



NATIONAL DEFENCE COLLEGE (KAREN)

**RESEARCH THESIS:
BIOTERRORISM THREAT AND ITS IMPLICATIONS ON NATIONAL SECURITY
IN KENYA**

**AUTHOR:
JULIUS KIPKORIR MUTAI**

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DISCLAIMER

The information contained in this paper is the result of my research. The views and or observations on this issue involved is my own. They do not in any way reflect the official position of the Ministry of Defence or that of National Defence College.

DECLARATION

This research thesis is my own original composition. It has not been presented in any other University.

Signature.....

Date.....

23/09/24

Julius Kipkorir Mutai
ND 601/0056/20203

SUPERVISORS' RECOMMENDATION

We confirm that the work reported in this thesis has been carried out by the candidate under our supervision

Signature.....

Date.....

24/9/2024

Dr. Zedekiah Sidha
Resident Lecturer,
National Defence University (KENYA)

Signature.....

Date.....

23/09/24

Dr. Mumo Nzau
Resident Lecturer,
National Defence University (KENYA)

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ABBREVIATIONS AND ACRONYMS

AU	African Union
BW	Biological Warfare
BWC	Biological Weapons Convention
CBRN	Chemical, Biological, Radiological and Nuclear
CDC	Center for Disease Control
COR	Conservation of Resource
COVID-19	Corona Virus 2019
CRISPR	Clustered, Regularly Interspaced, Short Palindromic Repeat
DNA	Deoxyribonucleic Acid
EMTs	Emergency Medical Technicians
IHR	International Health Regulations
KCA	Kenya Civil Aviation
KDF	Kenya Defence Forces
MAD	Mutually Assured Destruction
MFA	Ministry of Foreign Affairs
MOH	Ministry of Health
MST	Multiple Streams Theory
NCTC	National Counter Terrorism Center
NDC	National Defence College
NDU-K	National Defence University-Kenya
NIS	National Intelligence Service
NPS	National Police Service
RVF	Rift Valley Fever

SDS	Senior Directing Staff
SSA	Sub Saharan Africa
UK	United Kingdom
UN	United Nations
UNSC	United Nations Security Council
US	United States
USD	United States Dollars
VE	Violent Extremism
WHO	World Health Organization
ZDF	Zambian Defence Forces

OPERATIONAL DEFINITION OF TERMS

Biological Agents or bio-agents denotes virus, bacterium, parasite, protozoan, fungus and or toxins that can be employed purposely as a weapon in bioterrorism or biological warfare.

Biosafety refers to the safe working practices that are often associated with handling of biological materials, particularly those of infection and disease causing agents.

Bioterrorism denotes deliberate release of harmful agents such as bacteria, viruses, toxins and harmful bio-agents to cause serious illness or death to people, animals, foods and plants.

Challenges as used in the study, denotes (situation being faced with) something that needs great mental or physical effort to be done successfully and therefore tests a person's ability.

Development in the study denotes a process that creates growth and brings in social, environmental, political, economic, and cultural progress and positive changes.

National security denotes the approach to both national and international security that gives primacy to national beings and all their social, economic and environmental interactions.

National Development is the country's capacity to raise its residents' living standards (citizens). Providing individuals with basic livelihood requirements and supplying them with employment opportunities, better homes, and businesses can achieve it.

Opportunity in the context of the study refers to an occasion or situation that makes it possible to undertake an activity that gives immediate gains or rewards.

Terrorism "Criminal acts, including against civilians, committed with the intent to cause death or serious bodily injury, or taking of hostages, with the purpose to provoke a state of terror in the general public or in a group of persons or particular persons, intimidate a population or compel a government or an international organization to do or to abstain from doing any act

ABSTRACT

Bioterrorism presents a substantial global threat to national security, with potentially catastrophic outcomes. The primary aim of this research was to evaluate Kenya's preparedness to tackle bioterrorism. The study specifically sought to grasp the nature of bioterrorism as a threat to Kenya's national security, assess the legal and policy framework addressing bioterrorism, and gauge Kenya's readiness to confront such threats. Employing a mixed-methods approach, questionnaires were administered to various stakeholders, encompassing policymakers, security professionals, healthcare experts, and the general public. Furthermore, in-depth interviews and document analysis were conducted to gain comprehensive insights into the research objectives. The results unveil a nuanced understanding of bioterrorism as a multifaceted hazard to Kenya's national security. While existing legal and policy structures demonstrate dedication, gaps in execution and enforcement impede their efficacy. Kenya's preparedness levels fluctuate among stakeholders, with some expressing confidence in current measures, while others highlight deficiencies in technological capabilities and resource distribution. Notably, a significant proportion of respondents at 59 % are in agreement that global advancements in technology have heightened the risks and magnitude of bioterrorism. In summary, Kenya's endeavors to combat bioterrorism encompass legislative, policy, and operational measures. Nevertheless, enhanced coordination, capacity-building, and resource allocation are imperative to effectively address identified shortcomings. The study underscores the significance of proactive measures and holistic strategies in fortifying national security resilience against bioterrorism threats. Drawing from the findings, the study proposes several recommendations including; Strengthening collaboration and coordination among relevant stakeholders; Investing in technological infrastructure and capacity-building endeavors to enhance surveillance and detection; Regular assessments and revisions of existing legal and policy frameworks are also advised to ensure their pertinence and efficacy in addressing evolving bioterrorism threats. Further research is warranted to explore the socio-economic ramifications of bioterrorism incidents in Kenya and devise strategies to mitigate their impact. Assessing public awareness and perception of bioterrorism risks to inform targeted communication and educational campaigns is indispensable. Additionally, studying international best practices and drawing lessons from other nations' experiences in countering bioterrorism would be advantageous for policy and strategy development in Kenya.

CHAPTER ONE

INTRODUCTION

1.0 Introduction

The subject of terrorism is continually evolving, and no single definition is universally accepted. Despite this, numerous UN resolutions and documents offer working definitions and descriptions. One frequently cited definition is found in UN Security Council Resolution 1566 (2004), which characterizes terrorism as: "Criminal acts, including against civilians, committed with the intent to cause death or serious bodily injury, or taking of hostages, with the purpose to provoke a state of terror in the general public or in a group of persons or particular persons, intimidate a population or compel a government or an international organization to do or to abstain from doing any act." (*Working Group Established Pursuant to Resolution 1566 (2004) | Security Council*, n.d.) In recent times, the world has witnessed a growing wave of violent extremism that has taken the lives of many people, destroyed property, created insecurity, and caused panic among states.

1.1 Background of the Study

Terrorism has grown in complexity and sophistication recently due to the economic downturn, the increase in technology, and the emergence of failed states (Newman, 2018). Therefore, years ago, the idea of a disease outbreak resulting from the deliberate release of pathogens or toxins (bioterrorism) in major cities seemed unimaginable. According to Stoeva (2020), the growing danger of terrorism has raised concerns about the potential use of microorganisms as biological weapons. It is necessary to assess this risk and understand the historical background and utilization of biological agents. Olivera (2020) states that advancements in biotechnology and biochemistry have made creating and manufacturing these weapons easier. Newman (2018; Ali, Nzau & Khannenje, 2018; Abozaid, 2020; Siegel, 2021; Nzau, 2023) argues that genetic engineering possesses a highly perilous capacity. According to Kim & Lee (2021), the simplicity of production, wide accessibility of bio-terror agents, and technological expertise have contributed to the

increasing potential for bioterrorism and a growing interest among emerging nations in acquiring them.

According to Stoeva (2020), a bio-terror strike targets a civilian population through the deliberate release of biological agents. Ideological aims, whether political or religious, drive this spread, causing significant casualties and inflicting economic damage. Biological agents can be utilised in their natural state or alter them to enhance widespread distribution, leading to increased mortality due to resistance against existing medications and vaccines.

According to Kim and Lee (2021), it is essential to determine the specific agent responsible for a potential bioterrorism assault. This is important not only to avoid causing fear in the community, but also to effectively manage the illness and death rates associated with the spread of the agent.

According to Olivera (2020), the focus on studying bioterrorism resurfaced due to the difficulties that developed after the well-known Amerithrax mailing attacks in 2001. Otieno, et al (2016) conducted a comprehensive survey to assess the bio-security measures in Africa. The survey specifically focused on various categories of laboratories, including training laboratories, national diagnostic laboratories, veterinary diagnostic laboratories, and research institutes. The aim was to evaluate the capacity of these facilities in terms of bioterrorism prevention and laboratory safety. In their study, Chung, Baum, and Nyquist (2020) discovered that Kenyan laboratory facilities harbour numerous biological agents that pose a significant risk to biosecurity and bioterrorism, potentially compromising national security.

Siegel (2021) argues that the crucial factor in controlling bioterrorism assaults is the ability to recognise and promptly investigate them. Olivera (2020) asserts that epidemiologists and national security professionals play a crucial role in not only assessing the extent and severity of an assault but also in effectively carrying out interventions. According to Abozaid (2020), national security

is an approach to national and international security that prioritizes the nation's well-being and intricate social and economic interactions.

According to Olivera (2020), bioterrorism is the deliberate release of biological agents as a means of carrying out acts of terrorism. We inadequately comprehend the precise characteristics of bioterrorism in the contemporary world, as radical ideologies can manifest across various domains such as politics, religion, and gender dynamics. Tinnes (2020) defines *bioterrorism* as the deliberate dissemination of bacteria, viruses, protozoa, and other pathogens to cause illness or death. One example of a potential biological weapon is *Bacillus anthracis*, a type of bacteria that is known to produce anthrax.

The United Nations (2019) defines the core components of national security as primarily encompassing economic, environmental, food, health, political, personal, and community aspects. Tinnes (2020) highlights that a bioterrorism attack in a public location poses a significant national security concern. Consequently, this study aims to raise public awareness regarding bioterrorism as a threat. Kenyan authorities assert that their investigations have revealed the involvement of a terrorist network with ties to Syria and Somalia in the recruitment of university students and other young Kenyans.

According to Adan (2020), Kenya has implemented measures in partnership with the United States to protect against the potential threat of a bioterrorist strike. Criminals in the Republic of Kenya have obtained dangerous pathogens like anthrax, Rift Valley Fever (RVF), and Ebola, which they could potentially use as weapons of mass destruction. There is now a significant need to address the issue of bioterrorism as a threat to national security in Kenya.

1.2 Statement of the Problem

Recent times have seen an increased spread and sophistication of terrorism activities, posing significant threats to states, families, and individuals. Bioterrorism and the use of biological agents can exacerbate these threats, leading to mass casualties, epidemics, and illnesses among workers. Despite the potentially devastating consequences, the impact of bioterrorism on national security remains inadequately researched. The African continent, including Kenya, faces considerable challenges in combating bioterrorism and its implications for national security. Addressing these challenges will improve preparedness and response capacities, offering protection against both bioterrorist attacks and naturally occurring public emergencies. The urgent need to prevent bioterrorism in Kenya is underscored by the risk of potential attacks. Detecting threats at the planning and preparation stages is the best defense against bioterrorism. Therefore, it is critical to implement necessary actions in Kenya to effectively address bioterrorism as a threat to national security. This study aims to explore and develop the strategies, frameworks, and measures needed to mitigate the "Bioterrorism Threat and Its Implications on National Security in Kenya."

1.3 Objectives of the Study

The general objective of this study was to examine the extent of bioterrorism threat and its implications on national security in Kenya. The study sought to achieve the following objectives;

- (i) To determine the magnitude of bioterrorism as a threat to Kenya's national security.
- (ii) To evaluate the adequacy of the legal and policy framework in supporting efforts against bioterrorism in Kenya.
- (iii) To examine the level of Kenya's preparedness to fight bioterrorism.

1.4 Research Questions

The study sought to answer the following research questions;

- (i) What is the magnitude of the threat of Bioterrorism in Kenya?
- (ii) How adequate are the legal and policy framework on Bioterrorism in Kenya?
- (iii) What is the level of Kenya's preparedness to fight bioterrorism?

1.5 Justification of the Research

The rationale for this research is the justification for undertaking the study. Africa, particularly Kenya is a signatory to the United Nations Security Council (UNSC) resolution that prohibits use of biological toxins that could pose a threat to global peace (United Nations, 2019).

1.5.1 Policy Justification

This study aims to raise public awareness about bioterrorism as a threat to national security in Africa, with a specific focus on Kenya. Consequently, this research seeks to empower policymakers in Africa to assemble teams that can implement the crucial first step in preparing for bioterrorism: surveillance.

1.5.2 Academic Justification

The deliberate dissemination or potential dissemination of biological agents (such as viruses, bacteria, fungi, or their toxins) to induce illness or mortality among a nation's population or agricultural resources in order to instill fear in civilians or exert control over the government has emerged as a tangible prospect in the current context of heightened terrorist operations (Tinnes, 2020). Early detection and prompt investigation are critical for containing such attacks. Therefore, this research intends to inform academia, scholars, and research facilities handling harmful diseases about the importance of complying with international biosafety and biosecurity standards. Kenyan institutions of higher learning and state-funded research agencies have invested in programs aimed at enhancing biosecurity measures and tactics in the country.

1.6 Significance of the Study

In recent years, the complexity and scale of terrorism have surged globally. Bioterrorism, as highlighted by Adan (2020), can disrupt governments, weaken civil society, endanger peace, stability, and security, and threaten social and economic progress. These factors significantly affect national security satisfaction levels (United Nations, 2019). The cross-border nature of terrorism and violent extremism underscores the critical importance of international collaboration in detecting, identifying, and disrupting violent extremism, as well as apprehending terrorists and ensuring they face legal consequences. National security is a nation's inherent right, and safeguarding citizens is a primary government responsibility (United Nations, 2019).

Throughout history, from ancient times mentioned in the Bible to the present day, illnesses and bioterrorism toxins have been used as weapons of war (Tinnes, 2020). Historically, bioweapons have primarily targeted national populations. States are responsible for safeguarding the fundamental rights of their citizens by implementing proactive measures against bioterrorist threats and apprehending those responsible. Modern, commercially available technologies now allow for the large-scale production of bioweapon agents in small-scale facilities at a relatively low cost, eliminating the need for specialists and advanced research facilities.

1.7 Assumptions of the Study

Terrorism is a diverse and complex phenomenon, with terrorist groups differing widely in their psychology, motivation, and decision-making structures. Therefore, a thorough exploration of bioterrorism is necessary. Africa faces the potential threat of using naturally occurring or genetically modified agents to cause mass spread, leading to higher mortality or resistance to existing medicines and vaccines, which remains unaddressed. United Nations Security Council

resolutions prohibit the use of biological toxins that could endanger world peace and health security, providing strong motivation for this study.

This research aims to provide information and encourage future conversations and research on the emerging issue of bioterrorism. It will also highlight the necessary measures that institutions in Kenya must take to prevent the acquisition of biological agents and materials by individuals with malicious intentions, thereby mitigating potential harm.

1.8 Scope and Limitations of the Study

The scope of research pertains to the limits and magnitude of a study, delineating its precise goals, target population, variables, and methodologies, so enabling researchers to concentrate and offer a lucid comprehension of the subject matter under investigation.

1.8.1 Scope of the Study

The researcher specifically targeted the area's most heavily impacted by terrorism in Nairobi County for this study. The research endeavour spanned between 2014 and 2024, providing a comprehensive view of the region's evolving landscape of bioterrorism threats.

1.8.2 Limitations and Delimitations

This study on bioterrorism threats and their implications for national security in Kenya faced limitations related to data accessibility, as comprehensive information on biological agents and relevant policies was often restricted due to security concerns. Additionally, logistical challenges hindered efforts to engage experts and conduct public perception surveys, which could have provided valuable insights. Delimitations included a focus on Nairobi County, which may not fully

represent the national context, and the exclusion of certain bioterrorism aspects, such as historical case studies, due to time constraints.

1.9 Chapter summary

The chapter examined the growing threat of bioterrorism, where biological agents are deliberately used to cause harm and panic, within the broader context of evolving terrorism. It highlights how technological advancements have increased the feasibility of creating biological weapons, complicating the global terrorism landscape. Focusing on Kenya, the research assesses the nation's vulnerability due to inadequate biosecurity measures, evaluating its legal frameworks and preparedness to counter bioterrorism. Emphasizing early detection, response, and international cooperation, the study calls for enhanced surveillance and biosecurity in Kenya to prevent the misuse of dangerous pathogens and protect national security.

CHAPTER TWO

LITERATURE REVIEW

2.0 Introduction

This chapter gives a comprehensive literature review from research books, articles, periodicals, and scholarly journals on the research objectives under study. This literature review encompassed a theoretical review, an empirical review, a theoretical framework, and an analysis of the study's gaps. This section was further divided into sub-headers guided by key sub-topics.

