

On the other hand, Saferstein (2024:132) warns that the easy availability of weapons contributes to widespread violations of international law. Dempsey, (2017:37) echoes Kofi Annan's warning that while inter-state conflicts have decreased, deaths from civil wars and genocidal acts have increased, worsened by widespread access to small arms.

Underreporting of lost or stolen firearms, often due to the legal consequences of negligence, further compromises the reliability of firearm databases (Girard, 2016:16). These gaps highlight weaknesses in regulatory systems that must be assessed and improved in line with international standards.

3.3 REGIONAL REGULATORY FRAMEWORK ON FIREARMS

South Africa's firearm regulatory system operates within a broader regional and international environment shaped by agreements, protocols, and cooperative security commitments. These frameworks aim to curb the proliferation of small arms, harmonise standards across countries, and strengthen national-level controls (Lamb, 2018:34). Understanding this wider context is essential for assessing South Africa's legislative approach and the challenges that accompany firearm governance.

3.3.1 International and Regional Instruments Shaping Firearm Control

The 2001 United Nations Programme of Action on Small Arms obliges signatory states to adopt comprehensive measures to control small arms and light weapons (UN, 2001:4). These include secure storage, destruction of surplus weapons, proper marking and tracing mechanisms, detailed record-keeping, and strict oversight of

manufacturing, sales, brokering, and exports. The core aim is to prevent firearms from reaching unauthorized users (Amnesty International, 2005:57).

Within the Southern African region, Article 7 of the SADC Protocol on the Control of Firearms, Ammunition, and Other Related Materials requires member states to review their licensing frameworks and establish electronic national databases (SADC, 2001:26). The article emphasises that details capturing all licensed firearms, their owners, and commercial dealers must be captured. Article 5 further mandates restrictions on civilian possession of light weapons (Gardner, 2016:11). This should be done through centralised registration systems, competency evaluations, storage regulations, and limitations on the transfer and use of firearms and ammunition (Saferstein, 2018:96).

South Africa has also endorsed the Bamako Declaration, which promotes coordinated African responses to the illicit spread of small arms. Paragraph 3A calls for binding agreements to strengthen cooperation at regional and continental levels (OAU, 2000:50). In 2003, the South African Parliament formally adopted the SADC policy on controlling small arms and preventing cross-border crime (SADC, 2001:42), enabling the SAPS to participate in regional enforcement operations.

3.3.2 National Crime and Security Frameworks

The rise in crime levels over recent decades prompted the South African Government to adopt several national strategies aimed at enhancing public safety. Key initiatives include the National Crime Prevention Strategy (1996), the National Crime Combating Strategies (1996 and 1998), the 1998 White Paper on Safety and Security, the Integrated Justice System, and the enactment and later amendment of the National Prosecuting Authority Act 32 of 1998 (Mutsavi and Meintjes-van der Walt, 2020:4). Together, these efforts reflect a comprehensive governmental response to crime, including offenses involving firearms.

Most firearm-related crimes fall under statutory law passed by Parliament (Bertino and Bertino, 2021:254). According to Palmiotto (2017:3), South Africa's legal system combines common law, statutory law, constitutional provisions, and judicial precedent.

As Joubert explains, each statute is assigned a number corresponding to the year of enactment, such as the Firearms Control Act 60 of 2000.

3.3.3 Principles Underpinning Firearm Regulation

The primary goal of firearm legislation is not to resolve debates about the desirability of gun control, but rather to ensure the responsible management, regulation, and oversight of firearms (Strydom, 2016:18). Van Rooyen (2016:110) emphasises the persistent gap between policy formulation and implementation, a gap that often undermines legislative effectiveness. Watkins (2018:76) notes that firearm laws intersect closely with criminal law, seeking to enhance public safety through access restrictions, competency requirements, and penalties for violations.

Robertson et al. (2021:151) distinguishes prevention from deterrence. Prevention seeks to foresee and avert harmful events, while deterrence discourages individuals from engaging in prohibited behaviour. In firearm regulation, preventing high-risk individuals from accessing firearms addresses the root of the problem, while strict penalties for misuse aim to deter irresponsible or unlawful conduct among licensed owners (Lamb, 2018;46).

3.3.4 Firearm Prevalence and the State's Response

By 2015, South Africa had an estimated 4.5 million firearms, including 3.5 million registered to private individuals, with handguns forming the majority (Girard, 2015:33). Earlier estimates from 2010 already placed the total at nearly 6 million, indicating substantial growth over time. Concerns regarding accessibility and misuse prompted intensified government efforts to limit illegal firearms and curb cross-border trafficking (Sansbury, 2016:110).

To support these measures, the National Conventional Arms Control Committee (NCACC) was established at cabinet level. The NCACC reviews export applications, prohibits arms transfers to countries experiencing armed conflict, and restricts sales to undemocratic or military-led governments (Reyneke, 2017:74). This mechanism forms part of South Africa's broader strategy to promote security domestically and within the region.

3.4 NATIONAL POLICY FRAMEWORK FOR FIREARM REGULATION

This section outlines the national constitutional and legislative framework that governs the regulation, control, and oversight of firearms in South Africa. Building on the regional instruments discussed previously, it highlights the key legal and policy instruments that guide firearm ownership, usage, and policing within the country. The discussion traces the historical and legislative developments that culminated in the Firearms Control Act 60 of 2000, examines the roles of constitutional provisions, the South African Police Service, policy directives such as the 1998 White Paper on Safety and Security, and the National Crime Prevention Strategy, and identifies the broader challenges associated with enforcement and regulation. Together, these instruments form the foundation of South Africa's approach to balancing public safety, individual rights, and the reduction of firearm-related crime.

3.4.1 The Firearms Control Act (FCA) 60 of 2000

The Firearms Control Act (FCA) 60 of 2000 replaced the Arms and Ammunition Act 75 of 1969, introducing a more rigorous system for regulating firearm ownership and use. Designed in alignment with the Constitution and the SAPS Act, the FCA aims to support targeted policing strategies, protect constitutional rights to life and safety, and decrease the movement of illegal firearms by removing them from society (Fisher & Fisher, 2022:10; Ngema, Matadi, & Khanyile, 2024:72). The Act establishes a comprehensive management framework that mandates strict enforcement regarding the sale, possession, and safe storage of firearms (Palmiotto, 2017:20).

a) Licensing and Competency Requirements

In South Africa, owning a firearm is not an automatic right. According to Section 6(2) of the FCA, only those who have received a competency certificate can apply for a licence. Applicants must provide valid reasons for ownership (such as hunting, personal protection, or security) and undergo thorough background checks (Lamb & Warton, 2025:18). These checks examine criminal history, mental health, domestic violence records, and substance abuse (Dawud & Abdulkadir, 2021:475).

The gravity of these background checks is illustrated by high-profile cases, such as the student in Stellenbosch who committed murder while suffering from untreated psychological conditions (SABC News, 2022), and the case of a student constable in Soweto who was officially found unfit to own a firearm due to mental health issues yet was still involved in a fatal shooting (Madibo, 2012:3). These incidents underscore the necessity of the FCA's rigorous competency standards to prevent firearms from being accessed by high-risk individuals.

b) Operational Challenges and Forensic Realities

Despite these robust regulatory mechanisms, the effectiveness of the FCA in lowering murder rates depends heavily on the enforcement capacity of law enforcement agencies. Challenges such as corruption, administrative delays in the registration process, and the proliferation of illicit firearms continue to hinder the Act's performance (Mlambo, 2021:3). Furthermore, delays in ballistic analysis and the inadequate management of crime scenes complicate murder investigations involving firearms (Hill & Mofokeng, 2024:27).

Researcher's Insight

In the researcher's professional view, the transition from the old 'Arms and Ammunition Act' to the FCA created a sophisticated scientific ideal that local stations like Piet Retief often struggle to meet due to resource scarcity. For example, while Section 120 of the Act even criminalises the pointing of imitation firearms, recognising that replicas are often used in crimes (SAPA, 2006:1), the practical tracing of such items remains nearly impossible. At the station level, the success of the FCA is often a 'paper victory' unless it is backed by the immediate availability of forensic technicians who can process ballistic evidence before it is lost or contaminated.

Ultimately, while firearm regulations have contributed to a reduction in legal firearm misuse, the high rate of illegal possession remains a significant threat. Legal measures must be supported by intelligence-based investigations and community partnerships to address firearm violence effectively within the South African policing context (Mlambo, 2021:6).

3.4.2 The Constitution of the Republic of South Africa

Despite the constitutional protections in place, many South Africans still face significant safety risks, even though there has been a reported 50 percent decrease in firearm-related deaths between 2000 and 2009 (James et al, 2019:121). Hill and Mofokeng (2024:17) argue that both violence and firearm-related deaths can be managed and prevented. The use of a firearm in criminal activities reflects a clear intention to cause harm, which enables the execution of such intent (Harris and Lee, 2019:39). The criminal intention to harm others violates the right to life, and this violation must be addressed.

The Bill of Rights, as established in the Constitution (1996), ensures fundamental rights for every individual in South Africa. Specifically, Sections 11 and 12 protect the right to life and shield people from all forms of violence, while Section 7(2) requires the state to respect, protect, promote, and fulfil these rights. The Bill of Rights applies universally across all laws and is binding on all government branches, including the legislature, executive, judiciary, and all state institutions. Saferstein (2024:256) highlights the state's responsibility to regulate any factors that may endanger citizens and ensure public order is maintained.

The Constitution of the Republic of South Africa (1996), particularly Section 205(3), outlines the duties of the SAPS to prevent, investigate, and combat crime, maintain public order, secure the people and their property, and enforce the law. These constitutional provisions aim to ensure public safety by protecting citizens and requiring the state to implement adequate security measures. The South African government, as defined by its Constitution, is accountable for protecting the rights of all individuals within its territory.

These rights include the right to life and personal security, which ensures freedom from all types of violence. In this context, the Firearms Control Act 60 of 2000 was introduced to strengthen constitutional safeguards regarding life and physical well-being, increase regulatory control over legally owned firearms to reduce firearm-related crimes, create a thorough and efficient framework for firearm control and management, and ensure strict enforcement of firearm-related laws.

3.4.3 The South African Police Service Act 68 Of 1995

The SAPS plays a crucial role in the country's security framework, as outlined in Section 199(1) of the 1996 Constitution. According to Section 198(c), ensuring national security must be done in compliance with both domestic and international laws. Additionally, Section 205(3) outlines SAPS' responsibilities, which include maintaining public order, protecting citizens and their property, and enforcing the law. Section 214(1) formally sets up SAPS and defines its core functions, which are as follows:

- Ensuring the safety and security of all individuals and their property;
- Upholding and safeguarding the fundamental rights of every person;
- Preventing, combating, and investigating criminal activities.

The Police Act outlines the role of SAPS as the institution responsible for the welfare and security of South African citizens. It emphasises that failing to provide safety and security is a breach of duty. Under the leadership of the Minister of Police, the Constitution mandates that the executive body responsible for policing develop effective strategies for crime control. This directive led to the creation of the White Paper on Safety and Security (1998) and the enactment of the Firearms Control Act 60 of 2000.

3.4.4 The 1998 White Paper on Safety and Security

The White Paper serves several purposes, including setting strategic priorities for crime prevention and clarifying the role of safety and security within the constitutional context (Hill and Mofokeng, 2024:17). It provides the Department of Safety and Security with the necessary policy tools to achieve its vision and enhance the safety of South African citizens. This document examines the concepts of safety and security from two main perspectives: policing and law enforcement, and crime prevention, with an emphasis on social crime prevention.

The rights protected by the South African Constitution are intended to ensure safety by providing adequate protection against criminal offenders. The White Paper on Safety and Security (1998) highlights the importance of social crime prevention by

addressing the root causes of criminal behaviours and expanding its scope to include various contributing factors. It promotes an offender-centred approach that targets known offenders and individuals at risk of committing crimes, aiming to encourage positive behavioural change.

Strategies that reflect this approach include changes to environmental design, improved lighting for enhanced surveillance, and the creation of systems to limit the availability and use of firearms (White Paper on Safety and Security, 1998). The increased accessibility of firearms is identified as a principal factor contributing to crime in the 1996 National Crime Prevention Strategy (NCPS), which is referenced within the White Paper.

3.4.5 The 1996 National Crime Prevention Strategy (NCPS)

The 1996 NCPS offers a thorough framework that promotes a multifaceted approach to crime prevention, incorporating both crime control and crime prevention strategies. A key aim of the NCPS is to implement programmes that target factors that increase the likelihood of engaging in criminal behaviour or becoming a victim. According to the International Centre for Crime Prevention, the presence of handguns significantly raises the risk of victimisation (Lamb, 2018:45). International trends show that firearm-related crime tends to rise during political transitions, as seen in Eastern Europe during the end of the Soviet Union and in Namibia during its independence period (UNODC, 2024:68).

A similar pattern was observed in South Africa as it moved from an apartheid regime to a democratic system, beginning in the early 1990s and culminating in the first democratic elections in 1994. According to Reyneke (2017:52), this transition period was characterised by greater firearm availability, political uncertainty, and weakened law enforcement. The cited scholar adds that these factors contributed to increased risks of both criminal activity and victimisation.

Similarly, Lamb and Warton (2025:16) note that the shift from apartheid to democracy in South Africa weakened social control structures. As a result, the NCPS, as a crime

prevention strategy, focused on addressing gun accessibility through strict regulation and control of firearm licensing.

In May 1996, the South African government launched the NCPS. Thid policy emphasised the necessity of firearm regulation. It recognises firearms as tools that facilitate criminal conduct (Mbonambi and Olutola, 2024:12). This followed observations that the availability of firearms increased the chance of victimisation in South Africa. In response to the threat posed by the transfer of firearms and ammunition from licensed individuals to criminals, the government focused on implementing legal and administrative measures to encourage responsible gun ownership (Lamb and Warton, 2025:16). This goal was achieved mainly through the passage of the Firearms Control Act (FCA), 2000 (Act 60 of 2000).

3.5 CHAPTER SUMMARY

This chapter examined the legal, constitutional, and policy frameworks governing firearms in South Africa, contextualising them within both national and regional regulatory environments. It highlighted how the democratic transition, socio-economic inequalities, urbanisation, and weakened social networks contributed to elevated crime rates and the proliferation of firearms. The discussion emphasised that both legal and illegal firearms play a significant role in enabling violent crime and that gaps in law enforcement and reporting exacerbate these challenges.

Regional and international instruments, including SADC protocols and the UN Programme of Action on Small Arms, establish standards for firearm control, storage, licensing, and cross-border cooperation. At the national level, strategies such as the National Crime Prevention Strategy, the White Paper on Safety and Security, and the Firearms Control Act 60 of 2000 provide a comprehensive regulatory framework to reduce firearm-related crime, ensure responsible ownership, and protect constitutional rights to life and personal safety.

The chapter also highlighted the critical role of the South African Police Service in enforcing firearm legislation, maintaining public order, and supporting crime prevention initiatives. While these measures have reduced legal firearm misuse, the

persistent circulation of illegal firearms underscores the need for integrated, multi-level approaches involving enforcement, intelligence, and community engagement.

In summary, this chapter establishes the legislative and institutional foundation for understanding firearm-related crime in South Africa, providing the necessary context for analysing the empirical findings and discussion presented in the next chapter.

CHAPTER 4

FINDINGS AND RECOMMENDATIONS

4.1 INTRODUCTION

This is the final chapter of the study. It presents and discusses the key findings that emerged from both the interviews and the reviewed literature. The purpose of this chapter is to outline the empirical results in relation to the research problem, the research objectives, and the guiding research questions. The structure of the chapter follows the sequencing of the research questions, commencing with the findings from the literature review followed by the findings from the semi-structured interviews. Each central theme is substantiated by evidence drawn from participant responses and relevant scholarly sources. The findings reported in this chapter form the analytical foundation upon which the recommendations that follow later in this chapter are developed.

4.2 OVERVIEW OF THE STUDY

Firearm evidence is usually found at crime scenes where a firearm was used. When items like cartridge cases, bullets, and ammunition are collected from the scene, they can be examined to identify the type of firearm involved. If a firearm is discovered at the scene, experts can inspect it to confirm or exclude it as the weapon used in the crime. The researcher conducted this study to improve understanding of how firearm evidence is used in murder investigations.

To achieve this, an extensive literature review was carried out, and interviews were conducted with participants. These included Sample A, comprising eight detectives from the Piet Retief Police Station, Sample B with seven forensic analysts from the Piet Retief Local Criminal Records Centre, and Sample C with five participants – consisting of Station Commanders and Senior Crime Intelligence Officers (see Table 1.4). In broad terms, the sample included Operational Commanders, Detective Branch Commanders, and senior staff responsible for oversight, strategy, policy implementation, and resource management in serious crime investigations.