2.1 Theoretical Literature Review

The theoretical literature serves as a comprehensive assessment of established theories, providing a framework for formulating the arguments the research study wants to further. This section comprises theories formulated by scholars to elucidate emergent occurrences, establish correlations, and formulate predictions.

Most industrialized and emerging nations view the risk of biological warfare as unlikely. Nevertheless, the fear of bioterrorism, which involves the use of biological pathogens as weapons by extremists against civilian populations, is significant (Okello, 2014). There are nations and rebel organisations that possess both the will and the ability to deliberately create highly hazardous germs and use them as weapons in acts of terrorism. Urie Bronfenbrenner developed the Ecological Systems Theory.

Bronfenbrenner posits that the microsystem level exists (Bronfenbrenner, 1995). The relationship between biotic and abiotic variables is direct. The Ecological Systems Theory was founded on the premise that it consists of five distinct layers. According to Bronfenbrenner (1998), this level is considered the one most closely connected to the individual. Bronfenbrenner (1994) conceptualises a child's environment as a network of external things organised at hierarchical levels, each of which significantly influences a child's development. At this stage, the designation

changed to bio-ecological system theory. The study demonstrated the significant influence of a child's biology as the primary environment, as well as the varying impacts of the same conditions on different kinds and subspecies of cattle.

Okello (2014) asserts that the Regional Environmental Security Complex Hypothesis serves as a tool for evaluating the threat of bioterrorism to national security. Ravenhill (2017) emphasizes that understanding the Regional Environmental Security Complex theory necessitates recognizing the global nature of environmental security issues. This is because environmental degradation affects the entire planet's ecosystem. Nevertheless, the regional level should address environmental concerns that transcend national borders, specifically those that only extend beyond a regional boundary (Braden, 2000).

According to McGwire (2012), the Conservation of Resources (COR) theory, initially proposed by Steven E. Hobfoll in 1989 posits that individuals strive to acquire, maintain, and protect their resources. The theory explains the reason for nations' efforts to preserve their existing resources while seeking new ones. Ravenhill (2017) highlights that the COR theory has gained significant recognition as one of the most frequently referenced ideas in organisational psychology and behavior. Various domains along the stress continuum, including burnout and traumatic stress, have applied the COR hypothesis. Additionally, confirming the theory's importance, the COR theory serves as the primary foundation for the job demands-resources model, a more specific theory on organisational stress in the workplace. One great thing about COR theory is that it can lead to a lot of different hypotheses that are more general than those that come from theories that focus on a single resource, like control, or that talk about resources in a general way (Okello, 2014). The World Health Organisation (WHO) classified coronavirus 2019 (COVID-19) as a global emergency, presenting a significant risk to many sectors, such as healthcare, agriculture, and manufacturing. The COVID-19 pandemic has significantly impacted how people view the

modern world, prompting serious concerns about the fundamental aspects of daily life due to its high number of deaths and illnesses (Mukeka & Ogutu, 2019). The sickness and the risk of transmission have led to stringent global restrictions, limiting travel and trade, imposing quarantine measures on billions of individuals, resulting in a substantial economic downturn, and interrupting supply networks for food and manufactured goods.

The current deterrence theory is undergoing a revival. Defence researchers express concern about the inadequate security measures in Kenya's laboratories, which may need help to withstand the threat posed by regional terror groups such as Al Shabaab. According to reports, these groups are actively searching for ingredients to create bioterrorism weapons. Otieno et al. (2016). The setback for deterrence theory and practice stems from its theoretical framework's rapid and premature growth. The concept of deterrence has undergone deliberate and significant expansion, encompassing new and unfamiliar domains. This broadening of meaning has resulted in occasional confusion. González-Candelas (2017) suggests that an influential aspect of the psycho-sociological study tradition is the concept that terrorism has a 'contagious' nature. The idea, proposed by Martha Crenshaw in 1983, posits that bioterrorism assaults do not happen randomly. Instead, there is a discernible pattern of periodic cycles in the frequency of these attacks, often referred to as waves of bioterrorism.

2.2 Empirical Literature Review

The review begins with a systematic exploration of existing literature in order to gain a profound understanding of empirical studies on the extent of bioterrorism as a threat to national security. Moreover, it allows for the identification of research gaps that warrant further investigation, thereby setting the stage for the study to contribute new insights and knowledge in this field.

2.2.1 Concept of Terrorism

Currently, different governments' political and economic interests worldwide influence the concept of terrorism, making it highly subjective (Olivera, 2020). According to Wakhungu and Njiruh (2015), terrorism continues to be a significant subject of concern for governments worldwide because of the severe consequences it can cause. The counterterrorism instruments, both universal and regional, are considered the latest additions to the existing set of instruments.

According to Records (2003), terrorism originates in the Latin word 'terrere,' which means 'to fear.' The term "terrorism" acquired its contemporary meaning during the Reign of Terror in France. The Roman Empire employed a wide range of violent methods, including the crucifixion of people and even large-scale genocide, in order to compel individuals and nations to submit to their authority. Over a few months during the French Revolution, the guillotine executed over 20,000 individuals. Notable instances of severe state terrorism in recent history include Nazi Germany, the Stalinist Soviet Union, communist China during Mao's rule, Pol Pot's Cambodia, and various other dictatorships and totalitarian regimes.

According to Silke (2019), a terrorist is one who aims to advance his deluded cause by using tactics of intimidation and force, with the sole aim of spreading fear and panic to destabilise the existing government. While various types of terrorism exist, it is important to understand their trends and patterns in order to coordinate prevention and adequate response strategies (Zhenmin, 2020).

The threat of terrorism is spreading and destabilizing many regions around the world. For instance, the rise of violent extremism in Africa has created threats resulting in death, destruction, and instability in states where terrorist groups operate. Schmid and Forest (2021) posit that bioterrorism refers to terrorism attacks that are considered the deliberate release of viruses, bacteria, or any other germs with the sinister aim of causing illness or death. Nature often harbors these subsequently released germs.

Koehler (2019) argues that the key differentiating factor between a terrorist and other extremists is their unwavering dedication to carrying out acts of extreme violence. Violent extremism is defined as the convictions and behaviours of individuals who endorse or employ violence driven by ideological, religious, or political motives in order to attain extreme ideological, religious, or political stances (United Nations, 2019). According to Otieno et al. (2016), the susceptibility to potential acts of terrorism is an inevitable consequence of a society that values freedom and democracy.

The precise characteristics of bioterrorism in the contemporary world are inadequately comprehended, as radical ideologies can manifest across various domains, such as politics, religion, and gender dynamics. According to Koch and Maiguy (2021), bioterrorism is the deliberate dissemination of bacteria, viruses, protozoa, and other pathogens to cause illness or death. One possible agent employed in a biological attack is *Bacillus anthracis*, a bacterium known to cause anthrax.

2.2.2 Background of Bioterrorism

According to Chung (2020), bioterrorism refers to the deliberate release of hazardous biological agents as a means of carrying out acts of terrorism. This is because, throughout history, nations have frequently employed toxic substances for the goal of assassinations, both targeting specific individuals and occasionally even entire armies. As early as the sixth century, historical records claim that the Assyrians intentionally contaminated water supplies with the fungus *Claviceps purpurea*, also known as rye ergot, as a form of biological warfare (Zhenmin, 2020). Instances of deliberate poisoning commonly referenced include the Tartar army's act of flinging the corpses of plague victims over the city walls of Kaffa in 1346 and the British's transmission of smallpox through infected blankets to the Native American people loyal to the French in 1767.

The probability of using the agent and the level of danger each agent presents determine the categorization. For anyone interested in acquiring further knowledge about a particular agent or condition, hyperlinks accompany the agents and the disorders they induce (Stoeva, 2020). Nevertheless, memorising all the intricate data about each agent is very challenging for most individuals. Public comprehension of the peril of bioterrorism and the appropriate course of action in the event of a terrorist attack is of utmost importance. In order to address this situation, it is necessary to create a bioterrorism-ready plan that will establish an effective communication system among public health agencies, hospitals, and the civilian population. This includes sharing medical and epidemiological information between public health and law enforcement agencies, understanding the legal and administrative measures required for a bioterrorist attack, and implementing environmental monitoring.

According to Zhenmin (2020), Afghanistan reportedly used mycotoxins, or fungal poisons, in a phenomenon known as 'yellow rain.' The proliferation of religious cults and radical political factions has contributed to the heightened risk of bioterrorism or biological threats in contemporary times. According to Olivera (2020), chemical, biological, radiological, and nuclear (CBRN) dangers are highly significant and imminent risks due to their anticipated profound impact on impacted societies. Olivera (2020) asserts that the lack of a significant CBRN incident by non-state actors does not mean that terrorists are not actively pursuing the acquisition of dangerous materials. Otieno et al. (2016) state that it is crucial to avoid terrorists acquiring CBRN materials and compounds. To accomplish this task, researchers must thoroughly investigate and chart all the resources employed in the study of bioterrorism. According to Stoeva (2020), biological weapons are agents used in conflict that intentionally and directly or indirectly impact nations, animals, or flora.

Silke (2013) asserts that the weaponization and dissemination of bio-terror substances, including poisons, can take the form of liquid droplets, aerosols, or dry powder. Zhenmin (2020) emphasizes the influence of bioterrorism on health security in the twenty-first century international system. The author emphasises that emergency medical technicians (EMTs) play a crucial role as the initial responders in bioterrorism incidents. Therefore, the Multiple Streams Theory (MST) examines their practices, preparedness, and policy implications. The results of this analysis confirm that bioterrorism is a genuine threat. Strengthening bioterrorism readiness among EMTs will have additional consequences for societal transformation through the development of policies aimed at improving and modernising community-based bioterrorism preparedness programmes.

According to Carus (2017), security officials in the Asia-Pacific region should not only address the ongoing risk of new and re-emerging infectious illnesses, but also be prepared for the potential use of infectious organisms as weapons by terrorists to further their goals. Conventionally, we characterize security threats as coming from outside the state, stemming from the anarchic nature of the international system, and being either terrorist or military in nature. Bioterrorism is a diverse and complex occurrence. Terrorist groups and organisations vary widely regarding their psychology, motivation, and decision-making structure. Koch and Maiguy (2021) define religious terrorism as the actions of groups aiming to establish a religious, social, and political structure. This includes two categories: groups that adhere to an extreme interpretation of mainstream religious beliefs and non-traditional religious groups that represent new religions, such as Aum Shinrikyo, which was responsible for the 1995 sarin nerve gas attack on the Tokyo underground system.

In their study, Koch and Maiguy (2021) analyse the potential risks of bioterrorism in the modern day, specifically focusing on the utilisation of biological weapons. This narrative explores how nations see modern biological threats by examining the political, scientific, and historical origins

of biological warfare (BW). Keshavamurthy, Thumbi, and Charles (2021) argue that bioterrorism is an intricate system that spreads disease-causing organisms or toxins to cause injury or death to nations, animals, or plants. Biological weapons come in various forms but typically comprise two components: a weaponized biological agent and a delivery system (Zhenmin, 2020). In the majority of our country's history, efforts to transfer illnesses were infrequent and inept; they likely needed more success, and if they did, they were likely unnecessary since natural routes of transmission were already present.

2.2.3 Nature of Bioterrorism as Threat to National Security

Carus (2017) documents bioterrorism occurrences as early as 1800. However, the United States' 2001 anthrax attack marked the beginning of bioterrorism's recognition as a significant public health hazard. Stoeva highlights that bioterrorism was a sensitive topic in Africa that had received little attention or coverage until recently. According to Chung, Baum, and Nyquist (2020), bioterrorism and other severe biological occurrences can lead to a vast number of casualties, widespread illness, sickness among healthcare workers, contamination of the environment, legal complications, and anxiety within the medical community and the general public. According to Botha (2013), bioterrorism has detrimental effects on all aspects of national security. Therefore, it is advisable to stay informed through the news media about the symptoms to watch out for and the appropriate time to seek medical attention. The healthcare system cannot accommodate the entire community's request for disease testing.

According to Carus (2017), bioterrorism has a significant and immediate effect on national health, resulting in severe consequences for the ability of victims to enjoy their right to life, liberty, and physical well-being. Koch and Maiguy (2017) assert that Al Qaeda established a bioterrorism initiative during the late 1990s. *Biological terrorism* can be broadly defined as the deliberate release of biological agents or toxins to cause harm to humans, animals, or plants.

Lee (2021) defines *bioterrorism* as a deliberate biological attack aimed at undermining national security. It is commonly believed that a biological attack requires four essential components: perpetrators, agents, means of delivery, and targets. González-Candelas (2017) asserts that increasing discussions in the United States (US) regarding the potential risks associated with bioterrorism, to some extent, influenced the motivation behind the event. Regardless, the programme was still in its early developmental phase in September 2001. Carus (2017) states that despite the group's advancements in building a laboratory in Afghanistan, there is no proof of their acquisition of any biological agents. Koch and Maiguy (2017) contend that the issue of bioterrorism in Africa has faced scepticism, with some asserting that developing and utilising bioterrorism weapons is more challenging than commonly believed. Zhenmin (2020) argues that sceptics believe that technical issues may not pose a substantial limitation in sub-Saharan Africa (SSA). Tacit knowledge, an unrecorded and crucial piece of information necessary for the utilisation of scientific and technological advancements in the creation of biological weapons, is familiar to a diminishing set of practitioners in the field of BW but remains unknown to other experts in the biological sciences.

According to González-Candelas (2017), the prevalence of naturally occurring infections in East Africa and the increasing incidence of Ebola raise concerns about the potential availability of these pathogens by individuals with evil intentions. Pathogenic microorganisms naturally exist in the East Africa region and are available to anyone with sufficient expertise to induce illness intentionally. Given the same circumstances, it is reasonable to assume that Eastern Africa, along with other regions, is susceptible to the potential danger posed by bio-weapons. According to the Kenyan authorities, their investigations revealed that the terrorist network, which had affiliations in Syria and Somalia, engaged in the recruitment of university students and other young individuals in Kenya.

2.2.4 Legal and Policy Framework for Fighting Bioterrorism

Despite the unlikely occurrence of a biological strike by terrorists or a hostile nation, public health emergency response still requires careful planning. Multiple cross-agency simulations have revealed vulnerabilities in bio-emergency response systems (Zhenmin, 2020). These exercises have facilitated the concentration of planning efforts on the necessity of emergency plans to tackle the possibility of a significant bioterrorism incident that might overpower medical capacities, result in widespread sickness and fatalities, and result in economic and social upheaval.

Effectively implementing vaccines, antibodies, and other medications during a bioterrorist incident depends on several critical factors. These include the potential number of individuals at risk, the reliability of the emergency transportation system, the accessibility of viable vaccines and drugs, and the capacity of the healthcare system to effectively communicate with the public and distribute the necessary treatments to those in need. According to Carus (2017), the risk of bioterrorism is increasing due to technological advancements, the rapid growth of the global biotechnology industry, and the emergence of loosely connected transnational terrorist groups that have shown interest in bioterrorism. These elements expand the range of materials, technologies, and knowledge required to create a biological weapon, reducing the difficulty of carrying out bioterrorism and its spread.

González-Candelas (2017) asserts that there is growing apprehension among scientists about the increasing accessibility of a contemporary method known as Clustered, Regularly Interspaced, Short Palindromic Repeat (CRISPR), which enables even non-professionals to commence experimentation. The technology functions as a molecular tool that can precisely remove deoxyribonucleic acid (DNA) coding sections and substitute them with new sequences. This innovative method is currently accessible in the marketplace, allowing anyone to purchase specific do-it-yourself kits that have the potential to result in significant complications. Kim & Lee (2021)

suggest that the moral or political abhorrence of biological weapon deployment may attract governments or non-state actors to bioterrorism.

Keshavamurthy (2021) asserts that altering or mutating agents of bioterrorism can adversely affect health security systems by increasing their virulence and ability to cause disease. Bioterrorists can engineer them to resist current medications and spread through air, food, water, fomites, or infected hosts (including nations, animals, insects, and other reservoirs). Carus (2017) emphasizes that healthcare first responders, being at the forefront of dealing with potential casualties, need to enhance their ability to detect and respond to bioterrorist attacks with preventative measures to meet today's local, international, and regional challenges. As a result, first responders will need to be aware of potential bioterrorism agents, know how to rule them out, know how to detect and diagnose bioterrorism agents, and know the treatment options available for the agent used.

According to Chung et al. (2020), Kenya sometimes addresses bioterrorism by ensuring consultation on the legal and regulatory framework for the establishment of Strategic Trade Controls (STC) of dual-use goods in line with United Nations (UN) Security Council Resolution 1540, protecting domestic producers and industries from unfair trade practices through the application of appropriate trade defense instruments, and promoting public-private sector and civil society organizations' (CSOs) participation in international trade matters.