The aim and objectives of this research were to explore how firearm evidence can be utilized in the investigation of murder. To accomplish these aims and objectives, the following research questions were addressed:

1. What is the role of forensic science in the investigation of crime?
2. What is the role of forensic science in murder investigation?
3. How can firearm evidence be used in the investigation of murder?
4. What is the extend of murder case that are being reported at the Piet Retief Police Station?
5. What is the conviction rate of murder at Piet Retief Police Station?
6. What are the primary challenges encountered by investigators in effectively utilising firearm evidence in murder investigations within the South African jurisdiction, particularly at Piet Retief Police Station?
7. How do the identified challenges impact the utilisation of firearm evidence in murder investigations at Piet Retief Police Station, and what are the implications for investigative outcomes and case resolution?
8. How is firearm evidence collected at the crime scene?
9. How should firearm evidence be processed during the investigation of a crime scene to be admissible in court?

4.3 FINDINGS

The findings are presented in a structured manner aligned with the research questions (RQ1–RQ9) to ensure clarity and coherence. Data from document analysis (literature review) and interviews and are synthesised thematically. This approach highlights areas of convergence and divergence between practitioner experiences and established forensic standards. Each section focuses on specific aspects of firearm evidence utilisation, investigative procedures, and case management, with subthemes drawn from both empirical and literature-informed insights. Tables are used to summarise patterns and alignments, while the narrative provides interpretive analysis, linking observed practices to operational challenges and implications for investigative outcomes.

4.4 FINDINGS FROM THE LITERATURE REVIEW

To establish a normative framework, the study consulted a range of literature, including textbooks, peer-reviewed articles, and organisational reports. Collectively, these sources guide forensic science, crime scene management, and investigative procedures. The literature provides benchmarks against which the interview data were analysed, highlighting alignment and divergence between scholarly standards and field practice.

4.4.1 Literature Insights on Case Management and Forensic Procedures

The synthesis of literature-based insights with primary interview data provides a robust framework for understanding the application of forensic science in murder investigations. Documented research underscores the centrality of forensic practices, including ballistics, fingerprint analysis, DNA, and toxicology testing. The data sources emphasise procedural adherence, including chain-of-custody and comprehensive crime scene documentation (Saferstein, 2018:71; Van Rooyen, 2016:104).

While these sources establish normative expectations, the practical realities of investigative work are shaped by contextual factors, including resource constraints, operational capacity, and case complexity. By juxtaposing theoretical guidance with the experiences of Piet Retief investigators, it becomes possible to identify both alignment with best practices and areas where procedural or contextual limitations influence investigative outcomes.

The integrated Table 4.1, which follows, aligns each research question (RQ) with literature findings, corresponding interview insights, and an analytical assessment of alignment across the two data sets. This presentation provides a concise evaluation of how practice aligns with scholarly expectations and highlights the implications for investigative credibility, procedural reliability, and case success.

Table 4.1 Integrated Findings Summary

Research Question	Document Analysis Findings	Interview Findings	Alignment Across Data Sets	Interpretation / Implications
RQ1 – Role of Forensic Science in Crime Investigation	Use of ballistics, fingerprints, DNA, toxicology; procedural adherence (Saferstein, 2018:64; Rondinelli, 2017:379; James et al, 2019:121)	Reliance on expert reports, lab analysis, documentation; some gaps	Strong	Forensic science guides operational decisions and strengthens case credibility
RQ2 – Role of Forensic Science in Murder Investigation	Application of forensic techniques in murder; autopsy, scene documentation (Watkins et al., 2017:145; Van Rooyen, 2016:132; Saferstein, 2024:102)	Expert involvement in complex or gang-related murders; selective use of advanced tests	Strong	Targeted forensic application improves scene interpretation and case progression
RQ3 – Application of Firearm Evidence	Collection, identification, ballistic analysis, chain-of-custody adherence (Houck and Siegel, 2015:172; James et al., 2019:212; Bertino, 2020:229)	Firearm evidence central; investigators report careful collection and documentation	Strong	Firearm evidence is key for linking suspects to crimes and supporting prosecutions
RQ4 – Patterns of Murder	Weapons: firearms, knives, blunt objects; motives: gang, domestic, robbery (Gardner, 2016:98; Harris and Lee, 2019:134; Watkins, 2018:93)	Confirmed patterns, triggers, crime context, planned vs impulsive incidents	Strong	Recognising patterns informs prioritisation, profiling, and investigative strategy
RQ5 – How Murders Are Committed	Offender behaviour, weapon choice, situational triggers (Girard, 2016:260;	Investigators emphasise method informs motive and suspect identification	Strong	Understanding methods aids investigative hypotheses and linking evidence to suspects

	Watkins, 2018:98; DiMaio and DiMaio, 2019:112).			
RQ6 – Investigative Limitations and Barriers	Contamination, backlog, incomplete documentation, procedural lapses (Harris and Lee, 2019:72; Houck and Siegel, 2015:169; Lamb and Warton (2025:2016; Ngema et al., 2024:75)	Limited knowledge, contamination, lab delays, witness reluctance	Strong	Limitations directly affect case outcomes; highlights need for professional development and procedural reinforcement
RQ7 – Consequences for Case Outcomes	Compromised evidence reduces success and admissibility (Fisher and Fisher, 2022:209; Hill and Mofokeng (2024;17; Marais, 2016:6)	Lapses linked to delayed or unsuccessful prosecutions	Strong	Procedural adherence preserves case integrity and legal defensibility
RQ8 – Individualisation and Linking Evidence to Suspects	Ballistic comparison, matching firearm to case (Saferstein, 2018:75; Van Rooyen, 2016:140; Mistek et al., 2018:643)	Corroboration with circumstantial evidence; microscopy; precision emphasised	Strong	Accurate individualisation strengthens case credibility and reduces wrongful attribution.
RQ9 – Contamination Prevention and Chain of Custody	Chain-of-custody, secure packaging, restricted access, safety (Robertson et al., 2021:175; Palmiotto, 2017: 154; Schwikkard and Van der Merwe, 2016:272)	Step-by-step scene handling, photographic documentation, and collaboration with labs	Strong	Maintaining evidence integrity is essential for admissibility and reliable investigative outcomes

Table 4.1 demonstrates a consistently strong alignment between literature-informed standards and the practices reported by investigators, particularly in the application of forensic disciplines, firearm evidence handling, and evidence individualisation. For instance, both sources confirm the critical role of ballistic analysis in linking suspects to crimes, reinforcing its centrality in murder investigations. Deviations are most notable in procedural adherence and case outcomes, where operational limitations (such as laboratory delays or incomplete documentation) pose risks to evidence integrity and prosecutorial success (Hill and Mofokeng, 2024:17).

These findings suggest that while investigators largely conform to established forensic protocols, systemic constraints can compromise optimal practice. The synthesis further illustrates how knowledge of murder patterns, offender methods, and evidence handling directly informs investigative strategy, prioritisation, and courtroom preparedness. Anchoring the analysis in both literature and first-hand accounts enables a nuanced understanding of investigative practice, situating local realities within broader forensic norms. The subsequent sections expand upon the interview data, using verbatim quotes to substantiate the thematic interpretations and provide depth to the analysis.

4.5 DATA FROM SEMI-STRUCTURED INTERVIEWS

Building on the literature-informed benchmarks, this section interprets insights from interviews with investigators at Piet Retief Police Station. The analysis adopts an interpretive approach in line with the research paradigm (see Section 1.11.2). This method focuses on how practitioners' experiences align with, diverge from, or extend the standards and expectations identified in the literature.

Rather than cataloguing responses, the discussion focuses on patterns, procedural nuances, and operational constraints, illustrating how theoretical guidance is translated into practice. The findings are anchored in participant narratives, providing both empirical depth and analytical insight. This strategy sets the stage for subsequent discussion on the implications of these insights for investigative practice and policy.

4.5.1 RQ1 – Role of Forensic Science in Crime Investigation

This research question examined the role of forensic science in general crime investigations, focusing on how investigative personnel apply forensic disciplines such as ballistics, fingerprints, DNA, and toxicology to support case development. Participant A1 highlighted:

> *"Without forensic analysis, we would often be working blind. The evidence gives direction to the whole investigation."*

Findings show that forensic science is foundational for operational decision-making. Investigators consistently rely on expert reports and laboratory analyses to validate their observations and guide investigative actions. Procedural adherence and documentation enhance both the efficiency of investigations and the credibility of cases presented in court.

4.5.2 RQ2 – Role of Forensic Science in Murder Investigation

This research question explored how forensic techniques are applied explicitly in murder investigations. Focus areas included autopsies, crime scene documentation, and selective application of advanced tests, such as toxicology and DNA analysis, particularly in complex or gang-related murders. Participant A4 explained:

> *"Expert involvement is critical in gang-related cases. They uncover details that aren't obvious at the scene."*

Findings indicate that murder investigations require targeted application of forensic science, with expert involvement enhancing the accuracy of scene interpretation and supporting case progression. Effective integration of laboratory and field analysis improves both the quality of evidence and case outcomes.

4.5.3 RQ3 – Application of Firearm Evidence

This research question examined how firearm evidence is collected, documented, and analysed to support investigative objectives. Emphasis was placed on identifying

firearms, ammunition, and ballistic markings, as well as on chain-of-custody procedures. Participant B5 remarked:

> *"Each bullet tells a story; connecting it to the weapon often opens new leads."*

Findings suggest that firearm evidence is central to linking suspects to crimes. Proper documentation and analysis of ballistic evidence strengthen investigative conclusions and reduce the risk of misattribution, thereby increasing the reliability of prosecutorial outcomes.

4.5.4 RQ4 – Patterns of Murder

This research question explored patterns in the nature, frequency, and context of murders. Areas examined included weapons used, motives, victim-perpetrator relationships, and situational influences such as alcohol, drugs, or location type. Participant A6 declared:

> *"Domestic incidents often escalate quickly. Understanding context is key to prevention and investigation."*

Findings indicate that recurring patterns, such as gang-related violence and domestic disputes, inform investigative prioritisation and resource allocation. Recognising these patterns allows investigators to anticipate behaviours and develop strategic approaches to evidence collection and suspect identification.

4.5.5 RQ5 – How Murders Are Committed

This research question focused on methods and circumstances under which murders are perpetrated, examining offender behaviour, environmental context, and weapon selection. Participant A5 commented:

> *"Recognising the method can lead us directly to the motive and likely suspect."*

Findings reveal that understanding the commission method is critical for developing investigative hypotheses and predicting offender behaviour. A detailed analysis of

crime execution aids in profiling suspects and strengthens links between evidence and the individuals involved.

4.5.6 RQ6 – Investigative Limitations and Barriers

This research question explored operational challenges faced by investigative personnel, including limited forensic knowledge, contamination risks, procedural lapses, and resource constraints such as laboratory backlogs. Participant B2 lamented:

> *"We sometimes face backlogs or lack the training to fully utilise forensic tools. It affects how quickly cases progress."*

Findings indicate that these limitations have direct consequences for case outcomes. Investigators' ability to gather and process evidence efficiently is constrained by knowledge gaps and resource shortages, highlighting the need for ongoing professional development and procedural reinforcement.

4.5.7 RQ7 – Consequences for Case Outcomes

This research question investigated how lapses in evidence management, contamination, and procedural errors affect prosecutorial success and admissibility. Participant A8 noted:

> *"A single misstep in evidence handling can undo months of investigative work."*

Findings indicate that compromised evidence significantly reduces the likelihood of successful prosecution. Maintaining strict adherence to collection and documentation protocols is critical for preserving case integrity and ensuring that investigative findings are legally defensible.

4.5.8 RQ8 – Individualisation and Linking Evidence to Suspects

This research question explored the individualisation of firearm evidence; how investigators distinguish one firearm from another to definitively connect it to a

suspect. Methods such as comparison microscopy and corroboration with circumstantial evidence were central to this process. Participant B1 emphasised:

> *"Each weapon leaves a unique signature. Our task is to match that signature to the case without doubt."*

Findings indicate that the accuracy of individualisation significantly influences the strength of the prosecutorial case and reinforces the credibility of investigative outcomes. Reliable matching of ballistic evidence reduces wrongful attribution and increases confidence in investigative conclusions.

4.5.9 RQ9 – Contamination Prevention and Chain of Custody

This research question investigated the methods used to prevent contamination and maintain the integrity of evidence during collection, transport, and analysis. Focus areas included secure packaging, restricted access, and meticulous documentation. Participant C2 elaborated:

> *"If the chain of custody is broken, even the strongest evidence can be dismissed. So, we treat every piece as sacred."*

Findings suggest that adherence to contamination-prevention and chain-of-custody protocols is essential to preserving evidentiary integrity. Even minor procedural lapses can compromise case outcomes, highlighting the critical role of quality control, training, and adherence to standards in forensic practice.

4.5.10 Summary of Findings

The expanded findings show that forensic science underpins all stages of murder investigation, from evidence collection and analysis to courtroom presentation. RQ7–RQ9 explicitly highlight the importance of individualisation, linking evidence to suspects, and preventing contamination, complementing the original RQs. Collectively, the nine RQs present a cohesive, evidence-based account of investigative practice, operational challenges, and procedural rigour at Piet Retief Police Station.

4.6 DISCUSSION OF FINDINGS

This section synthesises the key findings of the study across all nine research questions. The discussion integrates empirical insights drawn from interviews with detectives, forensic analysts, and senior SAPS management. It juxtaposes these findings with established literature on forensic science, investigative practice, and murder investigation. The purpose is to critically evaluate the extent to which investigative practice at Piet Retief aligns with normative forensic standards, to identify gaps, and to consider the implications for the reliability, admissibility, and overall effectiveness of murder investigations in a rural South African context.

4.6.1 The Role of Forensic Science in Crime Investigation (RQ1)

The findings affirm that forensic science plays a foundational role in contemporary crime investigation. Literature consistently emphasises that forensic science serves to *identify, analyse, and interpret* physical evidence to reconstruct events, link suspects to scenes, and provide objective, court-ready information (Saferstein, 2018:64; Fisher and Fisher, 2022:41; Houck and Siegel, 2015:78). This study's interview data largely corroborate these assertions, though with differing levels of understanding across participant groups.

Participants in Sample A (detectives) displayed a limited grasp of forensic science, often reducing it to "fingerprints and cartridges." Their responses lacked reference to broader forensic domains such as trace evidence, toxicology, digital forensics, and crime scene reconstruction, despite these being highlighted in the literature as integral to holistic investigation (Lamb and Warton, 2025:16). In contrast, Samples B and C demonstrated a more comprehensive understanding, explicitly acknowledging laboratory analysis, expert input, and the importance of documentation.

The contrast between participant groups suggests variation in exposure, training, and forensic literacy. While the literature positions forensic science as an essential investigative tool, operational practice at Piet Retief remains uneven. The limited forensic knowledge among detectives directly constrains the practice of evidence-based policing. This supports existing scholarship that emphasises the need for

continuous professional development to bridge the gap between scientific capability and practical utilisation (Dempsey, 2017:63).

Overall, findings illustrate partial alignment with literature: while investigators appreciate the value of forensic science, the full spectrum of its application is not consistently integrated into routine investigative practice.

4.6.2 Application and Processing of Firearm Evidence (RQ2 and RQ6)

Firearm evidence emerged as a central component of murder investigations in the study area, reflecting the high prevalence of firearm-related murders. Literature stresses that proper recovery, documentation, and ballistic analysis of firearm evidence are crucial for linking a weapon to a crime (Fisher and Fisher, 2022:103; Ngema et al., 2024:75; Saferstein, 2018:78). Participants affirmed this, with one noting that “each bullet tells a story.” This finding highlights practitioner recognition of the evidential value of ballistic markings.

However, the study revealed significant inconsistencies in practice. While Samples B and C demonstrated strong awareness of correct handling procedures. For instance, photographing before touching, packaging items separately, maintaining the chain of custody. Sample A displayed gaps that expose cases to the risk of contamination or evidential challenge. Literature makes clear that mishandling, improper packaging, or a disrupted chain of custody can render crucial evidence inadmissible (Du Plooy, 2016:42; James and Nordby, 2019:117).

Furthermore, forensic backlogs, limited local laboratory capacity, and delays in ballistic testing compromised investigative timelines. These operational constraints align with South African forensic research, which warns of systemic challenges that weaken the potential of firearm evidence (Van Rooyen, 2016:140). Thus, while the theoretical value of ballistic evidence is clear, its practical utilisation is impeded by human, procedural, and infrastructural limitations. This observation reinforces the need for stronger procedural standardisation, better interdepartmental collaboration, and investment in forensic capacity.

4.6.3 Nature, Extent, and Character of Murders in Piet Retief (RQ3 and RQ5)

The findings reveal a complex pattern of murder in Piet Retief, characterised by both *organised* and *impulsive* forms of violence. Firearms dominate premeditated killings, particularly gang-related shootings and targeted executions. In contrast, knives, broken bottles, and blunt objects are more common in spontaneous, emotionally charged encounters, often fuelled by alcohol or interpersonal conflict.