Keshavamurthy (2021) says that Kenya has faced growing acts of violent extremism over the last few years. With the advent of genetic engineering and gene synthesis, there is fear that some of these groups may use more sophisticated methods, including the development of biological weapons. Kenya has taken specific actions to deal with these threats through legislation and other initiatives.

According to Chung *et al.* (2020), Kenya's legislation focuses on biosafety, not biosecurity. This means the legislative framework focuses on preventing non-intentional acts (biosafety) and not

deliberative actions of aggression or attack from bioterrorism or bio-threats (biosecurity); for example, Article 2(5) of the Constitution provides that the general rules of international law shall form part of the law of Kenya. Article 2(6) further states that any treaty or convention ratified by Kenya shall be incorporated into Kenyan law. This means that if Kenya ratifies the BWC, it will automatically become part of Kenya's laws. The Treaty Making and Ratification Act provides a legal framework for ratifying treaties requiring parliamentary approval. Other laws include the Plant and Seed Varieties Act, the Noxious Weeds Act, the Environmental Management Act, the Crop Act, and the Industrial Property Act.

The COVID-19 outbreak in Kenya has generated significant disruption and anxiety, leading to increased awareness and discussion about the potential of biological terrorism. In 2019, the United Nations acknowledged that the COVID-19 outbreak has heightened awareness about the threat of biological terrorism, while also emphasizing that the international community has been grappling with these legal issues for a considerable amount of time. Reports have recently surfaced of intentional use of biological agents for malevolent purposes.

2.2.5 Level of Kenya's Preparedness to Fight Bioterrorism

Keshavamurthy (2021) asserts that the risk of a devastating biological event is increasing due to global travel, urbanisation, terrorist interest in weapons of mass destruction, and rapid technological advancements. These factors may lead to the development and manipulation of pathogens that have the potential to cause a pandemic. However, numerous African nations need more capability to address some challenges. According to Kim & Lee (2021), in April 2019, the Africa Centre for Disease Control (CDC) initiated a programme to enhance the biosecurity and biosafety systems of African Union Member States in order to meet the requirements of the International Health Regulations (IHR) (2005), the Biological Weapons Convention (BWC), and United Nations Security Council Resolution (UNSCR) 1540.

According to Carus (2017), comprehending and measuring the consequences of a bioterrorist assault is critical for advancing public health readiness in response to such an attack. In 2021, Keshavamurthy developed a model to assess the effects of three traditional biological warfare agents when dispersed as aerosols in a suburban area of a major African city. According to Newman (2018), the model demonstrates that the economic consequences of a bioterrorist strike can vary from approximately 477.7 million USD per 100,000 individuals exposed (in the case of brucellosis) to almost 26.2 billion USD per 100,000 individuals exposed (in the case of anthrax). As a result, promptly implementing a post-attack prophylaxis program is the most crucial method for minimizing these losses in Africa. The model employs an insurance parallel to provide an economic rationale for taking preparedness actions.

Siegel (2021) argues that national security needs to focus more on the existing body of security literature as a security component. Therefore, a bioterrorism attack scenario in Africa would pose significant challenges to health security and the protection of those affected. Additionally, environmental pollution could constitute an ongoing danger to the community. The interplay between collective and individual components of health security, such as protection against infectious organisms, risk factors associated with non-communicable diseases, and chemical and nuclear threats, demonstrates the influence of bioterrorism on national security in Africa. Enhancing individual health security by accessing vaccines and medicines can lead to collective health security which is crucial for preparedness in fighting bioterrorism. (Mannes 2008)

González-Candelas (2017) argues that the pathogens responsible for anthrax, plague, brucellosis, smallpox, viral encephalitis, and viral hemorrhagic fevers are of significant concern. It is relatively easy and inexpensive to produce these pathogens. These pathogens can spread as aerosols, covering vast geographical regions and causing fatal or debilitating diseases. Koehler (2019)

asserts that if unleashed in optimal environmental conditions, these agents have the potential to infect hundreds of thousands of individuals, posing a significant threat to health security and resulting in fatalities in African countries such as Kenya. Bioterrorism and other severe biological incidents can lead to a large number of casualties, widespread illness, sickness among healthcare workers, contamination of the environment, legal complications, and anxiety within the medical community and the general public (Koehler, 2019).

Keshavamurthy (2021) highlights bioterrorism's significant risk to individual health security in Kenya. Individual health security is a fundamental national right, and it is the government's responsibility to protect them accordingly (Mannes, 2008). Therefore, it is the responsibility of states to safeguard the fundamental rights of their citizens and others by implementing proactive measures to shield them from the danger of bioterrorist activities and apprehending those responsible for such crimes (Wakhungu & Njiruh, 2015).

According to Barston (2006), early discovery and prompt inquiry are crucial to controlling such attacks. Mannes (2008) asserts that a health epidemiologist's function is crucial in assessing the extent and severity of an outbreak and efficiently carrying out interventions. This study aims to raise awareness about the threat of bioterrorism as a severe health security issue in Africa, specifically focusing on Kenya's preparedness to fight bioterrorism. The state of the nation's health security is crucial in determining its capacity to effectively prepare for and handle an infectious disease outbreak or bioterrorist assault. The expanding fields of biotechnology and bioengineering may have proportionately contributed to the occurrence of bioterrorism. According to the Biosecurity Survey conducted in Kenya in 2019, the Republic of Kenya has experienced several severe plant and animal disease outbreaks in recent years. The occurrences encompassed coffee berry disease throughout the 1960s, 1970s, and 1980s; Rift Valley Fevers (RVF) in animals in 1980; a potentially fatal maize mosaic virus; a blast in rice; and aflatoxins, among other instances.

These attacks have extensive implications for national health and food security. Zhenmin (2020) asserts that fatalities have occurred in nations where individuals have consumed products tainted with illness infections, such as RVF and aflatoxins. If these breakouts were indeed acts of terrorism, Kenya must enhance its vigilance and surveillance.

Zhenmin (2020) argues that for most industrialized and developing countries, the likelihood of biological warfare being a significant danger appears distant. Mannes (2008) notes that the menace of bioterrorism, characterized by extremists using biological organisms as weapons against civilian populations, is a highly alarming issue. According to Newman (2018), there are nations and dissident organisations that have both the inclination and the ability to deliberately create very hazardous infections and use them as weapons in acts of terrorism.

Kenya is now enforcing the Biological Weapons Convention (BWC), which forbids the creation, manufacturing, obtaining, transfer, accumulation, and utilisation of biological and toxin weapons (United Nations, 2019). At the end of a two-day session in Nairobi City, essential government departments responsible for safeguarding residents against dangerous organisms and bio-terrorism threats detailed the existing steps they have implemented.

The National Biosafety Authority has guaranteed to consistently regulate the transfer, processing, and use of genetically modified organisms to prevent any negative impacts on public health and the environment (UN, 2019). The Office of the Director of Public Prosecution (ODPP) cannot achieve victory in the battle against biological threats alone; a multi-agency approach is necessary.

The exchange of pertinent facts and data is crucial in bolstering the prosecution of those involved in accumulating and transporting dangerous weapons (UN, 2019). In 2019, the United Nations identified various obstacles to the sluggish implementation of the Biological Weapons Convention (BWC). Among these challenges are competing priorities, insufficient resources, inadequate institutional arrangements, limited policy awareness, unclear communication channels,

deficiencies in the national legal framework, and the COVID-19 pandemic, which hindered certain states from carrying out planned activities.

2.3 Theoretical Framework

This section provides a detailed explanation of the theory that underpins the concepts and phenomena, illustrating the interconnectedness of these concepts within the research framework.

This study aims to use contemporary deterrence theory to anchor the impact of bioterrorism.

2.3.1 Contemporary Deterrence Theory

Quackenbush and Zagare (2016) apply contemporary deterrence theory to various sub-state and non-state security concerns such as insurgency, terrorism, radicalization, organised transnational crime, cyber insecurity, and piracy. The deterrence agenda now includes "more traditional inter-state security dilemmas, stemming from rogue regimes, nuclear and missile proliferation, and recent advances in missile technology and defence."

In recent decades, terrorism has exposed specific preferences or biases that have influenced the field and societal perceptions of what terrorism entails. This necessitates the development of a comprehensive theoretical framework. According to Wilner (2010), a wide range of militant activities, including promoting violent beliefs, brainwashing and recruiting individuals, financing militancy, and organising specific assaults, can be prevented by using specific threats that are customised to the situation.

Wilner (2010) asserts that the prevention of both conventional and CBRN terrorism receives equal attention. From ancient biblical times to the contemporary era, documented history has used diseases and bioterrorism toxins as weapons of war. Historically, national populations have been the primary target of bioterrorism, although this is not always the case. The manufacturing or deployment of numerous bio-weapon agents no longer requires specialised specialists or advanced

research facilities. Commercially available technologies enable large-scale synthesis of bioweapon agents in small-scale facilities.

Nuclear weapons-related deterrence measures frequently include or encompass the issue of deterring bioterrorism. Nuclear deterrence significantly influenced geopolitics, health, and national security plans during the latter part of the twentieth century. During its peak, the concept of mutually assured destruction (MAD) was a significant concern. Both superpowers had arsenals capable of launching a retaliatory strike in the event of a nuclear attack. Specifically, they possessed submarine-launched ballistic missiles with nuclear warheads that were difficult to detect (Wilner, 2010). Nevertheless, these historical methods undercut and oversimplify the unique difficulties of preventing bioterrorism.

In Lee's (2021) argument, opponents present four viewpoints that downplay the threat of biological terrorism. Firstly, they contend that the limited use of biological weapons in the past implies their unlikely use in the future. Secondly, they claim that the development and use of bioweapons are morally repugnant and highly dangerous, making it unlikely that anyone would intentionally employ them. Thirdly, they assert that the production and dispersal of biological agents require advanced laboratories, limiting access to only the most sophisticated facilities. Lastly, they contend that we can disregard the highly improbable potential destructiveness of bioweapons. While there may be some substance to these concerns, the threat of bioterrorism to national security in Africa is accurate and ongoing.

The current deterrence theory is undergoing a revival.

Defence analysts express concern about the inadequate security measures in Kenya's laboratories, which may need help to withstand the danger posed by regional terror groups like Al Shabaab. These groups actively search for materials to create bioterrorism weapons (Wilner, 2010). The setback for deterrence theory and practice stems from this theoretical framework's rapid and

premature growth. As deterrence ventures into unfamiliar and unexplored domains, its definition has intentionally and significantly expanded, to the point that it can occasionally be perplexing.

According to Kim and Lee (2021), bioterrorism is considered a growing threat that has emerged from four different periods: before the understanding of germs, the application of microbiology, the use of microbiology in industry, and the advancements in molecular biology and biotechnology. According to Siegel (2021), with the increase in global anti-vaccination campaigns and the weakening of current domestic and international efforts to handle epidemics and pandemics, it is essential to develop a strategy that utilises cyber capabilities and does not rely solely on the presence of a deliberately created biological weapon.

Bioterrorism, which refers to the deliberate use of disease crises by terrorist organisations to achieve political objectives, is a relatively unexplored threat in Africa (Siegel, 2021). The escalating occurrence of epidemics and pandemics like Ebola and COVID-19, along with the simultaneous growth in regional terrorism, raises the possibility of disease crises being used as political instruments.

According to Kim and Lee (2021), the United Nations has developed thirteen treaties over a forty-year period to prevent and defeat terrorism. The sectoral instruments, also known as specialised agreements, tackle a wide range of issues related to terrorism, such as the illegal seizure of aircraft and the act of taking hostages, as well as the prevention of terrorist explosions. These instruments are crucial in strengthening the global legal framework against terrorism and facilitating international collaboration.

Chung et al. (2020) assert that specific measures are necessary to prevent terrorist acts and prohibit terrorist-related offences. These measures include requiring countries to make certain behaviours illegal, establishing criteria for jurisdiction (such as the principle of "extradite or prosecute"), and providing a legal framework for cooperation on extradition and legal assistance. According to

Carus (2017), bioterrorism and its consequences can significantly burden the healthcare system, requiring it to manage the effects (Biosecurity Survey in Kenya, 2019). To effectively respond to any covert or overt bioterrorist attack, a robust healthcare system must be in place, which includes a robust illness monitoring system, quick epidemiological and laboratory investigations, efficient medical management, and practical information, education, and communication strategies. Mannes (2008) asserts that deterring terrorism typically involves embracing and integrating a more comprehensive comprehension of deterrence. Zhenmin (2020) posits that although the primary focus remains on the individual seeking to challenge (the deterred actor) and their unwanted action, the defender's influence on their behavior extends beyond traditional deterrence theory by incorporating additional arguments.

Zhenmin (2020) defines the Dual-Use-Goods (DUG) model as a policy categorising commodities with commercial and military or proliferation applications. These items are subject to export restrictions and controls imposed by national and international organizations. According to Ali (2020), this message from the government outlines its strategy for strategic export control in 2014. Specifically, it focuses on the export restriction of military equipment and dual-use commodities. According to Kim and Lee (2021), regulating the export of military equipment is crucial to fulfilling our national goals and international responsibilities. For instance, we achieve this by ensuring that Egypt only exports its products to approved recipient countries in accordance with established guidelines.

Chung et al. (2020) assert that the sale of military equipment is contingent upon the existence of valid security and defence policy justifications, and it must not conflict with Kenya's foreign policy. Ali (2020) asserts that while the occurrence of a bioterrorist assault is highly unpredictable, we should not disregard the potentially catastrophic aftermath of a successful attack. In previous years, Kenyan agencies reported that they had effectively thwarted a plot by a group of medical

interns to carry out a biological terrorist assault utilising anthrax bacteria as a weapon against the Kenyan population.

2.4 Research Gap

In terms of bioterrorism (bio-terror), the literature review established that biodefense preparedness and the accessibility of information regarding emerging infectious diseases remain problematic. Efforts should be made to enhance the methods of spreading information and strengthen the connections between security, defense, health officials, and clinicians in remote regions. Another briefly discussed strategy is the emphasis on pathogen security, which involves controlling and preventing access to the ingredients required for the development of biological weapons (deterrence through denial).

This researcher discovered limited and insufficient resources for strategies and actions to counteract bioterrorism in Africa, particularly regarding the need for more available literature on the legal and policy framework for combating bioterrorism in Kenya. Therefore, following the nuclear non-proliferation model, pathogen security aims to regulate the substances, machinery, and individuals associated with creating and utilising biological agents. Furthermore, bioterrorism's repercussions on national security are evident in the destabilization of economies, the overwhelming of healthcare systems, the significant increase in unemployment rates, and the tightening of borders. Terrorists can flourish in situations characterised by disease, chaos, and fragility.

This research has identified a gap in the existing literature regarding the use of bioterrorism as a potential trend that could arise from evolving methods of terrorism in Africa. The potential impact of bioterrorism on national security in Kenya is of utmost importance. Depending on the pathogen, potential exposure can endanger hundreds of lives daily. Hence, it is imperative to provide

education and assistance to frontline practitioners, as well as implement strategies to reduce the time interval between the occurrence of an outbreak and its reporting.

2.5. Chapter Summary

This chapter explored theoretical frameworks related to the bioterrorism threat on national and global security, including Bronfenbrenner's Ecological Systems Theory, Okello's Regional Environmental Security Complex Hypothesis, and Hobfoll's Conservation of Resources (COR) theory. It also addresses the resurgence of deterrence theory and Crenshaw's idea of terrorism's 'contagious' nature. Highlighting bioterrorism as a significant threat, especially in Africa, the chapter points out gaps in existing legal frameworks like Kenya's Treaty Making and Ratification Act and the exacerbation of these issues by the COVID-19 pandemic. It underscores the urgent need for improved communication, coordination, education, and strategies to better prepare for and respond to bioterrorism.

CHAPTER THREE

RESEARCH METHODOLOGY

3.0 Introduction

This chapter outlines the research methodology for the entire study. The chapter discusses the study design, population, sampling procedures, research instruments, sample size, data collection procedure, data analysis, and ethical considerations of the research. For such research, the researcher starts with a general idea and uses this study as a medium to identify issues that can be the focus of future research.

3.1 Study Design

This study utilised a mixed-methods approach, approaches to provide a comprehensive understanding of the research problem, leveraging the strengths of each methodological approach. to provide a more comprehensive understanding of the research problem. It seeks to leverage the strengths of both methods. Questionnaires were administered to various stakeholders, encompassing policymakers, security professionals, healthcare experts. The interviews delve into nuanced perspectives on bioterrorism threats, revealing current strategies, challenges, and opportunities for enhancing preparedness and response. They also offer insights into community perceptions and behavioral responses amid potential bioterrorism incidents.

The mixed methods research approach enhances understanding of bioterrorism threats, providing actionable insights for policymakers and security professionals to mitigate risks and safeguard national security. Integrating qualitative depth with quantitative rigor supports a proactive strategy, strengthening societal resilience and readiness against potential threats.

3.2 Study Site

Bioterrorism extends beyond global, regional, national, and local boundaries. Therefore, the researcher conducted the study across the entirety of Kenya, specifically focusing on Nairobi County. The target population consisted of security practitioners and policymakers specializing in anti-terrorism and national security. The county's status as a net consumer of products from other areas, which may not have the same level of security as installations or utilities in Nairobi city, led to the selection of this site. Furthermore, the locations frequently visited by United States citizens, as well as other foreigners and tourists in Nairobi and other parts of Kenya, remain appealing targets for terrorists who are planning potentially imminent attacks. Terrorist organisations have the potential to launch surprise attacks, specifically aiming at hotels, embassies, restaurants, shopping centres, markets, educational institutions, police stations, places of worship, and other locations commonly visited by foreigners and tourists.

3.3 Study Population

The respondents included the Kenya Defence Forces (KDF), Kenya Medical Research Institute, Kenya Prison Services, Ministry of Foreign Affairs and Diaspora, National Police Services (NPS), National Intelligence Service (NIS), Ministry of Interior, Postal Corporation of Kenya, and Ministry of Health (MoH). These organizations are pivotal in studying bioterrorism due to their diverse roles: KDF and NPS, handle defense, law enforcement, and counter-terrorism; NIS provides critical intelligence; KEMRI and MoH offer expertise in medical research and public health; the Ministry of Foreign Affairs and Diaspora supports international cooperation; the Ministry of Interior coordinates national security; Kenya Prison Services aid in rehabilitation; and the Postal Corporation of Kenya examines communication channels. Collectively, they provide a comprehensive framework for addressing bioterrorism complexities. Table 3.1 illustrates this proportion as follows:

Table 3.1: Target Population

Number	Respondent Category	Population Frequency
	Kenya Defence Forces	20
	Kenya Medical Research Institute	10
	Kenya Prison Service	5
	Ministry of Foreign Affairs and Diaspora	10
	Ministry of Health	10
	Ministry of Interior	10
	National Intelligence Service	20
	National Police Service/NCTC	30
	Postal Corporation of Kenya	5
	Total	120

Source: Multi-Agency Security Teams by National Counter Terrorism Center (2024)

3.4 Sampling Procedure

This study employed purposive sampling and stratified sampling techniques. These sampling techniques are classified as non-probability sampling and are particularly effective when studying specific cultural domains with knowledgeable experts in the terrorism and security sectors. Both qualitative and quantitative research techniques employed purposive sampling. Selecting the purposive sample was crucial to ensuring the quality of the gathered data, emphasising the importance of reliability and competence among the informants.

The sample size had a substantial impact on this study, enabling the researcher to draw accurate conclusions about the population. By ensuring a sufficient sample size, the researcher was able to reduce bias in the sample selection process, which could have otherwise undermined the accuracy and reliability of the data and the subsequent findings of the study. The major data for this study was collected through the questionnaire and interviews. Researchers collected qualitative data through interviews to gain useful insights into the perceptions and experiences of participants.

3.5 Sample Size

Kothari (2011) asserts that one can calculate the total sample size using various research formulas. Mugenda and Mugenda (2014) argue that determining the appropriate sample size requires the use of a straightforward formula. However, this process also involves practical considerations when selecting values for the assumptions needed in the formula. In certain situations, making decisions about these assumptions can be complex. The sample size for this study is determined using the single population proportion formula, specifically the Yamane formula as described by Kothari (2011).

The formula for the sample size is given at a confidence interval of 95% with a significance of 5% (0.005). The sample size will be calculated via.

Where;

$$n = N / (1 + N * e^2)$$

n is the sample size, **N** is the population size, **e** is the level of precision.

N = Target population size (120)

e = margin of error (0.05)

Sample size **n** = $120 / (1 + 120(0.05)^2) = 92.30$

The study's sample size comprised 92 participants selected from the target groups. The sampling technique employed was a method of selecting a sample from a given population. This study specifically employed purposive sampling, also referred to as deliberate sampling, selecting respondents based on their judgment and suitability to provide the required information. Given the challenging nature of reaching or locating the population of interest, we also employed the snowballing technique. Through purposive and snowball sampling, a total of 92 respondents were sampled from the targeted population involved in the security and defence sectors.

3.6 Data Collection

This study gathered both primary and secondary data to support a range of recommendations and conclusions. Primary data was acquired by utilising a semi-structured questionnaire and interviews. The researcher began by arranging appointments with the respondents. Following this, questionnaires were distributed to the participants, allowing them up to two weeks to complete and submit their responses.

Additionally, the researcher collected secondary data from security-related sources like books, journals, articles, and periodicals. This method allowed for the acquisition of accurate data, which in turn enabled the production of fresh perspectives or the validation and affirmation of prior research on bioterrorism.

3.7 Data Analysis and Presentation

The data collected were systematically arranged and examined using document and topic analysis, with a specific emphasis on identifying emerging themes from the research. The method of thematic analysis, which is frequently used to identify themes within a dataset, was employed. Themes, which are recurring patterns found within a certain set of data under predetermined conditions, were identified in order to acquire insights into the research objectives. To ensure the research instrument's accuracy and consistency, a preliminary sample analysis of the research tool was performed to verify its congruence with the study goals. Thematic analysis was used as a qualitative analytical tool to identify, analyse, and report patterns in the data. In addition, descriptive statistics were used to summarize and describe the main features of a dataset to provide simple summaries about the sample and the observations that have been made to effectively communicate the study findings.

3.8 Ethical Consideration

The study data were gathered from diverse population of the government agencies and various stakeholders engaged in bioterrorism complexities. The researcher obtained permission from relevant authorities and NACOSTI to safeguard the rights of respondents when providing their responses. Throughout the research, all appropriate research procedures were adhered to, with strict adherence to the guidance provided by the academic supervisor. All sources of information were duly acknowledged to maintain academic integrity. Prior to the administration of the questionnaire, consent was sought and obtained from respondents to ensure their privacy and confidentiality during their voluntary participation in the study. These measures were implemented to uphold ethical standards and respect participants' rights throughout the research process.

3.9 Chapter Summary

This chapter detailed the research methodology for studying bioterrorism threats, using a mixed-methods approach that combines quantitative surveys and qualitative interviews to provide a comprehensive understanding of the issue. The research focuses on Nairobi County, Kenya, and involves a sample of 92 participants selected through purposive and snowball sampling techniques from key organizations like the Kenya Defence Forces and Kenya Medical Research Institute. The sample size was determined using the Yamane formula, with a 95% confidence interval. Data were collected through semi-structured questionnaires and interviews, complemented by secondary data from security-related sources. Thematic and descriptive statistical analyses were employed to identify emerging themes and summarize findings. Ethical considerations, including informed consent and confidentiality, were strictly observed throughout the study.

CHAPTER FOUR

DATA ANALYSIS, PRESENTATION, AND DISCUSSION

4.0 Introduction

This chapter presents the findings, interpretations, and discussions of field data collected during the research on the threats of bioterrorism to Kenya's national security. The data collection process involved utilising an interview guide, which was then organised and analyzed. For data analysis purposes, we selected content analysis and document analysis methodologies. Scholars have highlighted that document analysis entails a systematic approach to evaluating printed or digital materials. Similar to other analytical methods, qualitative research utilising document analysis typically entails scrutinising and interpreting data to extract significance, enhance understanding, and foster empirical insights (Fischer, 2006). Other qualitative research approaches incorporate document analysis as a form of triangulation, easily accommodating multiple methodologies like the mixed methods this study adopted.

4.1 Characteristics of Respondents

4.1.1 Response Rate

The study achieved a 76% response rate from participants. The age distribution of most respondents was between 30 and 39 (38.6%), followed by 40–49 (31.4%) and 50–59 (30.0%). This indicates a diverse range of experiences and perspectives among participants, consistent with findings by Adan (2020) and Gupta and Kumar (2022). Understanding the age group difference is crucial as it facilitates the implementation of tailored solutions and strategies to enhance preparedness against bioterrorism threats.

Table 4.2: Characteristics of Respondents

Category	Frequency	Percent
Respondents Gender		
Male	42	60.0%
Female	28	40.0%
Total	70	100.0%
Age of Respondents		
30-39	27	38.6%
40-49	22	31.4%
50-59	21	30.0%
Total	70	100.0%
Education Level		
Postgraduate degree	33	47.1%
Undergraduate degree	20	28.6%
Tertiary college	13	18.6%
Secondary education	4	5.7%
Total	70	100.0%
Organization and Department		
Accountant	15	21.4%
Defence/Military	22	31.4%
KDF (Kenya Defense Forces)	12	17.1%
Ministry of Defence/MOD (Ministry of Defence)	8	11.4%
MOD Finance	1	1.4%
National Security	1	1.4%
Police	1	1.4%
Total	70	100.0%
Experience		
Less than 5 years	5	7.1%
5 to 15 years	24	34.3%
16 to 25 years	19	27.1%
More than 25 years	22	31.4%
Total	70	100.0%
Work Specialization		
Finance	8	11.4%
Accounting	12	17.1%
Administration	3	4.3%
Military	26	37.1%
Others	21	30.0%
Total	70	100.0%
Terrorism Familiarity		
Familiar with terrorism	70	100.0%
Understanding of bioterrorism		
Yes	41	58.6%
No	3	4.3%
Total	70	100.0%

4.1.2 Socio-demographics

Table 4.2 above provides further details of significant attributes, including various socio-demographic factors such as gender, age, education level, organisational affiliation, department, years of service, and work specialisations of the respondents, which were scrutinised to form a holistic profile. This detailed demographic analysis forms the basis for understanding the diverse backgrounds and experiences of participants, thereby enhancing discussions and insights throughout the research.

4.1.2.1 Gender

According to Table 4.2, the gender distribution of respondents was 60.0% male and 40.0% female, aligning with previous studies by Bognoe (2019) and Kharaishvili et al. (2020), which similarly showed a higher male representation. However, it's crucial to acknowledge the significant presence of female respondents, emphasising gender diversity in research, as noted by Ali (2020) and Botha (2013). This balanced gender representation underscores the importance of inclusive approaches in addressing security and defence issues, as discussed by Adan (2020) and Gupta and Kumar (2022).

4.1.2.2 Educational Level Attainment

A significant portion of respondents have advanced degrees (47.1%), with undergraduates comprising 28.6%, tertiary college-educated at 18.6%, and secondary educated at 5.7%. This emphasises the prevalence of higher education qualifications among respondents, indicating notable expertise and specialisation in relevant fields, as highlighted by Keshavamurthy et al. (2021) and Kim and Lee (2021). The prevalence of postgraduate degrees indicates a strong knowledge base and expertise within the study group, aiding in a thorough understanding of bioterrorism and national security concerns.

4.1.2.3 Professional Background of Respondents

Respondents' organisational affiliation shows a majority linked to defence sectors, with "defense/military" being the largest group (31.4%), consistent with Baguma (2017) and Barston (2006). This concentration highlights the importance of involving these sectors in countering bioterrorism threats effectively. Experience levels vary, with a significant portion having 5 to 15 years (34.3%) and over 25 years (31.4%) of experience. This mix reflects findings by González-Candelas (2017) and Bognoe (2019), enhancing idea exchange and approach diversity in addressing bioterrorism. Military roles dominate (37.1%), followed by accounting (17.1%) and finance (11.4%), reflecting expertise highlighted by Kharashvili et al. (2020) and Botha (2013). This diversity suggests a multidisciplinary approach to tackling bioterrorism and national security. All participants in the study were familiar with the term "terrorism" (100.0%), demonstrating a high level of awareness among respondents. Regarding bioterrorism, the majority claim to comprehend the concept (58.6%), while a small proportion reported a lack of understanding (4.3%). This finding emphasises the importance of addressing any gaps in understanding bioterrorism, as discussed by Bognoe (2019) and Adan (2020), to ensure comprehensive preparedness and response strategies against such threats. The high level of terrorism familiarity among respondents underscores the significance of the issue within their spheres of knowledge and indicates a widespread recognition of the term, providing a solid foundation for addressing related security concerns.

4.2 The Extent of Bioterrorism as A Threat to National Security in Kenya

This section delves into the nature of bioterrorism as a critical threat to Kenya's national security, aligning with the primary research objective of identifying the dimensions of this threat. Bioterrorism poses multifaceted challenges to the security landscape, necessitating a thorough examination of its characteristics and implications. By exploring the specific context of Kenya,

this section aimed to shed light on the unique dynamics of bioterrorism and its potential impact on the nation's security infrastructure by exploring Kenya's specific context.

Table 4.3: The extent of bioterrorism as a threat to national security in Kenya

Statements	Strongly Agree	Agree	Undecided	Disagree	Strongly Disagree
Global advancement has led to an increase in the risks and magnitude of bioterrorism as a threat.	18, (25.71%)	24, (34.29%)	10, (14.29%)	7, (10%)	11, (15.71%)
Bioterrorism remains a greater threat to security in the twenty-first century than ever before.	21, (30%)	28, (40%)	7, (10%)	7, (10%)	7, (10%)
Bioterrorism remains a serious threat to national security in Africa today.	14, (20%)	21, (30%)	18, (25.71%)	10, (14.29%)	7, (10%)
The effect of bioterrorism on national security elements remains under-studied in Kenya.	7, (10%)	17, (24.29%)	14, (20%)	21, (30%)	10, (14.29%)

According to respondent data, Table 4.3 above displays perceptions of bioterrorism's threat to Kenya's national security. It shows opinions on four statements, ranging from "strongly agree" to "strongly disagree." Firstly, a notable portion (25.71% strongly agree, 34.29% agree) acknowledges that global advancements increase bioterrorism risks, reflecting an awareness of how technological progress enables global bioterrorism incidents.

Secondly, there's a strong consensus (30% strongly agree, 40% agree) that bioterrorism is a bigger threat in the 21st century, emphasizing the evolving security landscape and the need for attention and resources towards emerging threats like bioterrorism. A significant portion (30% strongly agree, 30% agree) expresses concern about the threat of bioterrorism to African and Kenyan security, highlighting its seriousness. This suggests an understanding of regional dynamics and Kenya's vulnerability to bioterrorism.

Lastly, uncertainty exists about the extent of bioterrorism's impact on national security research in Kenya. While some (10%) strongly agree it's understudied, a larger proportion (24.29% agree, 20% undecided) indicate varying levels of agreement, hinting at the need for further research. Overall, the table indicates a consensus on the heightened bioterrorism threat globally and its specific implications for Kenya's national security, along with identified gaps in research on this topic.

4.3 Global Advancement and Risks of Bioterrorism

In exploring the correlation between global advancements and the escalating risks of bioterrorism, respondents presented diverse yet predominantly concurring viewpoints. A substantial majority underscored the pivotal role of advanced technology in amplifying the threats posed by bioterrorism. They highlighted how technological progress has facilitated the production and dissemination of biological agents, thereby increasing the potential for malicious exploitation by terrorist groups. This consensus among respondents underscores the critical need for heightened vigilance and proactive measures to address the evolving challenges posed by bioterrorism in an increasingly interconnected world.

One respondent articulated the impact of advanced technology, stating,

"Due to advanced technology, the level of details in the net to prepare and use pathogens for the purpose of bioterrorism is very high today."

This observation underscores the significant impact of technological advancements, which have not only democratized access to knowledge and resources but also enabled the orchestration of bioterrorism threats with unprecedented sophistication. By leveraging advanced technological tools and readily available information, individuals or groups with malicious intent can manipulate biological agents and disseminate them with alarming ease and efficiency (Pandey, 2024). This heightened level of sophistication poses a grave challenge to national security agencies and

underscores the pressing need for robust counterterrorism measures to address the evolving landscape of bioterrorism threats.

Furthermore, respondents emphasised the interconnectedness of the modern world as a contributing factor to the heightened risk of bioterrorism. They highlighted how technology, particularly the internet, facilitates the production and transmission of bioagents, thereby amplifying the reach and impact of such threats (Gupta and Kumar, 2022). This observation resonates with past scholarly perspectives, which have similarly underscored the role of technology and globalisation in exacerbating the risks associated with bioterrorism. In an increasingly interconnected world, where information flows freely and borders are porous, the proliferation of bioterrorism threats knows no bounds.

Consequently, addressing the challenges posed by bioterrorism necessitates proactive measures and international collaboration. It is imperative for nations to strengthen their defence mechanisms, enhance surveillance capabilities, and foster cooperation at both regional and global levels. By pooling resources, sharing intelligence, and coordinating response efforts, the international community can effectively mitigate the risks associated with bioterrorism and safeguard global security.