This duality aligns strongly with South African murder literature, which identifies socio-economic stressors, substance abuse, and gang activity as key drivers of violence (Guyll et al., 2023:98; Watkins, 2018:4; DiMaio and DiMaio, 2019:87). The unique geographical context: rural farms, border communities, urban townships, further shapes murder patterns by enabling both cross-border firearm trafficking and isolated domestic incidents.

Participants consistently emphasised that murder investigations must account for context, as understanding the method often leads directly to insights on motive and suspect identification. This aligns with criminological perspectives that offender behaviour, weapon choice, and situational triggers are critical for investigative hypothesis-building (Lamb and Warton, 2025:206; Mbonambi and Olutola, 2024:15).

Hence, the findings demonstrate strong alignment with literature regarding the drivers and characteristics of murder and highlight the need for both policing and community-based interventions to address structural and behavioural risk factors.

4.6.4 Murder Investigation Procedures (RQ4 and RQ6)

The literature outlines a clear process for murder investigation, from securing the scene to submitting exhibits for laboratory analysis, grounded in statutes such as the Criminal Procedure Act 51 of 1977 and the Firearms Control Act 60 of 2000. SAPS Standing Orders further regulate the responsibilities of first responders and investigative teams.

Findings from this study confirm adherence to many of these protocols—but also reveal persistent procedural weaknesses. Participants acknowledged the importance

of scene security, restricted access, photographing before touching, and accurate documentation. However, they also identified systemic obstacles: limited manpower, insufficient vehicles, lab delays, and weaknesses in documenting evidence continuity. Such challenges mirror the literature, which highlights that rural forensic environments are especially vulnerable to procedural lapses due to resource shortages (Harris and Lee, 2019:72; Dempsey, 2017:81).

The study thus underscores the tension between *policy expectations* and *operational realities*. While investigators know what is required, they are not always resourced or trained to carry it out consistently.

4.6.5 Foundational Forensic Principles (RQ7, RQ8 and RQ9)

a) Physical Evidence

Participants demonstrated varying levels of understanding of physical evidence. Sample C showed strong alignment with literature, identifying physical evidence as any material object capable of establishing links or disproving claims (Saferstein, 2024:58; De Vos, 2016:4). Samples A and B displayed partial or incomplete conceptions, indicating a need for more formalised training.

b) Locard Exchange Principle

This principle, “every contact leaves a trace,” is central to forensic investigation (Houck and Siegel, 2015:28; Mistek et al., 2018:642). Yet most participants, especially Sample A, lacked a clear understanding of it, despite its relevance for linking suspects, victims, and scenes.

c) Identification and Individualisation

Participants struggled to distinguish identification (“what is this object?”) from individualisation (“does it originate from this specific source?”). Literature emphasises individualisation as the key to linking bullets to firearms or fingerprints to individuals (James et al., 2019:17).

d) Continuity of Possession and Contamination

Samples B and C exhibited strong awareness of chain of custody requirements (Du Plooy, 2016:39; Fisher and Fisher, 2022:910). Sample A responses deviated significantly, posing risks to evidentiary admissibility. Evidence contamination was widely understood across samples, reflecting a general awareness of its consequences (Harris and Lee, 2019:10).

4.7 UNEXPECTED FINDINGS

The study revealed several striking and, in some cases, unexpected findings that illuminate the gap between the theoretical potential of firearm evidence and its practical utilisation in murder investigations at Piet Retief Police Station, South Africa. These findings highlight the extent to which systemic, procedural, and contextual factors shape investigative effectiveness.

4.7.1 Low Conviction Rates Despite Recovery of Firearm Evidence

A key unexpected finding was the disconnect between the frequent recovery of ballistic evidence and the relatively low conviction rates that followed. Despite the objective scientific value of bullets, cartridge cases, and ballistic linkages, these did not consistently enhance prosecutorial outcomes.

Interviews revealed that this failure stemmed not from the absence of evidence but from:

- Delays in ballistic and DNA analysis,
- Incomplete or inconsistent documentation,
- Breakdowns in the chain of custody,
- Weaknesses in courtroom presentation of technical evidence.

This finding is significant because it shows that the scientific potential of firearm evidence is compromised primarily at *procedural* and *legal* stages rather than during forensic analysis.

4.7.2 Operational Realities Exert a Greater Influence Than Expected

Although literature acknowledges limited resources within rural investigative environments, the *severity* of operational barriers at Piet Retief was greater than anticipated.

Investigators consistently cited:

- Shortages of vehicles and staff,
- Lack of basic protective or forensic equipment,
- Excessive workloads,
- Restricted access to specialised forensic units.

These challenges had direct effects on the quality and timeliness of investigations, contributing to contamination, insufficient documentation, and missed forensic opportunities. The influence of these contextual constraints proved far more consequential than predicted by existing forensic literature.

4.7.3 Widespread Reliance on Informal, Experience-Based Practices

Another unexpected finding was the degree to which detectives relied on informal practices and personal experience rather than established forensic protocols.

Although practical experience is valuable, this reliance revealed:

- Gaps in formal forensic training,
- Inconsistent supervision and lack of procedural reinforcement,
- A normalisation of shortcuts due to time pressure and inadequate resources.

This finding suggests that deviations from standardised procedures are not occasional errors but structural features of the working environment.

4.7.4 Limited Practical Application of Locard's Exchange Principle

Although foundational to forensic science, Locard's Exchange Principle was rarely consistently applied in practice. Several detectives struggled to articulate the principle, and even those who understood it conceptually found it challenging to apply it under real-world conditions.

Contributing factors included:

- Rushed scene clearance,
- Inadequate protective clothing,
- Limited equipment for trace evidence collection,
- Lack of continuous professional development.

This disconnect between theory and practice was more pronounced than expected, further explaining why crucial trace evidence is often left uncollected or compromised.

4.7.5 More Severe Community and Societal Impacts Than Foreseen

One of the most striking findings was the extent of community distrust resulting from unresolved firearm-related murders. Participants described growing fear, reluctance to cooperate, and perceptions of SAPS inefficiency—all of which undermine long-term crime prevention and investigative success.

This socio-legal consequence was far stronger than anticipated in the literature, which tends to focus more on technical and procedural issues than on community-level effects.

Participants noted that persistent unsolved murders lead to:

- Reduced witness cooperation,
- Community reluctance to share intelligence,
- Heightened fear of retaliation,
- Declining trust in law enforcement.

This creates a feedback loop: weakened investigations contribute to community distrust, which, in turn, limits the cooperation needed to solve cases.

4.7.6 Overall Significance

Collectively, these findings reveal a substantial gap between forensic capability and its practical realisation in a rural policing environment. They highlight that:

- Scientific potential alone does not ensure investigative or prosecutorial success,
- Procedural compliance and resource availability are decisive factors, and
- Weak investigative outcomes carry wider social consequences beyond individual cases.

These unexpected findings reinforce the need for investment in training, supervision, procedural standardisation, community engagement, and resource allocation to realise the benefits of firearm evidence in murder investigations fully.

4.8 CONTRIBUTIONS OF THE STUDY

This study makes several significant contributions to both theory and practice in forensic science, criminal investigation, and policing. These contributions emerge from the integration of empirical findings, literature-informed analysis, and the contextual realities of murder investigations in a rural South African environment.

4.8.1 Theoretical Contributions

- Advances understanding of forensic science in murder investigations The study demonstrates how forensic science functions not merely as a technical tool but as a framework for reconstructing events, testing investigative hypotheses, and strengthening evidentiary reasoning. It reinforces the interplay between criminological theory, forensic principles, and real-world investigative practice.

- Reinforces and contextualises foundational forensic principles. Concepts such as the Locard Exchange Principle, identification vs individualisation, and

continuity of possession are examined through the lens of practical implementation. The findings show where theory aligns with practice and where significant gaps occur, thereby contributing to the literature on the operationalisation of forensic principles in resource-constrained settings.

- Contributes to the literature on murder patterns in rural South Africa By identifying the dual nature of murder patterns (i.e., premeditated firearm-related killings alongside impulsive, interpersonal violence), the study enriches crime trend research in lesser-studied rural and semi-urban environments. This supports broader criminological scholarship on socio-economic and contextual determinants of violent crime.

- Extends theoretical debates on evidence reliability and investigative integrity The study highlights how systemic constraints, rather than scientific limitations, undermine forensic potential. This adds nuance to theoretical discussions about the factors influencing evidential reliability and judicial outcomes.

4.8.2 Practical Contributions

- Identifies operational gaps in investigative capacity. The study reveals critical weaknesses in the handling of firearm evidence, crime scene management, chain-of-custody procedures, and the application of forensic principles. These insights provide a practical foundation for targeted interventions in training and operational reform.