In comparing the findings with previous studies, Gupta and Kumar (2022) and Linkous et al. (2021) similarly emphasise the pivotal role of advanced technology in amplifying the threats posed by bioterrorism. They highlight how technological progress has facilitated the production and dissemination of biological agents, aligning with the sentiments expressed by respondents. This alignment underscores the urgency of addressing the evolving challenges posed by bioterrorism in an increasingly interconnected world, as emphasised by Pandey (2024) and Tin et al. (2022) in their respective works.

Furthermore, Pandey (2024) provides insights into the enduring nature of the bioterrorism threat in the contemporary era, emphasising its persistence despite advancements in counterterrorism efforts. This aligns with the respondents' perceptions regarding the enduring threat of bioterrorism, suggesting that it remains a potent concern in the twenty-first century. Similarly, Tin et al. (2022) delve deeper into the role of advancing technology in exacerbating the risks associated with bioterrorism, resonating with respondents' observations on the ease of perpetrating such acts in today's interconnected world. The findings of this study resonate with the perspectives of past scholars such as Braden (2000), who underscore the persistent and multifaceted nature of the bioterrorism threat. By synthesising these scholarly perspectives, the study reinforces the urgency of proactive measures, robust surveillance systems, and international collaboration in countering the persistent threat of bioterrorism to national security. The alignment between respondents' perspectives and those of past scholars highlights the complexity and urgency of addressing bioterrorism as a significant security challenge in the contemporary landscape.

4.4 Bioterrorism in the Twenty-First Century

Despite varied responses, a prevailing sentiment emerged, suggesting that bioterrorism remains a potent concern in the twenty-first century, potentially surpassing previous eras in severity. This consensus was supported by diverse justifications provided by respondents, reflecting a heightened awareness of the evolving nature of security threats and the imperative for proactive measures. Furthermore, this alignment with scholarly perspectives underscores the gravity of the bioterrorism threat and the necessity for concerted efforts to address it effectively in contemporary security discourse.

4.4.1 Technology Advancement

One respondent highlighted the ease, with which lone actors can perpetrate bioterrorist acts in today's interconnected world, stating,

"Technological advancement, the lone wolf can unleash this any time."

This observation highlights a concerning reality: in today's interconnected and technologically advanced world, the tools and information required to orchestrate bioterrorism are increasingly accessible. With the proliferation of digital platforms and the widespread availability of knowledge on biotechnology and microbiology, individuals or groups with malevolent intentions can easily obtain the resources needed to execute bioterrorist acts. The internet, in particular, serves as a vast repository of information, providing step-by-step guides and tutorials on how to manufacture and deploy biological agents. This ease of access underscores the urgent need for comprehensive strategies to counter the evolving landscape of bioterrorism threats. Simply put, the traditional barriers to entry in this realm have been significantly lowered, posing unprecedented challenges to national security. Addressing this reality requires proactive measures that encompass not only robust surveillance and intelligence gathering but also initiatives aimed at disrupting the dissemination of harmful knowledge and enhancing global cooperation to combat bioterrorism effectively.

4.4.2 Religious Fundamentalism

Additionally, respondents pointed to the proliferation of extremist fundamentalism and terrorism as a driving force behind the heightened risk of bioterrorism on a global scale. They emphasized the pervasive nature of these ideologies and their potential to catalyze bioterrorist activities. The sentiment expressed by respondents resonates with past scholarly perspectives, highlighting the urgent need for proactive measures and international collaboration to mitigate the risks associated with bioterrorism.

In comparing the findings regarding the enduring threat of bioterrorism with previous studies, Braden (2000) underscores the persistence of this threat despite advancements in counterterrorism efforts, aligning with the prevailing sentiment among respondents. Braden's emphasis on the

ongoing nature of the bioterrorism threat reinforces the notion that, despite concerted efforts to address it, the risk remains significant and must be continuously addressed through proactive measures.

Furthermore, Chung, Baum, and Nyquist (2020) advocate for the enhancement of surveillance capabilities and institutional capacities to mitigate the diverse challenges associated with bioterrorism, resonating with the calls for proactive measures expressed by respondents. Their emphasis on bolstering surveillance aligns with the respondents' recognition of the need for heightened vigilance and preparedness in addressing the evolving landscape of bioterrorism threats. By drawing parallels between the findings of this study and the recommendations put forth by previous scholars, it becomes evident that a multifaceted approach encompassing enhanced surveillance, institutional capacity-building and proactive measures is essential in effectively countering the persistent threat of bioterrorism.

4.5 Bioterrorism's Impact on National Security in Africa

In delving into the persistent specter of bioterrorism across Kenya, participants were prompted to assess its current relevance and impact, offering ratings that delineated their perceptions of the threat it poses to national security within the region. These ratings were not isolated judgments but rather part of a broader inquiry aimed at understanding the nuanced perspectives and underlying concerns surrounding the bioterrorism phenomenon. Through this exploration, valuable insights into the current state of awareness, understanding, and scholarly engagement with bioterrorism in Kenya are sought.

One respondent emphasized the widespread potential for bioterrorism incidents, stating,

"Very many non-state actors with the capability to unleash it."

This observation underscores the pressing necessity for robust security measures and strategic preparedness to effectively mitigate the heightened risks of bioterrorism across the African

continent. It emphasizes the urgency for proactive steps to be taken in response to the escalating threat of bioterrorism, particularly within Africa's unique socio-political and economic landscape. The term "robust security measures" signifies the implementation of comprehensive strategies spanning surveillance, intelligence gathering, border control, and emergency response protocols.

4.5.1 Strategic Preparedness

Similarly, "strategic preparedness" underscores the importance of preemptive planning and readiness to address potential bioterrorism incidents before they manifest. Within Africa, where resources may be constrained and vulnerabilities are pronounced, the imperative for such measures is particularly acute. This observation underscores the critical need to not only acknowledge the threat but also actively engage in collaborative efforts among African nations, regional entities, and international partners to fortify security frameworks and bolster preparedness against bioterrorism. Furthermore, respondents voiced concerns about the overreliance of African nations on biotechnology from developed countries. This observation reflects the need for comprehensive strategies and investments to bolster the capacity of African nations to effectively detect, respond to, and mitigate bioterrorism threats in a timely manner.

The concerns raised by respondents regarding the persistent threat of bioterrorism across Africa align closely with the findings of Mannes (2008), Matei and Hahhaday (2022), and McGwire (2012), who have extensively explored various facets of bioterrorism's implications for national security. These scholars have underscored the urgent imperative for implementing robust security measures and fostering strategic preparedness to effectively mitigate the risks posed by bioterrorism. Their research resonates strongly with the sentiments expressed by respondents, highlighting the critical need for proactive measures to address the evolving threat landscape of bioterrorism comprehensively. By emphasizing the urgency of enhancing security frameworks and readiness capabilities, both the respondents and previous studies underscore the vital importance

of proactive measures in safeguarding national security against the persistent threat of bioterrorism in Africa.

4.6 Impact of bioterrorism on national security elements

Respondents provided varied responses, reflecting a spectrum of viewpoints on the depth of study regarding bioterrorism's impact on national security in Kenya. One respondent expressed uncertainty (Rating: 3), suggesting that

“While awareness may be high, the level of formal study remains questionable.”

This sentiment underscores the complexity of the issue and the need for further investigation into the extent of scholarly engagement with bioterrorism within the Kenyan context. Another respondent highlighted the lack of integration of bioterrorism studies into broader educational curricula, potentially hindering awareness and preparedness efforts. This observation underscores the importance of incorporating bioterrorism-related topics into educational programs to ensure that students and professionals alike are equipped with the knowledge and skills necessary to mitigate potential threats effectively.

In their examination of the less-explored effects of bioterrorism on national security components, Mukeka and Ogutu (2019) present insightful observations when compared to earlier research. They delve into the socioeconomic factors propelling the spread of bioterrorism and its consequences for marginalized communities, shedding light on the intricate relationship between socioeconomic circumstances and susceptibility to radicalization. Their findings stress the importance of tackling underlying socioeconomic vulnerabilities. This viewpoint echoes concerns expressed by participants regarding the potential socioeconomic fallout of bioterrorism incidents.

Mukeka and Ogutu's research emphasizes the socioeconomic aspect of bioterrorism, highlighting the necessity of comprehensive strategies that address both immediate security concerns and the fundamental causes of vulnerability and radicalization. This concurrence underscores the

significance of addressing socioeconomic factors in mitigating the impact of bioterrorism on national security, advocating for holistic approaches to bolster resilience and promote inclusivity within societies.

4.7 Legal and Policy Framework for Combating Bioterrorism in Kenya

This segment concentrates on evaluating Kenya's legal and policy infrastructure concerning the fight against bioterrorism. Given the serious threat bioterrorism poses to national security, it's crucial to have strong legal and policy frameworks in place to thwart, detect, and manage potential incidents efficiently. The aim is to thoroughly assess Kenya's current legal and policy setup regarding bioterrorism readiness and response. By scrutinizing the existing framework, this assessment seeks to pinpoint its strengths, weaknesses, and areas for improvement, thereby informing recommendations to bolster the nation's ability to counter bioterrorism risks.

Table 4.4: Legal and Policy Framework for Fighting Bioterrorism in Kenya

Statements	Strongly Agree	Agree	Undecided	Disagree	Strongly Disagree
The legal frameworks for fighting bioterrorism in Kenya remain under-developed.	15 (21.43%)	25 (35.71%)	10 (14.29%)	12 (17.14%)	8 (11.43%)
There is a non-existence policy framework for fighting bioterrorism in Kenya to-date.	20 (28.57%)	15 (21.43%)	10 (14.29%)	10 (14.29%)	15 (21.43%)
There is low level of effectiveness in the existing regulatory framework for bioterrorism preparedness in Kenya today.	10 (14.29%)	20 (28.57%)	15 (21.43%)	15 (21.43%)	10 (14.29%)
Few methods and scanty measures exist to counter bioterrorism in the Kenyan context.	25 (35.71%)	10 (14.29%)	8 (11.43%)	12 (17.14%)	15 (21.43%)

Table 4.4 presents insights into the perceived legal and policy frameworks for combating bioterrorism in Kenya, as indicated by respondents' opinions. The data reveal a spectrum of views on various aspects of the existing frameworks and their effectiveness in addressing the threat of

bioterrorism within the country. Firstly, regarding the development of legal frameworks, a substantial proportion of respondents, comprising 35.71%, agreed that the legal frameworks for fighting bioterrorism in Kenya remain under-developed. This suggests a widespread perception that there may be inadequacies or gaps within the legal infrastructure necessary to effectively counter bioterrorism threats.

Secondly, the absence of a policy framework specifically tailored for combating bioterrorism in Kenya garnered notable attention. Nearly 29% of respondents strongly agreed that there is a non-existent policy framework for fighting bioterrorism in Kenya to date. This viewpoint underscores concerns about the absence of dedicated strategic guidelines or directives aimed at addressing bioterrorism threats within the national security agenda. Thirdly, respondents expressed reservations about the effectiveness of the existing regulatory framework for bioterrorism preparedness in Kenya. A significant proportion, 28.57%, agreed that there is a low level of effectiveness in the current regulatory framework. This suggests perceived shortcomings in the enforcement or implementation of regulations designed to mitigate bioterrorism risks and enhance preparedness measures.

Lastly, respondents highlighted concerns about the adequacy of methods and measures available to counter bioterrorism within the Kenyan context. A considerable portion, 35.71%, agreed that few methods and scanty measures exist for this purpose. This indicates a perceived lack of robust strategies or resources dedicated to preventing, detecting, and responding to potential bioterrorism incidents within the country. In summary, the data from Table 4.4 shed light on the perceived deficiencies and challenges within the legal and policy frameworks aimed at combating bioterrorism in Kenya. These findings underscore the importance of further examination and potential reforms to strengthen the nation's preparedness and response capabilities against the evolving threat landscape of bioterrorism.

Respondents were tasked with evaluating the existing frameworks, shedding light on their perceptions and concerns regarding the state of preparedness against bioterrorism within the country.

Respondents were asked to rate the extent to which they believe the existing legal frameworks for fighting bioterrorism in Kenya are under-developed. One respondent stated,

"I am not aware of any" (Rating: 1),

This sentiment underscores a prevailing lack of familiarity among respondents regarding the existing legal provisions pertaining to bioterrorism. Many respondents expressed uncertainty or outright disagreement, suggesting a gap in understanding or awareness regarding the legal frameworks in place to address bioterrorism within Kenya. Some respondents admitted to being unaware of any specific legal frameworks addressing bioterrorism (Rating: 4), indicating a notable deficiency in knowledge regarding this critical aspect of national security. Others expressed skepticism about the adequacy of existing laws, noting limitations in the legal frameworks' alignment with the country's level of scientific and technological advancement (Rating: 1). This skepticism implies a perceived mismatch between the sophistication of Kenya's legal infrastructure and the complexity of contemporary security threats, such as bioterrorism. Additionally, concerns were raised about the efficacy of the legal system, with mentions of terrorists being released by courts and challenges in burden of proof (Rating: 2). This reflects broader apprehensions about the judicial system's ability to effectively address bioterrorism-related cases and ensure accountability for perpetrators. The responses highlight a significant gap in understanding and familiarity with the legal frameworks aimed at combating bioterrorism, signaling a potential area for improvement in Kenya's national security strategy.

However, another respondent expressed confidence in the legal infrastructure, mentioning,

"I believe it is in place" (Rating: 4),

While some respondents seemed to perceive that the necessary legal frameworks exist to address bioterrorism (Rating: 4), others expressed reservations about their adequacy. Specifically, concerns were raised regarding the capability of these frameworks to effectively tackle the complexities associated with bioterrorism, especially in light of Kenya's level of scientific and technological advancement (Rating: 1). This sentiment suggests a perception among certain respondents that existing legal structures may not be sufficiently equipped to address the unique challenges posed by bioterrorism, highlighting a potential discrepancy between legal capacity and evolving security threats.

One respondent remarked,

"The legal frameworks are not adequate to address details of bioterrorism in keeping with the level of science of the country" (Rating: 2),

This observation underscores a critical gap in legal preparedness, signaling a pressing need for further development and enhancement of legal frameworks to effectively address the multifaceted challenges posed by bioterrorism. The concern raised by respondents regarding the adequacy of existing legal provisions reflects a broader uncertainty regarding Kenya's capacity to mitigate the risks associated with bioterrorism. This uncertainty is particularly significant given the potential catastrophic consequences of a bioterrorism incident and the intricate nature of addressing such threats within a legal framework. Addressing these gaps requires a comprehensive approach that involves not only the development of robust legal instruments but also capacity-building initiatives to ensure effective implementation and enforcement. Furthermore, it underscores the importance of continuous assessment and adaptation of legal frameworks to keep pace with evolving threats and advances in science and technology.

Comparing these findings with past scholarly perspectives, Newman (2018), Okello (2014), and Olivera (2020) provide insights into various aspects of legal frameworks and their effectiveness in

addressing emerging security threats. Newman's work emphasizes the need for adaptive legal frameworks capable of responding to evolving security challenges, highlighting the importance of legal preparedness in safeguarding national security. Similarly, Okello's research delves into the role of legal institutions in enhancing security governance, shedding light on the critical nexus between legal frameworks and effective security management. Olivera's study may offer valuable insights into the role of international legal norms and conventions in shaping national legal frameworks, providing a broader context for understanding Kenya's legal landscape.

Furthermore, research by Newman (2018) may offer insights into the complexities of bioterrorism preparedness within the African context, potentially aligning with some of the concerns raised by respondents regarding legal under-development. Newman (2018)'s examination of bioterrorism preparedness efforts in Africa may shed light on the unique challenges faced by countries in the region and provide valuable lessons for Kenya in strengthening its legal and policy frameworks. Generally, these past studies underscore the urgent need for Kenya to prioritize the development and enhancement of its legal frameworks to effectively address the evolving threat landscape and safeguard national security.

4.8 Non-existence Policy Framework for Fighting Bioterrorism

The absence of a comprehensive policy framework for combating bioterrorism in Kenya raises significant concerns about the nation's preparedness to address this critical security threat. This section aims to assess respondents' perceptions regarding the existence of such a framework, providing insights into the current state of readiness and the level of attention given to bioterrorism within Kenya's security landscape. By exploring these perspectives, the analysis seeks to uncover potential gaps and challenges in policy formulation and implementation, thereby informing strategies to strengthen Kenya's capacity to mitigate the risks posed by bioterrorism. Respondents were asked to rate their agreement with the statement and provide justifications for their ratings.