- Improves understanding of the impact of resource limitations on forensic practice. The findings demonstrate the extent to which shortages in personnel, equipment, and laboratory capacity shape investigative quality. This contribution is especially valuable for policy makers and SAPS management, who must allocate resources strategically.

- Provides evidence-based recommendations for procedural standardisation The study offers actionable guidance on improving documentation practices, strengthening inter-agency collaboration, enforcing scene protocols, and enhancing the utilisation of ballistic evidence. These recommendations can be

integrated into SAPS Standing Orders, training curricula, and Forensic Science Laboratory workflows.

- Highlights the importance of community cooperation and trust. By demonstrating how unresolved firearm-related murders erode public confidence, the study underscores the need for community engagement strategies. This contribution emphasises that forensic practice cannot be divorced from broader social and policing dynamics.
- Bridges the divide between theory, policy, and field realities. The findings provide a realistic picture of investigative practice in a rural policing context, offering insights for improving the alignment between policy expectations and practical constraints.

Overall, the study makes a balanced, evidence-based contribution that advances both academic knowledge and practical police performance.

4.9 LIMITATIONS OF THE STUDY

While the study provides valuable insights into forensic practice and murder investigation within Piet Retief, several limitations must be acknowledged to contextualise the findings.

a) Participant Scope

The study relied primarily on investigators from Piet Retief Police Station and forensic practitioners from the Ermelo Local Criminal Record Centre. The perspectives of other relevant stakeholders, such as community members, victims' families, prosecutors, ballistic scientists, and senior national-level SAPS managers, were not included. Their absence may limit the breadth of interpretive insights.

b) Geographical Limitation

Findings reflect the operational conditions, crime patterns, and resource constraints specific to Piet Retief and its surrounding rural areas. These contexts differ significantly from metropolitan settings, where forensic capacity, gang structures, and

investigative workflows may vary. Therefore, the findings should not be indiscriminately generalised to all South African regions or provinces**.**

c) Time and Resource Constraints

Limited time and resources restricted the number and duration of interviews, as well as opportunities for direct observation of live crime scenes or laboratory processes. Broader sampling or extended fieldwork may have yielded additional perspectives or variations in cases.

d) Focus on Firearm Evidence

While firearm evidence was the central focus and appropriate given its prevalence in local murders, other crucial forms of evidence, such as digital, trace, chemical, and advanced biological evidence, were not explored in depth. As a result, the findings provide a detailed but specialised examination of forensic practice.

e) Dependence on Self-Reported Data

As with all interview-based qualitative research, the study relies partly on the accuracy of participant recollection and self-reporting. Some descriptions of practice may reflect ideal procedures or personal perceptions rather than consistently applied routines.

Although these limitations suggest caution when generalising the findings, they do not undermine the study's value. Instead, they highlight the need for further research across diverse policing contexts, larger forensic samples, and broader methodological triangulation. The insights generated remain highly relevant for strengthening investigative practice in Piet Retief and similar rural jurisdictions.

4.10 RECOMMENDATIONS

This section presents the recommendations derived from the study's findings, structured around the research questions outlined in Section 4.3. The recommendations are divided into two sections: Recommendations for Practice and Recommendations for Future Research. Each section begins with a statement of the

current scenario based on empirical findings, followed by actionable or investigatory guidance.

4.10.1 Recommendations For Practice

The following recommendations are intended to strengthen the integration of forensic science into murder investigations, enhance the management of firearm evidence, and improve investigative outcomes in Piet Retief and similar rural policing contexts.

RQ1: Significance of Forensic Science in Crime Investigations

Current scenario: Forensic science is critical in linking suspects to crime scenes and supporting investigative outcomes. However, findings reveal limited integration of forensic principles in daily police work.

Recommendations:

- Introduce forensic science training modules in police curricula to familiarise officers with forensic principles, evidence handling, and investigative significance.
- Conduct practical workshops led by forensic experts to build confidence and competence in applying forensic techniques.
- Establish continuous professional development programmes to keep investigators updated on evolving forensic methodologies.

RQ2: Application of Firearm Evidence

Current scenario: Firearm evidence is central to murder investigations, yet officers often lack expertise in collection, preservation, and analysis.

Recommendations:

- Provide targeted theoretical and practical training on firearm evidence handling, scene processing, and ballistic interpretation.

- Develop operational guidelines for safe handling, packaging, and chain-of-custody management.
- Enhance collaboration between detectives, the Local Criminal Record Centre, and forensic laboratories to support timely admissible analysis.
- Implement mentorship programmes where experienced investigators guide junior officers in crime scene reconstruction and ballistic interpretation.

RQ3: Nature and Extent of Murder in Piet Retief

Current scenario: Murders are predominantly firearm-related, often linked to gang activity, interpersonal conflict, and substance abuse.

Recommendations:

- Strengthen intelligence-led policing to target gang networks responsible for execution-style killings and armed robberies.
- Implement community-based conflict resolution and substance-abuse intervention programmes.
- Raise public awareness regarding the dangers of illegal firearm possession and misuse.

RQ4: Murder Investigation Procedures

Current scenario: Investigations are sometimes compromised due to poor crime scene management and inconsistent evidence handling.

Recommendations:

- Assign trained investigators to murder scenes to prevent contamination and preserve ballistic and forensic evidence.
- Store firearm-related evidence in separate, clearly labelled containers to prevent cross-contamination.

- Strengthen confidential informant systems and anonymous tip-off mechanisms to improve witness cooperation, particularly in gang-related cases.

RQ5: Methods and Motives of Murders

Current scenario: Murders range from premeditated firearm killings to impulsive stabbings and blunt-force attacks, with substance abuse often escalating violence.

Recommendations:

- Conduct firearm amnesty campaigns and targeted raids on gang strongholds to reduce illegal weapon circulation.
- Strengthen enforcement of the Firearms Control Act 60 of 2000, including licensing, reporting of stolen firearms, and safe storage requirements.
- Establish specialised anti-gang and anti-drug task forces in high-risk areas.
- Promote youth diversion initiatives, vocational training, and educational support programmes to reduce youth involvement in gangs and violence.

RQ6: Processing Firearm Evidence at Crime Scenes

Current scenario: Inconsistent evidence handling reduces the evidential value of firearm exhibits in court.

Recommendations:

- Adopt standardised procedures for securing and processing firearm evidence, including photography, evidence logging, and chain-of-custody documentation.
- Restrict access to crime scenes to authorised personnel and maintain detailed entry–exit logs.
- Prioritise officer safety when handling firearms.

- Collaborate with the Mpumalanga Forensic Science Laboratory (FSL) to expedite ballistic analysis and support timely case progression.

RQ7–RQ9: Physical Evidence, Forensic Principles, and Evidence Integrity

Current scenario: Investigators demonstrated limited understanding of the Locard Exchange Principle, individualisation, and continuity of possession.

Recommendations:

- Provide targeted training on the Locard Exchange Principle and its application in investigations.
- Conduct workshops on identification, individualisation, and continuity of possession for investigators, LCRC personnel, and ballistic examiners.
- Reinforce chain-of-custody protocols and contamination prevention to maintain evidential integrity.
- Integrate forensic principles into ongoing professional development programmes.

4.10.2 Recommendations for Future Research

The following recommendations highlight areas where further investigation could expand understanding, improve evidence handling, and strengthen investigative practices in South Africa.

RQ1: Significance of Forensic Science in Crime Investigations

Current scenario: Forensic science is recognised as essential, but routine application in investigations remains limited.

Recommendations:

- Investigate barriers to integrating forensic science into routine investigative practices across different policing contexts.

- Conduct comparative studies to assess whether formal forensic training improves case resolution rates.
- Explore perceptions of forensic science among officers at different ranks to identify organisational and cultural influences.

RQ2: Application of Firearm Evidence

Current scenario: Officers frequently handle firearm evidence but lack adequate technical knowledge.

Recommendations:

- Evaluate the effectiveness of firearm evidence training programmes in improving investigative competency.
- Examine the impact of improved collaboration between police and forensic laboratories on case outcomes.
- Assess how enhanced firearm evidence handling influences court decisions and conviction rates.

RQ3: Nature and Extent of Murder in Piet Retief

Current scenario: Murder patterns are influenced by both premeditated and impulsive violence.

Recommendations:

- Conduct longitudinal studies on murder trends in rural and semi-urban areas.
- Explore socio-economic and cultural drivers of violence to inform prevention strategies.
- Investigate the effectiveness of community-based interventions in reducing firearm-related violence.

RQ4: Murder Investigation Procedures

Current scenario: Procedural inconsistencies compromise investigative integrity.

Recommendations:

- Evaluate standardised crime scene protocols in different policing contexts.
- Study the role of emerging technologies (e.g., digital evidence management) in improving investigative outcomes.
- Explore strategies for improving witness cooperation in high-risk or gang-affected communities.

RQ5: Methods and Motives of Murders

Current scenario: Both premeditated and impulsive killings require distinct investigative and prevention strategies.

Recommendations:

- Investigate the relationship between substance abuse, gang activity, and violent crime.
- Assess the impact of firearm amnesty campaigns, anti-gang task forces, and youth diversion initiatives on murder reduction.
- Explore recidivism patterns among perpetrators of different types of murder.

RQ6: Processing Firearm Evidence at Crime Scenes

Current scenario: Inconsistent evidence handling undermines evidential reliability.

Recommendations:

- Conduct observational studies of firearm evidence processing to identify best practices.

- Investigate how rapid forensic analysis affects case progression and judicial outcomes.
- Study correlations between officer training, resource availability, and evidence quality.

RQ7–RQ9: Physical Evidence, Forensic Principles, and Evidence Integrity

Current scenario: Investigators' understanding of key forensic principles is inconsistent.

Recommendations:

- Examine the impact of targeted forensic principle training on investigative accuracy.
- Investigate links between strict chain-of-custody adherence and successful prosecutions.
- Compare forensic principle application across jurisdictions to inform national standardisation.
- Explore the effect of integrated forensic practices on public confidence in policing.

4.10.3 Summary of Recommendations

In summary, the recommendations collectively emphasise an integrated, evidence-based approach to murder investigation in Piet Retief. For practice, they advocate for enhanced forensic training, standardised evidence management, improved inter-agency collaboration, and targeted community interventions. For research, they highlight opportunities to investigate procedural barriers, training effectiveness, technology adoption, and socio-cultural drivers of violence. Together, these measures provide a roadmap for improving investigative competence, strengthening the integrity of forensic evidence, and ultimately promoting justice and public safety in rural South African policing contexts.

4.11 CONCLUSION

This study evaluated the utilisation of firearm evidence in murder investigations at Piet Retief Police Station, Soth Africa. The overarching aim was to evaluate current practices, identify challenges, and propose strategies to improve investigative effectiveness. Guided by nine research objectives and corresponding research questions, the study employed a qualitative phenomenological design to explore the lived experiences of detectives involved in firearm-related murder investigations. Drawing on the literature, empirical findings, and Locard's Exchange Principle as the theoretical framework, the study provides significant insights into the role of forensic evidence in supporting justice in South Africa.

The findings confirm that firearm evidence is critical in linking suspects to crime scenes, reconstructing events, and corroborating witness accounts. However, the study also identified operational, procedural, and resource-related challenges that compromise the effectiveness of investigations. Key challenges include limited access to specialised equipment, inadequate training in firearm forensics, inconsistent adherence to standard operating procedures (SOP), and logistical constraints in evidence management. These challenges negatively impact case resolution, potentially contributing to lower conviction rates and delayed justice delivery.

The study contributes to knowledge in both theoretical and practical domains. Theoretically, it demonstrates the applicability of Locard's Exchange Principle in real-world investigations, illustrating how trace evidence transfers underpin case reconstruction and forensic analysis. In practice, it highlights actionable strategies to improve investigative outcomes, such as enhancing inter-agency collaboration, investing in investigator training, standardising evidence-collection and processing protocols, and optimising resource allocation. These contributions provide a foundation for more effective firearm-related murder investigations and strengthen the integrity of forensic evidence in the South African context.

While this study offers valuable insights, it also acknowledges limitations. The research focused exclusively on Piet Retief Police Station, a single rural policing context, which may limit the generalisability of findings to urban or differently resourced

police stations. The sample was restricted to 20 detectives, which, while sufficient for phenomenological inquiry, may not capture all perspectives within the broader investigative community. Additionally, the study relied primarily on qualitative data from interviews and did not incorporate quantitative analysis of conviction rates or crime statistics beyond publicly available reports.

Based on the findings and limitations, the study recommends several directions for future research. Comparative studies could examine the utilisation of firearm evidence across multiple police stations or provinces to identify best practices and contextual variations. Quantitative research linking evidence-handling practices to case outcomes could provide statistical validation of the identified challenges. Further exploration of technological innovations, such as digital forensics tools and ballistic databases, could enhance the efficiency and accuracy of firearm investigations. Finally, research examining community perceptions and cooperation in firearm-related investigations could illuminate the social factors that influence investigative success.

In conclusion, this study underscores the pivotal role of firearm evidence in murder investigations while acknowledging the practical challenges faced by detectives at Piet Retief Police Station, South Africa. By addressing these challenges through improved training, resources, inter-agency collaboration, and procedural standardisation, investigative effectiveness can be significantly enhanced. Thus, the study offers both theoretical insights and practical guidance. This knowledge can contribute to more robust forensic practices, higher conviction rates, and ultimately, the promotion of justice and public safety within the Piet Retief community and other similar contexts.

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ANNEXURES

Annexure A: Unisa Ethical Clearance

College of Law_RERC

NHREC Registration # : (if applicable)
Ref #: 6226
Name: MR WELCOME BONGANI MAGAGULA
Student #: 56341091
Staff #:

Date: 13/01/2025

Dear: MR WELCOME BONGANI MAGAGULA

Decision: Ethics Approval from 13/01/2025 to 13/01/2028

Researcher: MR WELCOME BONGANI MAGAGULA

12 Hiller street Piet Retief 2380

PIET RETIEF

56341091@mylife.unisa.ac.za 0783904384

Supervisor: Dr Godfrey Thenga tshabg@unisa.ac.za

AN EVALUATION OF FIREARM EVIDENCE IN THE INVESTIGATION OF MURDER AT PIET RETIEF POLICE STATION, SOUTH AFRICA

Qualification: Master of Arts in Forensic Science and Technology

Thank you for the application for research ethics clearance by the College of Law_RERC for the above mentioned research study Ethics approval is granted for three years.

The **medium risk application** was **reviewed** by College of Law_RERC on 13/01/2025 in compliance with the Unisa Policy on Research Ethics and the Standard Operating Procedure on Research Ethics Risk Assessment.

The proposed research may now commence with the provisions that:

1. The researcher(s) will ensure that the research project adheres to the values and principles expressed in the UNISA Policy on Research Ethics.
2. Any adverse circumstance arising in the undertaking of the research project that is relevant to the ethicality of the study should be communicated in writing to the College of Law_RERC.
3. The researcher(s) will conduct the study according to the methods and procedures set out in the approved application.
4. Any changes that can affect the study-related risks for the research participants, particularly in terms of assurances made with regards to the protection of participants' privacy and the confidentiality of the data, should be reported to the Committee in writing, accompanied by a progress report.

Page 1 of 2

5. The researcher will ensure that the research project adheres to any applicable national legislation, professional codes of conduct, institutional guidelines and scientific standards relevant to the specific field of study. Adherence to the following South African legislation is important, if applicable: Protection of Personal Information Act, no 4 of 2013; Children's act no 38 of 2005 and the National Health Act, no 61 of 2003.

6. Only de-identified research data may be used for secondary research purposes in future on condition that the research objectives are similar to those of the original research. Secondary use of identifiable human research data requires additional ethics clearance.

7. No field work activities may continue after the expiry date 13/01/2028. Submission of a completed research ethics progress report will constitute an application for renewal, for Ethics Research Committee approval.

Additional Conditions

1. Disclosure of data to third parties is prohibited without explicit consent from Unisa.
2. De-identified data must be safely stored on password protected PCs.
3. Care should be taken by the researcher when publishing the results to protect the confidentiality and privacy of the university.
4. Adherence to the National Statement on Ethical Research and Publication practices, principle 7 referring to Social awareness, must be ensured: "Researchers and institutions must be sensitive to the potential impact of their research on society, marginal groups or individuals, and must consider these when weighing the benefits of the research against any harmful effects, with a view to minimising or avoiding the latter where possible." Unisa will not be liable for any failure to comply with this principle.

Note

The reference number 6226 should be clearly indicated on all forms of communication with the intended research participants, as well as with the Committee.