"There is a non-existence policy framework for fighting bioterrorism in Kenya to-date"

Responses to the question regarding the existence of a policy framework for combating bioterrorism in Kenya reflected a diverse range of perspectives among respondents. Some respondents disagreed with the statement, either due to uncertainty about the presence of such a framework or because they believed it exists (Rating: 2). Conversely, others expressed agreement or strong agreement with the statement, suggesting a perception of the absence of inadequacy of policy measures addressing bioterrorism (Rating: 4, 5). This mixed perspective underscores the complexity of the issue and the varying interpretations among stakeholders regarding the state of policy preparedness for combating bioterrorism in Kenya. One respondent expressed uncertainty about the existence of a policy framework, stating,

"Not sure if there is any policy but I doubt because it's beyond the scope of our scientific research institutions" (Rating: 3).

The quotation sheds light on the uncertainty surrounding the existence of policy measures explicitly crafted to tackle bioterrorism within the sphere of Kenya's scientific research institutions. It suggests that there is a lack of clarity or consensus among respondents regarding whether such specialized policies are in place to address the unique challenges posed by bioterrorism within the country's scientific community. This ambiguity underscores potential gaps in the regulatory framework pertaining to bioterrorism preparedness and response within Kenya's scientific research landscape.

Another respondent highlighted the absence of coordination or policy coherence between government institutions, stating,

"Yes, there is no coordination or policy between the institutions of government... At times, the courts release [terrorists or criminals] and they end up continuing with their terror activities"

(Rating: 2).

This quotation underscores the challenges posed by fragmented policy implementation and enforcement, potentially hindering effective counterterrorism measures. It suggests that even if policies exist on paper, their practical application and enforcement may be inconsistent or lacking, leading to gaps in addressing the complex threat of bioterrorism. This fragmentation in policy implementation can result in a disjointed approach to combating bioterrorism, where responses may vary depending on the interpretation and execution of policies by different governmental bodies or agencies. As a result, there may be a lack of cohesive strategies and actions to effectively prevent, detect, and respond to bioterrorist threats, leaving vulnerabilities within Kenya's security framework.

In comparing our findings with past scholarly perspectives, it becomes evident that researchers such as Ravenhill (2017) provide comprehensive analyses of counterterrorism policy frameworks, offering insights into overarching strategies crucial for effective policy formulation and implementation. While not directly focused on Kenya, Ravenhill's work likely addresses principles of interagency coordination, adaptive responses to emerging threats, and international collaboration, which are essential considerations for combating bioterrorism. Similarly, Schmid and Forest (2021) likely delve into global counterterrorism policies, offering valuable insights into transnational trends and governance mechanisms. Their research may highlight themes such as multilateral collaboration and countering extremist ideologies, which resonate with our study's emphasis on the need for coherent governance structures. Furthermore, Siegel (2021) likely explores specific policy interventions and institutional frameworks in counterterrorism, providing insights into policy efficacy and operational modalities that could inform Kenya's approach to combating bioterrorism. Integrating these past scholarly perspectives with our findings offers policymakers a holistic understanding of effective counterterrorism policy paradigms, facilitating

the development of tailored frameworks to mitigate the multifaceted threats posed by bioterrorism in Kenya.

4.9 Assessing Kenya's Regulatory Framework for Bioterrorism Preparedness

In this section, our focus centers on a comprehensive assessment of Kenya's regulatory framework concerning its preparedness for potential bioterrorism incidents. Our paramount aim is to delve into the perceptions of respondents regarding the efficacy and adequacy of the current regulatory landscape in confronting and mitigating bioterrorism threats. To accomplish this, respondents were entrusted with the task of evaluating the effectiveness of Kenya's existing regulatory framework through a rating system. Subsequently, they were prompted to elucidate and substantiate their assessments with detailed justifications, offering invaluable insights into their perspectives on the matter.

Responses to the question revealed a spectrum of perspectives on the effectiveness of Kenya's regulatory framework for bioterrorism preparedness. Some respondents expressed uncertainty about the presence or efficacy of such a framework, suggesting a lack of clarity regarding regulatory provisions. For instance, one respondent stated,

"Not sure if there is a legal framework in the first place" (Rating: 3).

The response indicating uncertainty about the existence of a legal framework for bioterrorism preparedness in Kenya (Rating: 3) reflects a significant lack of clarity regarding the regulatory landscape. This uncertainty may stem from a lack of awareness or accessibility to information regarding the specific legal measures in place to address bioterrorism threats. It underscores a potential gap in knowledge or communication regarding regulatory frameworks among certain segments of the population or within relevant sectors. Such uncertainty could hinder effective preparedness efforts, as it may lead to ambiguity regarding roles, responsibilities, and available resources for addressing bioterrorism incidents. This highlights the importance of enhanced

transparency and dissemination of information regarding regulatory frameworks to ensure a more informed and coordinated response to bioterrorism threats.

Another respondent highlighted corruption as a hindrance to regulatory effectiveness, stating,

"Corruption also plays a part. Sometimes the terrorists bribe their way out" (Rating: 2).

The acknowledgment of corruption as a factor influencing the effectiveness of the regulatory framework for bioterrorism preparedness is a significant insight provided by a respondent. This statement (Rating: 1) highlights a critical challenge in ensuring the efficacy of regulatory measures in combating bioterrorism. The mention of terrorists potentially bribing their way out of legal consequences suggests vulnerability in the enforcement and implementation of regulatory measures. Corruption within law enforcement or judicial systems can undermine the rule of law and compromise security efforts, allowing perpetrators to evade accountability and perpetuate threats to national security. This observation underscores the multifaceted nature of the bioterrorism threat, which not only requires robust regulatory frameworks but also effective mechanisms to combat corruption and uphold the integrity of security measures. It emphasizes the importance of addressing systemic issues such as corruption to enhance the overall effectiveness of bioterrorism preparedness strategies.

Conversely, other respondents strongly agreed with the statement, indicating the absence or inadequacy of a regulatory framework to address bioterrorism threats effectively. Reasons cited included resource limitations, lack of expertise, and deficiencies in existing regulations. One respondent strongly agreed, emphasizing,

"Strongly agree because of the lack of the required expertise and equipment necessary" (Rating: 1).

The statement "Strongly agree because of the lack of the required expertise and equipment necessary" (Rating: 1) underscores the critical role of expertise and equipment in effective

bioterrorism preparedness. The respondent's assertion highlights a perceived deficiency in both human resources and technological capabilities within Kenya's regulatory framework for addressing bioterrorism threats. Insufficient expertise in fields such as biosecurity and epidemiology can hinder the timely detection, containment, and response to bioterrorism incidents. Additionally, the absence or inadequacy of specialized equipment for surveillance, detection, and decontamination further exacerbates the challenges faced in combating bioterrorism effectively. This viewpoint underscores the need for capacity-building initiatives aimed at enhancing the expertise of relevant personnel and investing in advanced technologies to bolster the country's bioterrorism preparedness efforts. It also emphasizes the importance of strategic resource allocation and training programs to bridge existing gaps and strengthen the overall resilience of Kenya's regulatory framework against bioterrorism threats.

Another respondent stated,

"Strongly agree. Lack of efficiency and effectiveness in the existing regulations, rules, and procedures in preparation towards bioterrorism" (Rating: 4).

The assertion "Strongly agree. Lack of efficiency and effectiveness in the existing regulations, rules, and procedures in preparation towards bioterrorism" (Rating: 4) highlights concerns regarding the efficacy of Kenya's current regulatory framework in addressing bioterrorism threats. This sentiment suggests a perceived inadequacy in the regulations, rules, and procedures governing bioterrorism preparedness efforts within the country. The respondent likely believes that existing measures may lack clarity, consistency, or enforcement mechanisms necessary to effectively mitigate the risks posed by bioterrorism incidents. Such inefficiencies can compromise the timeliness and effectiveness of response efforts, potentially exacerbating the impact of bioterrorism incidents on public health and national security. This viewpoint underscores the need for comprehensive review and enhancement of existing regulatory frameworks to ensure they are

robust, responsive, and adaptable to evolving bioterrorism threats. Strengthening regulatory oversight, improving coordination among relevant stakeholders, and streamlining procedures for detection, response, and recovery are essential components in enhancing the overall resilience of Kenya's bioterrorism preparedness efforts.

Comparing our research findings with insights from past scholarly perspectives allows for a deeper understanding of the effectiveness of Kenya's regulatory framework for bioterrorism preparedness. Scholars like Silke (2013), Stoeva (2020), and Tinnes (2020) have likely explored various dimensions of counterterrorism policy and strategy, offering valuable insights into regulatory effectiveness. Silke's (2013) research, delving into the psychological and behavioral aspects of counterterrorism strategies, sheds light on factors influencing regulatory effectiveness, such as fear, resilience, and community engagement. Stoeva (2020) and Tinnes (2020), through comparative analyses of regulatory approaches across different regions, offer applicable lessons for Kenya's context, highlighting best practices, common challenges, and innovative solutions. Integrating insights from these past scholarly perspectives with our study's findings enables policymakers to identify gaps and formulate targeted policy interventions to enhance regulatory effectiveness and bolster national security resilience against bioterrorism threats. Moreover, leveraging existing knowledge and expertise informs evidence-based decision-making, enhancing Kenya's overall counterterrorism efforts.

4.10 Measures to Counter Bioterrorism

Within this section, the researcher aims to scrutinize the adequacy of methods and measures available to counter bioterrorism within the context of Kenya. The primary objective is to evaluate respondents' perceptions regarding the effectiveness of existing strategies in mitigating bioterrorism threats. To achieve this, respondents were tasked with rating their level of agreement with the statement "Few methods and scanty measures exist to counter bioterrorism in the Kenyan

context." Subsequently, they provided justifications for their ratings, offering valuable insights into their perspectives and concerns.

The responses to the question showcased a spectrum of viewpoints concerning the sufficiency of methods and measures to counter bioterrorism in Kenya. While some respondents disagreed with the statement, asserting the presence of adequate strategies (Rating: 2), others expressed agreement or strong agreement, indicating perceived deficiencies in current approaches (Rating: 4, 5). For instance, one of the respondent noted

"Few methods and scanty methods indeed, if there are any such."

In this response, there is a clear expression of doubt regarding the efficacy of the current methods and measures aimed at countering bioterrorism in Kenya. The respondent's skepticism implies a lack of confidence in the existing strategies and approaches employed to address bioterrorism threats within the country. By suggesting that there may be a deficiency in robust strategies, the respondent indirectly raises concerns about the adequacy of Kenya's preparedness and response mechanisms to combat bioterrorism incidents effectively. This sentiment suggests that there may be gaps in Kenya's ability to anticipate, prevent, and respond to bioterrorism events, potentially leaving the nation vulnerable to such threats. This response underscores the importance of reassessing and strengthening Kenya's strategies and measures for bioterrorism preparedness to ensure a more robust and effective response to such security challenges.

Another one indicated that

"It has been left only to the security forces. Lack of intelligence sharing is also a problem because our people do not take it seriously like the way Ethiopia."

This quotation underscores the respondent's skepticism regarding the effectiveness of existing methods and measures to counter bioterrorism in Kenya. The remark implies a perception of limited strategies in place, suggesting potential shortcomings in preparedness and response capabilities. Furthermore, it highlights concerns about the predominant reliance on the security forces for addressing bioterrorism threats, coupled with challenges related to intelligence sharing and public engagement. By drawing a comparison with Ethiopia's approach, the respondent underscores the importance of broader societal involvement and proactive reporting mechanisms in enhancing bioterrorism preparedness. Overall, the quotation reflects a need for comprehensive and collaborative efforts to bolster Kenya's capacity to address bioterrorism risks effectively.

Another participant noted that

"Strongly agree because of the lack of the required expertise and equipment necessary."

This quotation highlights the respondent's apprehensions regarding the adequacy of expertise and equipment essential for countering bioterrorism in Kenya. The statement suggests a discrepancy between the existing resources and the requirements for effectively mitigating bioterrorism threats, indicating potential weaknesses in the nation's preparedness. The emphasis on insufficient resources underscores concerns about the country's ability to detect, prevent, and respond to bioterrorism incidents adequately. By drawing attention to these deficiencies, the respondent signals the need for greater investment in capabilities and infrastructure tailored to combatting bioterrorism, thus enhancing Kenya's resilience against such security threats.

When contextualizing our findings with perspectives from past scholarly research, including those put forth by the United Nations (2019), Wakhungu and Njiruh (2015), and Waldman (2001), nuanced insights come to light. While some scholars may underscore the significance of bolstering robust public health systems and fostering international collaboration as vital components of countering bioterrorism, others might stress the importance of broader societal engagement and

the implementation of proactive measures to effectively address evolving threats. By synthesizing these diverse viewpoints with the outcomes of our study, policymakers gain a more comprehensive understanding of the multifaceted nature of bioterrorism preparedness and response in Kenya. This integration allows for the development of adaptive strategies that not only prioritize strengthening public health infrastructure and international cooperation but also encompass broader societal involvement and proactive measures tailored to the unique challenges posed by bioterrorism.

4.11 The level of Kenya’s Preparedness to Preventing Bioterrorism

This section aims to examine Kenya's level of preparedness in combating bioterrorism, addressing the third research objective. The primary focus is to assess the extent to which Kenya is equipped and ready to confront the threat of bioterrorism effectively. Through an analysis of various indicators and factors, insights into the country's current state of preparedness in dealing with potential bioterrorist incidents were provided.

Table 4.5: The level of Kenya’s Preparedness to Fight Bioterrorism

Statements	Strongly Agree	Agree	Undecided	Disagree	Strongly Disagree
Kenya is adequately prepared to fight bioterrorism at its infancy stage.	10 (14.29%)	20 (28.57%)	15 (21.43%)	20 (28.57%)	5 (7.14%)
Kenya has no strategy and measures to mitigate impact of bioterrorism on national security.	25 (35.71%)	10 (14.29%)	15 (21.43%)	10 (14.29%)	15 (21.43%)
Kenya has made several steps to prepare for bioterrorism attacks.	15 (21.43%)	15 (21.43%)	20 (28.57%)	20 (28.57%)	5 (7.14%)
Kenya has several institutions and organizations that are dedicated to addressing potential	10 (14.29%)	25 (35.71%)	10 (14.29%)	20 (28.57%)	5 (7.14%)

bioterrorism in the Country.					
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Table 4.5 above provides insights into the perceived level of preparedness of Kenya to combat bioterrorism, as assessed by respondents. The data reflect varying perspectives on the country's readiness and capabilities in dealing with the threat of bioterrorism, as well as the existence of strategic measures and dedicated institutions for addressing this issue. Regarding Kenya's preparedness to combat bioterrorism at its infancy stage. While 28.57% of respondents agreed that the country is adequately prepared, an equal proportion disagreed with this statement. This indicates a significant degree of uncertainty or disagreement among respondents regarding Kenya's readiness to tackle bioterrorism threats in their early stages.

There is a notable concern among respondents regarding the absence of a strategy and measures to mitigate the impact of bioterrorism on national security. A considerable majority, 35.71%, strongly agreed with this statement, suggesting a widespread perception of inadequacy in the strategic planning and mitigation efforts related to bioterrorism within Kenya. Opinions are divided on whether Kenya has taken significant steps to prepare for bioterrorism attacks. While 28.57% of respondents agreed with this statement, an equal proportion disagreed. This indicates a lack of consensus among respondents regarding the extent to which Kenya has proactively addressed the potential threats posed by bioterrorism through preparatory measures.

Regarding the existence of institutions and organizations dedicated to addressing potential bioterrorism in the country, a significant majority, 35.71%, agreed that such entities exist. This suggests recognition among respondents of the presence of specialized institutions or organizations tasked with addressing bioterrorism threats within Kenya's security apparatus. The data from Table

4.5 highlight a mixed perception of Kenya's preparedness to combat bioterrorism. While some respondents express confidence in the country's readiness and the existence of dedicated institutions, others raise concerns about the lack of strategic measures and mitigation efforts. These findings underscore the importance of further assessing and potentially strengthening Kenya's preparedness and response capabilities in addressing bioterrorism threats.

4.12 Adequacy of Kenya's Preparedness

In this subsection, the focus lies on evaluating Kenya's preparedness to combat bioterrorism threats during their initial stages. The objective is to assess respondents' viewpoints on the adequacy of Kenya's readiness and identify potential areas for enhancement. Respondents were tasked with rating Kenya's preparedness level and providing justifications for their assessments. This approach allows for a comprehensive exploration of Kenya's capacity to address bioterrorism threats at their onset. The respondents were asked “Kenya is adequately prepared to fight bioterrorism at its infancy stage?”

One of respondent noted that;

"Kenya has a response Unit."