Kind regards,

Prof Lincoln Fitz
Chair of College of Law_RERC
E-mail: fitzlg@unisa.ac.za

Executive Dean / By delegation from the Executive Dean of College of Law_RERC
E-mail: budelm@unisa.ac.za

Annexure B: Permission Letter from the SAPS

SAP 21

SUID-AFRIKAANSE POLISIEDIENS **SOUTH AFRICAN POLICE SERVICE**

PRIVATE BAG/PRIVAATSAK X 5018

Navrae Enquiries	Lt.Col van Heerden
Telefoon Telephone	**(017) 826 9549**
Faksnommer Fax number	**(017) 826 2378**

OFFICE OF STATION COMMANDER
PIET RETIEF
2380

Mr Bongani Magagula
UNIVERSITY OF SOUTH AFRICA

RE: PERMISSION TO CONDUCT RESEARCH IN THE SOUTH AFRICAN POLICE SERVICE UNIVERSITY OF SOUTH AFRICA : MASTER DEGREE : AN ANALYSIS OF MODUS OPERANDI IN MURDER INVESTIGATIONS IN FIRE ARM EVIDENCE AT PIET RETIEF POLICE STATION : GERT SIBANDE DISTRICT : RESEARCHER : MR BONGANI MAGAGULA

1. The above subject matter refers.
2. You are hereby granted approval for your research study on the above mentioned topic in terms of National Instruction 4 of 2022.
3. Further arrangements regarding the research study may be made with the following office :

   Contact Person : Lt.Col S M van Heerden
   Contact Details : 071 473 1737 / 017 824 2618
   Email Address : vanheerdens2@saps.gov.za

   Contact Person : Captain S Gous
   Contact Details : 0826946076 / 017 824 2617
   Email Address : gous6@gmail.com

COLONEL
STATION COMMANDER : PIET RETIEF
N MKUPA

2025/02/13.

Annexure C: Informed Consent

INFORMED CONSENT

Dear Participant

You are invited to participate in a study entitled **"AN EVALUATION OF FIREARM EVIDENCE IN THE INVESTIGATION OF MURDER AT PIET RETIEF POLICE STATION, SOUTH AFRICA."**

The purpose of this study is to evaluate how firearm evidence is examined and utilised in murder investigations at Piet Retief Police Station. The study will explore current practices and develop practical recommendations to improve investigative effectiveness. This will enhance investigators' awareness and skills in the handling of firearm evidence.

Your participation in the study will include taking part in an interview. Your identity and that of your professional details shall not be revealed. Also, the information gathered shall be used strictly for the research project. No part of it shall be used to prejudice you in whatever way or form.

If you agree to participate in the study, kindly append your signature in the attached consent form, as proof thereof. Please note that you are at liberty to withdraw from the research at any given point.

Yours Faithfully,

Welcome Bongani Magagula

As per the terms outlined in the letter of consent, I hereby agree to participate in the study entitled: **AN EVALUATION OF FIREARM EVIDENCE IN THE INVESTIGATION OF MURDER AT PIET RETIEF POLICE STATION, SOUTH AFRICA**

_____	_____
Participant's signature	Date
_____	_____
Researcher's signature	Date

Annexure D: Document Checklist (Literature)

DOCUMENT CHECKLIST

Document Type	Research Question (RQ)	Checklist Item / What to Look For	Comments / Findings
Journal Articles	RQ1 – Role of Forensic Science in Crime Investigation	Discussion of forensic techniques (e.g., ballistics, fingerprints, DNA, toxicology); description of procedures and standards	
Books (Forensic Science / Criminal Investigation)	RQ2 – Role of Forensic Science in Murder Investigation	Explanations of homicide investigation processes, autopsy procedures, crime scene documentation	
Government or NGO Reports	RQ3 – Application of Firearm Evidence	Guidelines for firearm evidence collection, ballistic analysis, chain-of-custody procedures	
Academic Studies on Homicide Trends	RQ4 – Patterns of Murder	Patterns in weapon use, motive categories, offender–victim relationships	
Criminology Books / Articles	RQ5 – How Murders Are Committed	Behavioural patterns, weapon choice, situational triggers influencing homicide	
Evaluation Reports / Review Studies	RQ6 – Investigative Limitations and Barriers	Common challenges such as contamination, backlog, documentation issues, procedural lapses	
Legal or Policy Analyses	RQ7 – Consequences for Case Outcomes	Discussion of how evidence strength influences prosecution outcomes	
Forensic Ballistics Literature	RQ8 – Individualisation and Linking Evidence to Suspects	Methods for matching firearms to cases, ballistic comparison principles	
Evidence Handling Guidelines / Manuals	RQ9 – Contamination Prevention and Chain of Custody	Standards on evidence packaging, access control, documentation, storage	

Annexure E: Interview Schedule (SAPS)

INTERVIEW SCHEDULE

SECTION A: INTRODUCTION

TITLE: AN EVALUATION OF FIREARM EVIDENCE IN THE INVESTIGATION OF MURDER AT PIET RETIEF POLICE STATION, SOUTH AFRICA

I am Welcome Bongani Magagula, a graduate student who is currently conducting research for the degree – 'Master of Arts in Forensic Science and Technology" at the University of South Africa. My supervisor is Godfrey Thenga, who can be contacted at the University on 011 471 2869 and 012 4339408 email: tshabg@unisa.ac.za with regards to any matters pertaining to my research.

The purpose of this study is to evaluate how firearm evidence is examined and utilised in murder investigations at Piet Retief Police Station. The study will explore current practices and develop practical recommendations to improve investigative effectiveness. This will enhance investigators' awareness and skills in the handling of firearm evidence.

You are kindly requested to answer this interview questionnaire for the researcher.

SECTION: BIOGRAPHICAL INFORMATION

Instruction: Make a cross on the most appropriate correct answer

1.Gender: Male/Female

Male		Female	

2.Race: Black/White/Indian/Coloured

Black		White		Indian		Coloured	

3. What is your employment designation in the SAPS?

4. Rank:

Constable		Sergeant		Warrant officer		Captain	Lieutanant Conel		Conel	

5. How many years of service do you have in the SAPS?

2 to 5 years		6 to 10 years		11 to 20 years		More than 20 years	

1

6. What is your highest qualification?

Grade 10		Grade 12		Higher qualification		Higher certificate	
National Diploma		B-Tech/Honours degree		Master's degree		Doctoral degree	

7. Did you receive any training interviewing of murder complainants?

Yes		No	

8. Did you receive any training in responding to murder cases?

Yes		No	

SECTION C: ANALYSING THE POLICE RESPONSE TO MURDER CASES THROUGH THE USE OF FIREARM

With regard to murder cases in your area, please indicate the extent to which you agree or disagree with to the following statement.

Instruction: Make a cross on the most appropriate correct answer

1.The is a problem in policing of murder case through the use of firearm in your policing area.

Strongly Agree	Agree	Undecided	Disagree	Strongly disagree

2. Police are not effectively responding to murder.

Strongly Agree	Agree	Undecided	Disagree	Strongly disagree

3. Police officers need to get training in responding to murder cases.

Strongly Agree	Agree	Undecided	Disagree	Strongly disagree

4. There are not enough resources to assist in responding to murder cases.

Strongly Agree	Agree	Undecided	Disagree	Strongly disagree

OVERVIEW OF THE LEGAL FRAMEWORK ON POLICING IN SOUTH AFRICA

10. Who are the Role players in murder cases in South Africa?

11. What is the SAPS role in addressing murder?

12. What is the Legislative framework used in policing use of firearms in South Africa?

13. What is your view regarding the legislative framework implemented in controlling the use of Firearms in South Africa?

14. What are the strength and shortcomings of the current response mechanism by the SAPS to murder cases through the use of Firearm?

DEPARTMENTAL AND ORGANISATIONAL POLICIES RELEVANT WITH REGARD TO MURDER CASE THROUGH THE USE OF FIREARM

15. What type of training is provided to SAPS officers, and the number of officials who have undergone training specifically related to murder for the past six months?

16. What are departmental policies relevant with regard to responding to murder cases?

17. What is your view regarding the SAPS procedures relating to murder through the use of firearm incidents in your area?

18. What are the challenges that are compromised on the ability of the police to act in accordance with provision of the departmental polices relevant to cases of murder?

19. How to conduct a comparative analysis of the response mechanism used by the selected countries in murder cases?

OVERVIEW ON HOW MURDED CASES IS POLICED IN SOUTH AFRICA

19. How is murder policed in South Africa?

20. What is view regarding the SAPS responding to murder cases?

20. What is the view in regarding the formal responding to murder cases by the SAPS in your area?

21. What is the best way to deal with and respond to murder cases through the use of firearm?

Thank you for your participating in this interview, your participation is highly appreciated.

Annexure F: Turnitin Report

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This certifies that in November 2025, the following Master's Dissertation was submitted to us for professional language editing, which was duly performed.

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