This response suggests a high level of confidence in Kenya's ability to respond to bioterrorism incidents, as indicated by the belief that the country has established specialized units capable of effectively managing such threats. The respondent's assertion implies that Kenya has dedicated resources and personnel trained to address bioterrorism, reflecting a perception of robust preparedness measures in place. This confidence may stem from existing governmental initiatives aimed at enhancing national security and emergency response capabilities, particularly in the context of combating terrorism and related threats. Generally, the response underscores a belief in Kenya's proactive stance and capacity to swiftly respond to bioterrorism challenges as they arise.

Another respondent stated that

"Kenya's technological level could be below ability to counter Bioterrorism."

The respondent's rating of 4 reflects significant concerns regarding Kenya's technological capacity to counter bioterrorism effectively. By assigning this rating, the respondent indicates a belief that the country's technological level may not be adequately advanced to address the complexities of bioterrorism threats. This interpretation suggests that there are potential deficiencies in Kenya's technological infrastructure and capabilities, which could hinder its ability to detect, prevent, and respond to bioterrorism incidents. Consequently, the rating underscores the importance of enhancing technological readiness and investing in advanced tools and systems to bolster Kenya's preparedness efforts against bioterrorism.

The respondent's rating of 4 indicates a notable level of skepticism regarding Kenya's technological preparedness for combating bioterrorism. This skepticism implies a lack of confidence in the country's existing technological infrastructure and capabilities to effectively confront bioterrorism threats, particularly at their initial stages. The rating suggests that the respondent perceives significant gaps or shortcomings in Kenya's technological readiness, which could compromise its ability to detect, mitigate, and respond to bioterrorism incidents promptly. This concern underscores the critical importance of advancing technological capabilities and investing in cutting-edge tools and systems tailored to address the unique challenges posed by bioterrorism.

This sentiment aligns with findings from prior scholarly research. For instance, studies by Kim and Lee (2021) and Koch and Maiguy (2021) have highlighted the importance of technological advancements in enhancing countries' preparedness to combat bioterrorism. These scholars emphasize the critical role of sophisticated surveillance systems, diagnostic tools, and information technology infrastructure in detecting and responding to bioterrorism threats effectively.

Therefore, the respondent's concerns regarding Kenya's technological capacity resonate with the broader scholarly discourse on the subject, emphasizing the need for substantial investments in technology to address gaps in preparedness.

4.13 Strategy and Measures to Mitigate Bioterrorism Impact

In this subsection, respondents' perspectives on Kenya's strategies and measures to mitigate the impact of bioterrorism on national security are explored. The respondents offered diverse opinions, reflecting varying levels of confidence and skepticism regarding the adequacy of Kenya's preparedness efforts against bioterrorism. Some respondents expressed agreement, suggesting that Kenya has implemented anti-terrorism laws and measures that could contribute to mitigating the impact of bioterrorism. However, others disagreed, citing resource constraints, lack of expertise, and deficiencies in infrastructure as hindrances to effective preparedness. This range of opinions underscores the complexity of the issue and the need for comprehensive strategies to address bioterrorism threats effectively. In this sense, one of the respondents noted that;

"The strategies are there but implementation is not adequate."

This response suggests that while Kenya may have formulated strategies to mitigate bioterrorism impact, the implementation of these strategies is perceived as lacking. It indicates potential gaps between policy formulation and execution, highlighting the need for improved implementation measures. The respondent's acknowledgment of existing strategies underscores recognition of efforts made by authorities to address bioterrorism threats. However, the emphasis on inadequate implementation implies a critical gap in operationalizing these strategies effectively. Addressing this disparity between policy intent and practical execution is essential to enhance Kenya's resilience against bioterrorism incidents. Implementing robust monitoring and evaluation mechanisms can help ensure that strategies are executed efficiently, thereby strengthening the country's overall preparedness framework.

The second participant stated that;

"There are several institutions and organizations put in place but require support."

The respondent acknowledges the presence of institutions dedicated to addressing bioterrorism in Kenya. However, the rating of 2 suggests a perception of inadequacy in the current level of support provided to these institutions. This implies that while there may be existing frameworks or organizations tasked with bioterrorism preparedness, they may lack sufficient resources or infrastructure to fulfill their mandates effectively. This highlights a potential gap in investment or support from relevant stakeholders in bolstering Kenya's capacity to address bioterrorism threats. Strengthening these institutions through increased funding, improved infrastructure, and enhanced collaboration with international partners could be essential steps in enhancing Kenya's preparedness against bioterrorism.

Comparison with past scholars such as Braden (2000) and Carus (2017) have emphasized the significance of comprehensive strategies and robust legal frameworks in mitigating the impact of bioterrorism. Both scholars highlight the importance of proactive measures and coordinated responses to effectively combat bioterrorism threats. However, when comparing their insights with the perceptions of respondents in Kenya, disparities emerge regarding the adequacy of specific measures in the Kenyan context. While Braden and Carus advocate for comprehensive strategies, respondents in Kenya express concerns about the effectiveness of existing measures, particularly in terms of implementation and resource allocation. This suggests a discrepancy between theoretical frameworks proposed by scholars and the practical realities faced by countries like Kenya. Therefore, tailored interventions that address the specific challenges identified by respondents are necessary to enhance Kenya's preparedness and response capabilities against bioterrorism threats.

4.14 Steps Taken by Kenya to Prepare for Bioterrorism Attacks

In this section of the study, we delve into the perceptions of respondents regarding the measures undertaken by Kenya to prepare for potential bioterrorism attacks. This exploration aims to shed light on the nation's proactive initiatives and readiness in addressing such security threats. In analyzing respondents' perspectives on Kenya's preparedness for bioterrorism attacks, we aim to provide a comprehensive understanding of the nation's strategies and initiatives in this critical area of national security. By examining the effectiveness of existing measures and identifying potential areas for improvement, we contribute to the ongoing discourse on enhancing Kenya's resilience against bioterrorism threats. One of the respondent noted that

"Kenya has enacted anti-terrorism laws and is already dealing with acts of terrorism."

This quotation suggests that Kenya has enacted anti-terrorism laws, reflecting a proactive stance in addressing security threats. The existence of legislative measures indicates a foundational step towards preparedness for bioterrorism attacks, as these laws may provide a framework for response and coordination in the event of such incidents. However, the effectiveness of these laws in specifically addressing bioterrorism may require further scrutiny and enhancement to ensure comprehensive preparedness.

Another respondent noted that

"Strongly disagree since research and knowledge on what is required has not been done."

The respondent's statement underscores a critical concern regarding the absence of sufficient research and knowledge concerning the necessary measures for preparedness against bioterrorism in Kenya. This highlights a fundamental gap in the country's understanding of bioterrorism threats and the strategies needed to effectively mitigate them. The lack of comprehensive research and knowledge could impede the development of robust preparedness plans and response strategies tailored to Kenya's specific context. Therefore, the quotation emphasizes the urgent need for

increased investment in research and capacity-building initiatives focused on bioterrorism preparedness to address this significant gap and enhance national security resilience.

In analyzing respondents' perceptions of Kenya's preparedness to combat bioterrorism, it is evident that the country has taken legislative measures to address terrorism, as noted by one respondent (Rating: 2). This indicates a proactive stance in enhancing national security and readiness. However, concerns arise regarding the lack of research and knowledge on the specific requirements for bioterrorism preparedness in Kenya, as highlighted by another respondent (Rating: 5). This gap underscores the need for further research and capacity-building initiatives to strengthen the country's preparedness efforts. While scholars like Waldman (2001) and González-Candelas (2017) emphasize the importance of legal frameworks and research initiatives in bioterrorism preparedness, disparities exist in assessing Kenya's specific efforts. Tailored interventions are necessary to address identified gaps effectively, aligning with recommendations for comprehensive and context-specific approaches to enhance bioterrorism preparedness.

4.14.1 Presence of Dedicated Institutions and Organizations

In this section, we delve into the opinions of participants regarding the existence of organizations focused on tackling potential bioterrorism in Kenya. Their viewpoints offer understanding into the sufficiency and efficiency of current institutional structures and resources aimed at countering bioterrorism risks within the nation.

One of the respondents noted that

"Kenya lacks the institutions to counter potential bioterrorism."

Comparison between Botha (2013) and Keshavamurthy et al. (2021) highlights the crucial role of dedicated institutions and coordinated efforts in effectively combating bioterrorism. They stress the need for specialized organizations with the necessary resources and expertise to respond promptly and effectively to bioterrorism incidents. However, when juxtaposing their findings with

the views expressed by respondents in Kenya, certain discrepancies become evident. While respondents acknowledge the presence of institutions such as the National Commission for Science, Technology, and Innovation (NACOSTI), there are concerns regarding these institutions' overall adequacy and effectiveness in dealing comprehensively with bioterrorism. This suggests a potential disparity between the theoretical significance of institutional support and the practical hurdles encountered during implementation. Hence, further research and analysis are necessary to pinpoint specific areas in need of improvement and to bolster Kenya's institutional capability in effectively mitigating bioterrorism risks.

4.15 Chapter Summary

This chapter analyzed the findings from a study on bioterrorism threats to Kenya's national security, highlighting significant concerns about the country's preparedness. With a 76% response rate, the study reveals widespread awareness of terrorism, with a majority recognizing the escalating threat of bioterrorism. Respondents, primarily male and educated, emphasized the increasing risks posed by advanced technology and global interconnectedness, which facilitate bioterrorism. The chapter underscores Kenya's vulnerability due to inadequate legal frameworks, corruption, and limited technological capacity. It calls for stronger, collaborative strategies and enhanced regulatory measures to bolster Kenya's resilience against bioterrorism threats.

CHAPTER FIVE

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

5.0 Introduction

Chapter five of this study provides a comprehensive summary of the findings presented in the preceding chapters, draw conclusions based on the analysis conducted, and offer recommendations for future actions. This chapter serves to synthesize the key insights gathered from the research and provide actionable insights for policymakers, stakeholders, and researchers involved in the field of bioterrorism preparedness and response.

5.1 Summary of Key Findings

This research study has revealed diverse viewpoints on Kenya's readiness to combat bioterrorism, spanning from trust in existing units to worries about technological capabilities and policy foundation. Data sourced from respondents' reveal differing opinions on the effectiveness of measures to lessen the impact of bioterrorism, with some recognizing legislative actions and others noting areas needing further research. Moreover, participants expressed doubt about the sufficiency of current institutional backing, pointing out shortcomings in infrastructure and organizational capability.

5.2 The Extent of Bioterrorism as a Threat to National Security in Kenya

The first objective of this study was aimed at establishing the nature of bioterrorism as a threat to national security in Kenya sheds light on respondents' perceptions, revealing varying levels of agreement among participants regarding different aspects of bioterrorism. Notably, a significant proportion of respondents strongly agree or agree that global advancements have heightened the risks and magnitude of bioterrorism, with 25.71% strongly agreeing and 34.29% agreeing. This indicates a consensus on the impact of technological progress. Similarly, a majority of respondent's express agreement that bioterrorism poses a significant threat in the twenty-first

century, with 30% strongly agreeing and 40% agreeing. However, opinions are more divided regarding bioterrorism's seriousness in Africa, with 20% of respondents undecided and others strongly agreeing or agreeing (20% and 30% respectively). Lastly, uncertainty persists regarding the extent of the study on bioterrorism's impact on national security elements in Kenya, with 24.29% of respondents expressing agreement and 14.29% strongly disagreeing.

The thematic analysis delved into the study's indicators respondents' perspectives on various dimensions of the bioterrorism threat. Regarding the correlation between global advancements and the escalating risks of bioterrorism, respondents predominantly underscore the pivotal role of advanced technology, with a significant majority highlighting how technological progress has facilitated the production and dissemination of biological agents. This consensus underscores the critical need for heightened vigilance and proactive measures to address the evolving challenges posed by bioterrorism. Similarly, respondent's express concerns about the overreliance of African nations on biotechnology from developed countries, reflecting the need for comprehensive strategies and investments to bolster the capacity of African nations to effectively detect, respond to, and mitigate bioterrorism threats in a timely manner.

Despite varied responses, there is a prevailing sentiment among respondents that bioterrorism remains a potent concern in the twenty-first century. Factors such as technological advancements, the proliferation of extremist ideologies, and porous borders contribute to the heightened risk of bioterrorism globally. Respondents emphasize the imperative for robust security measures, strategic preparedness, and international cooperation to effectively mitigate this evolving threat. Additionally, participants stress the importance of proactive steps to fortify security frameworks and bolster readiness capabilities, highlighting the necessity for collaboration among African nations and international partners.

Views on the depth of study regarding bioterrorism's impact on national security in Kenya vary among respondents. Some express uncertainty about the level of formal study, while others highlight the lack of integration of bioterrorism studies into educational curricula. This indicates the need for further investigation and integration of bioterrorism-related topics into educational programs to enhance awareness and preparedness efforts. Overall, the findings underscore the complexity of the bioterrorism threat and highlight the importance of further research and awareness efforts to effectively address it.

5.3 The Effectiveness of the Kenya's Legal and Policy Frameworks in Fighting Bioterrorism

The second objective of this study was to assess the effectiveness of Kenya's legal and policy framework for combating bioterrorism, which revealed varying perceptions among respondents, as detailed in Table 4.7. A significant majority of respondents, comprising 57.14% (combining the "strongly agree" and "agree" categories), believe that Kenya's legal frameworks for fighting bioterrorism are underdeveloped. This indicates a prevailing concern among respondents regarding deficiencies in the existing legal structures intended to address the threat of bioterrorism in the country.

There is a divide in opinions regarding the effectiveness of Kenya's regulatory framework for bioterrorism preparedness, with 42.86% agreeing that it is not effective enough. However, an equal proportion expresses uncertainty or disagreement. This indicates a divergence of opinions among respondents regarding the efficacy of current regulatory measures. Around 50% of respondents expressed uncertainty or disagreement regarding the existence of a comprehensive policy framework specifically tailored to address bioterrorism threats in Kenya. This suggests a lack of clarity or consensus among respondents on the presence and adequacy of policy measures addressing bioterrorism.

A considerable majority of respondents, accounting for 35.71%, agree that there are few methods and scanty measures in place to counter bioterrorism in Kenya. This underscores perceived inadequacies in the strategies and approaches employed to address bioterrorism threats within the country. Overall, the findings highlight perceived deficiencies in Kenya's legal and policy framework, as well as the effectiveness of regulatory measures for combating bioterrorism. The varying degrees of agreement and disagreement among respondents underscore the complexity of addressing bioterrorism threats and the need for comprehensive strategies to enhance preparedness and response capabilities in the country.

In the thematic analysis, respondents expressed uncertainty or disagreement about the presence of adequate legal frameworks to combat bioterrorism, citing limitations in alignment with scientific advancements and concerns about judicial efficacy. The effectiveness of current regulatory measures raised concerns, with corruption undermining enforcement and resource limitations affecting preparedness. Scepticism prevailed regarding the sufficiency of methods and measures to counter bioterrorism, with emphasis placed on the lack of expertise, equipment, and broader societal engagement. Integrating past scholarly perspectives with these findings highlights the need for adaptive legal and policy frameworks, enhanced regulatory effectiveness, and broader societal engagement to effectively address evolving bioterrorism threats in Kenya.

5.4 The Level of Kenya's Preparedness to Fight Bioterrorism

The third objective of this research was to assess Kenya's readiness to combat bioterrorism, as illustrated by key statistics from Table 4.8. The findings reveal a range of viewpoints on different aspects of bioterrorism preparedness. For instance, about 14.29% of participants strongly believed in Kenya's readiness to tackle bioterrorism in its early stages, while 28.57% agreed, 28.57% disagreed, and 7.14% strongly disagreed. Regarding the claim that Kenya lacks strategies and measures to mitigate bioterrorism's impact on national security, a significant 35.71% strongly

agreed, whereas 21.43% strongly disagreed. These figures highlight varying degrees of consensus among respondents. In summary, the analysis offers valuable insights into perceptions of Kenya's readiness for bioterrorism, spotlighting significant percentages indicating both agreement and disagreement among participants.

The thematic analysis explored respondents' viewpoints on Kenya's preparedness during the early stages of bioterrorism. While some respondents expressed confidence in Kenya's ability to respond effectively to bioterrorism incidents, citing the existence of specialised response units, others raised concerns about the country's technological capabilities, suggesting potential deficiencies that could hinder response efforts. Regarding strategies and measures to mitigate the impact of bioterrorism, respondents acknowledged the existence of anti-terrorism laws but highlighted challenges in their implementation. The adequacy of support for institutions dedicated to addressing bioterrorism also raised concerns, highlighting the need for increased resources and collaboration. Comparing this study to previous scholarly works showed that theoretical frameworks and real-world situations are not always the same. This shows how important it is to create customised interventions to deal with the problems that respondents identified.

5.5 Conclusion

In this section, conclusions are drawn based on the findings of the study, highlighting key insights regarding Kenya's preparedness to counter bioterrorism. Through a comprehensive analysis, areas of strength and areas needing improvement in the national response framework are identified.

5.5.1 The Magnitude of Bioterrorism as A Threat to National Security in Kenya

Based on the analysis of the nature of bioterrorism as a threat to national security in Kenya, the findings reveal a spectrum of perspectives among respondents, reflecting varying levels of agreement on different dimensions of the bioterrorism threat. Notably, a significant proportion of respondents acknowledge the heightened risks and magnitude of bioterrorism due to global

advancements, with a consensus emerging on the impact of technological progress. Similarly, a majority express agreement regarding the significant threat posed by bioterrorism in the twenty-first century. However, opinions are more divided concerning the seriousness of bioterrorism in Africa, indicating a nuanced understanding of regional dynamics.

Thematic analysis of respondents' perspectives delves into various aspects of the bioterrorism threat. Concerns about the correlation between global advancements and escalating bioterrorism risks highlight the pivotal role of advanced technology in facilitating the production and dissemination of biological agents. This underscores the urgent need for heightened vigilance and proactive measures to address evolving challenges. Moreover, respondent's express concerns about African nations' overreliance on biotechnology from developed countries, emphasizing the necessity for comprehensive strategies and investments to bolster regional capacity in detecting and mitigating bioterrorism threats.

Despite diverse viewpoints, there is a prevailing sentiment among respondents that bioterrorism remains a significant concern in the twenty-first century. Factors such as technological advancements, extremist ideologies, and porous borders contribute to the heightened global risk. Respondents stress the importance of robust security measures, strategic preparedness, and international cooperation to effectively mitigate this evolving threat. Additionally, there is a call for proactive steps to fortify security frameworks and readiness capabilities, highlighting the necessity for collaboration among African nations and international partners.

5.5.2 The Adequacy of Legal and Policy Framework in Fighting Bioterrorism in Kenya

In conclusion, assessing Kenya's legal and policy framework for combating bioterrorism reveals a spectrum of opinions among respondents. The majority express concerns about the underdevelopment of Kenya's legal frameworks, indicating perceived deficiencies in addressing

the threat of bioterrorism. Additionally, opinions are divided regarding the effectiveness of current regulatory measures, with uncertainty prevailing about the existence of comprehensive policy frameworks tailored to bioterrorism threats.

The thematic analysis gives more information about these results by showing that respondents had doubts and disagreements about whether the legal frameworks were adequate, whether the regulations were working well, and whether there were comprehensive policies in place. The limitations in aligning with scientific advancements, judicial efficacy, and the sufficiency of methods and measures to counter bioterrorism raise concerns. The findings underscore the complexity of addressing bioterrorism threats in Kenya and the need for adaptive legal and policy frameworks. There is a clear call for enhanced regulatory effectiveness, broader societal engagement, and strategic interventions to address evolving bioterrorism threats effectively. Comprehensive strategies and collaborative efforts will be crucial to bolstering Kenya's preparedness and response capabilities against bioterrorism.

5.5.3 The level of Kenya's Preparedness to Fight Bioterrorism

The assessment of Kenya's preparedness to combat bioterrorism reveals a spectrum of opinions among respondents, reflecting diverse viewpoints on different aspects of bioterrorism readiness. Key percentages extracted from Table 4.8 shed light on these perceptions, highlighting both areas of agreement and disagreement. Notably, while a portion of respondents expressed confidence in Kenya's readiness to address bioterrorism at its infancy stage, citing the presence of specialised response units, others raised concerns about the country's technological capabilities, suggesting potential deficiencies that could hamper response efforts. Similarly, opinions diverged regarding the existence of strategies and measures to mitigate the impact of bioterrorism on national security, with some acknowledging the presence of anti-terrorism laws but highlighting challenges in their implementation.

In the thematic analysis, respondents' viewpoints provided further insights into Kenya's preparedness for bioterrorism. Concerns about technological limitations and challenges in strategy implementation tempered confidence in Kenya's response capabilities. Additionally, respondents underscored the need for increased support for institutions dedicated to addressing bioterrorism, pointing to resource constraints and the necessity for enhanced collaboration. Comparing this study to previous scholarly works showed that there were gaps between theoretical frameworks and real-world situations. This showed how important it is to create customised interventions to deal with the problems that respondents identified.

5.6 Study Recommendations

Based on the findings, the following recommendations were made:

The National Police Service (NPS) should prioritise strengthening public awareness efforts by designing and implementing comprehensive campaigns to inform the public about the realities of bioterrorism threats, their potential impact on national security, and the crucial role of staying vigilant and reporting any suspicious activities.

The National Counter Terrorism Centre (NCTC), in partnership with the National Defence University of Kenya, the University of Nairobi, the Kenya Defence Forces (KDF), and the National Police Service, should promote an environment of interdisciplinary research by encouraging cooperation among research institutions, government bodies, and international allies to undertake interdisciplinary studies on emerging bioterrorism threats. This includes developing innovative technologies for detecting and responding to such threats.

The National Intelligence Service (NIS) and the Directorate of Criminal Investigations (DCI) should establish effective early warning systems by deploying robust surveillance systems and early alert mechanisms to identify and monitor potential bioterrorism risks. Leveraging

advancements in biotechnology, data analysis, and information sharing will enhance overall situational awareness and preparedness for rapid response.

5.7 Recommendations for Further Research

The following are the recommendations for further research:

Comprehensive Threat Assessment: Conduct a thorough assessment of emerging bioterrorism threats, including an analysis of evolving tactics, techniques, and procedures employed by terrorist organizations. Investigate the potential use of emerging biotechnologies in bioterrorism, such as gene editing and synthetic biology, and assess their implications for national security.

Policy and Legal Analysis: Conduct an in-depth analysis of Kenya's legal and policy frameworks related to bioterrorism preparedness and response. Evaluate the effectiveness of existing legislation, regulations, and interagency coordination mechanisms in addressing bioterrorism threats. Identify gaps, inconsistencies, and areas for improvement to inform future policy development and legislative reforms.

Public Health Preparedness: Investigate Kenya's healthcare system's preparedness to respond to bioterrorism incidents. Assess the capacity of healthcare facilities, public health agencies, and emergency responders to detect, diagnose, and manage bioterrorism-related illnesses. Explore strategies for enhancing healthcare infrastructure, workforce training, and medical countermeasure stockpiling to improve readiness and response capabilities.

These research recommendations aim to provide valuable insights into strengthening Kenya's overall preparedness and resilience against bioterrorism threats, contributing to enhanced national security and public safety.

5.8 Chapter Summary

This chapter summarized Kenya's preparedness to counter bioterrorism, highlighting strengths and areas for improvement. The findings show that while many respondents recognize the growing bioterrorism threat due to global technological advancements, opinions vary on its severity in Africa. Concerns about Africa's reliance on foreign biotechnology underscore the need for regional collaboration. Kenya's legal and policy frameworks are seen as underdeveloped, with calls for stronger regulations and alignment with scientific progress. Opinions on Kenya's preparedness are mixed, with some citing specialized response units, while others point to technological and implementation challenges, stressing the need for customized interventions and better collaboration.

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APPENDICES

Appendix I: Letter of Data Collection Authority from NDC

Telephone: 051- 851141
Fax: 051-851046
Email: ndu-kenya@mod.go.ke
When Replying Please Quote:
Ref: NDU - K/AA & R/02



National Defence University-Kenya
P O Box 3812 – 20100
Nakuru, Kenya

23 November 2023

TO WHOM IT MAY CONCERN

RE: RESEARCH AUTHORISATION

Col Julius Kipkorir Mutai of National Defence College, a College of National Defence University-Kenya, successfully defended his Master of Arts research proposal and has been allowed to proceed to the field to collect data for his thesis.

The research's topic is, "**Bioterrorism Threat to Human Security in Africa: A Case Study of Kenya**". The Candidate will be conducting the field work with effect from December 2023.

The purpose of this letter, therefore, is to request you to accord him any necessary assistance to successfully conduct the research.

Your continued assistance is highly appreciated.

Yours faithfully,

A handwritten signature in blue ink, appearing to read 'Anne W T Muigai'.

Prof Anne W T Muigai
Deputy Vice-Chancellor
National Defence University-Kenya

Appendix II: Letter of Data Collection Permit from NACOSTI


REPUBLIC OF KENYA


**NATIONAL COMMISSION FOR
SCIENCE, TECHNOLOGY & INNOVATION**

Ref No: 656385 **Date of Issue: 15/December/2023**

RESEARCH LICENSE



This is to Certify that Mr. Julius Kipkorir Mutai of National Defence University, has been licensed to conduct research as per the provision of the Science, Technology and Innovation Act, 2013 (Rev.2014) in Nairobi on the topic: BIOTERRORISM THREAT TO HUMAN SECURITY IN AFRICA: A CASE STUDY OF KENYA for the period ending : 15/December/2024.

License No: NACOSTI/P/23/31932

656385
Applicant Identification Number


**Director General
NATIONAL COMMISSION FOR
SCIENCE, TECHNOLOGY &
INNOVATION**

Verification QR Code


**NOTE: This is a computer generated License. To verify the authenticity of this document,
Scan the QR Code using QR scanner application.**

See overleaf for conditions

Appendix III: Research Consent Form

Serial Number:

The Research Consent Form

I am a student at the National Defence University (Kenya), pursuing a Master of Arts degree. It is an academic requirement that I collect data as part of a research study. For academic purposes only, this interview guide aims to gather information on the extent of bioterrorism's threat to national security in Africa through a case study of Kenya. Kindly fill out this guide to enable me to collect data for this study.

Before we begin, I request that you please give verbal consent to be a participant in this study. Thank you for taking the time to participate in this research. Please fill out the guide appropriately. It is my hope that you will answer the interview guide by ticking in the boxes provided as applicable and/or writing a brief follow-up statement.

Date.....

Signed Consent.....

Appendix IV: Research Data Collection Tool
The Key Informant Interview Guide

Section 1: Personal Profile

1. Gender? Male Female

2. Age? (Optional)
 Below 30 30-39 years 40-49years 50-59 years 60-69 years Above 70

3. Education level?
Secondary Tertiary College Undergraduate Postgraduate Other (specify)

4. Your organization and department?
.....
.....

5. How long have you worked for this organization?
.....
.....

6. Your work specialization?
.....
.....

7. Are you familiar with the term terrorism? Yes No

8. Do you understand the concept of bioterrorism? Yes No

Section 2: The nature of bioterrorism as threat to national security in Kenya

Choose and rate the following statements and give the justification for your answers?

9. Global advancement has led to increase in risks and magnitude of bioterrorism as a threat?

Rate:

(1= Strongly agree, 2 = Agree, 3 = Un-decided, 4 = Disagree and 5 = Strongly disagree)

Justification:

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10. Bioterrorism remains a threat to security in the twenty-first century than ever before?

Rating:

(1= Strongly agree, 2 = Agree, 3 = Un-decided, 4 = Disagree and 5 = Strongly disagree)

Justification:

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11. Bioterrorism remains a serious threat to national security in Africa today?

Rating:

(1= Strongly agree, 2 = Agree, 3 = Un-decided, 4 = Disagree and 5 = Strongly disagree)

Justification:

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12. The effect of bioterrorism on national security elements remains under-studied in Kenya?

Rating:

(1= Strongly agree, 2 = Agree, 3 = Un-decided, 4 = Disagree and 5 = Strongly disagree)

Justification:

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Section 3: The legal and policy framework for fighting bioterrorism in Kenya

Choose and rate the following statements and give the justification for your answers?

13. The legal frameworks for fighting bioterrorism in Kenya remain under-developed?

Rating:

(1= Strongly agree, 2 = Agree, 3 = Un-decided, 4 = Disagree and 5 = Strongly disagree)

Justification:

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14. There is a non-existence policy framework for fighting bioterrorism in Kenya to-date?

Rating:

(1= Strongly agree, 2 = Agree, 3 = Un-decided, 4 = Disagree and 5 = Strongly disagree)

Justification:

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15. There is low level of effectiveness in the existing regulatory framework for bioterrorism preparedness in Kenya today?

Rating:

(1= Strongly agree, 2 = Agree, 3 = Un-decided, 4 = Disagree and 5 = Strongly disagree)

Justification:

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16. Few methods and scanty measures exist to counter bioterrorism in the Kenyan context?

Rating:

(1= Strongly agree, 2 = Agree, 3 = Un-decided, 4 = Disagree and 5 = Strongly disagree)

Justification:

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Section 4: The level of Kenya’s preparedness to fight bioterrorism

17. Kenya is adequately prepared to fight bioterrorism at its infancy stage?

Rating:

(1= Strongly agree, 2 = Agree, 3 = Un-decided, 4 = Disagree and 5 = Strongly disagree)

Justification:

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.....

18. Kenya has no strategy and measures to mitigate impact of bioterrorism on national security?

Rating:

(1= Strongly agree, 2 = Agree, 3 = Un-decided, 4 = Disagree and 5 = Strongly disagree)

Justification:

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19. Kenya has made several steps to prepare for bioterrorism attacks?

Rating:

(1= Strongly agree, 2 = Agree, 3 = Un-decided, 4 = Disagree and 5 = Strongly disagree)

Justification:

.....
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.....

20. Kenya has several institutions and organizations that are dedicated to addressing potential bioterrorism in the Country?

Rating:

(1= Strongly agree, 2 = Agree, 3 = Un-decided, 4 = Disagree and 5 = Strongly disagree)

Justification:

.....
.....
.....

21. Other remarks

.....
.....
.....

Thank you for your participation

Appendix V: Research Timetable

ITEM	YEAR 2023						YEAR 2024		
Task	July	Aug	Sept	Oct	Nov	Dec	Jan	Feb	April

Selection of Title	■								
Final Proposal		■							
Submission to NACOSTI			■						
Data collection			■						
Data analysis			■						
Chapter 2 submission				■					
Chapter 3 submission					■				
Chapter 4 Submission						■			
Chapter 5 Submission							■	■	
Chapter 6 Submission									■
Final Draft Project									■
Completed Research Project									■

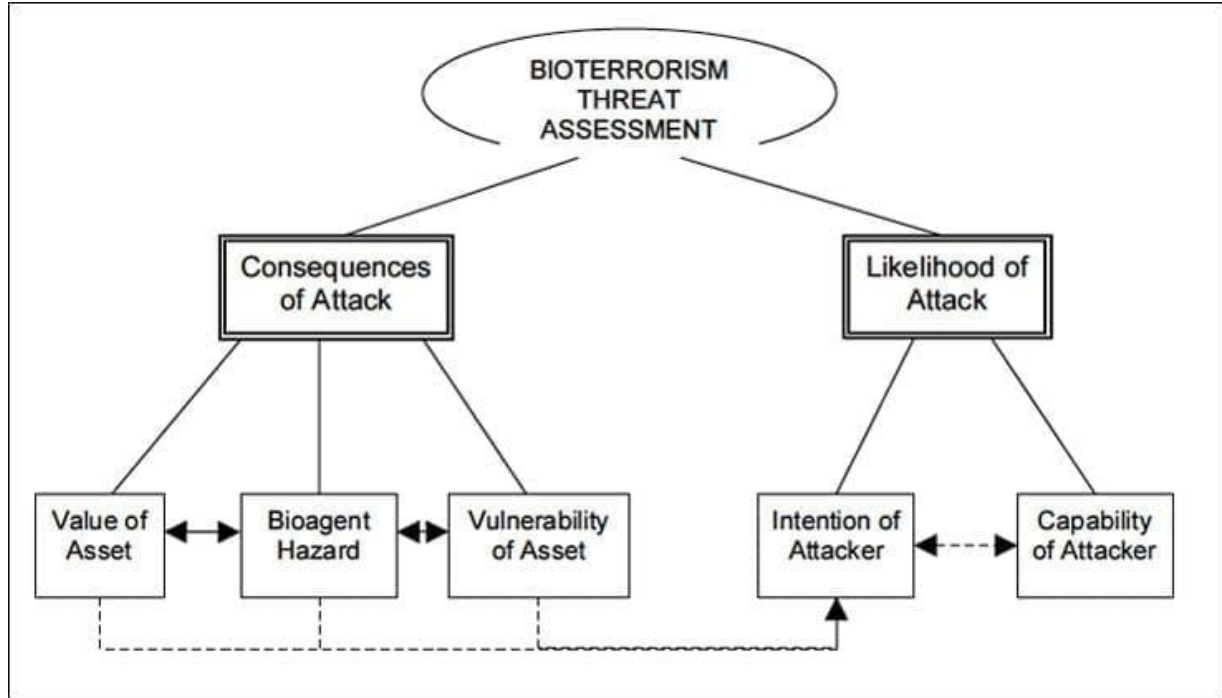
Source: Author, (2023)

Appendix VI: Research Budget

Item	No of units	Unit price (KES)	Total price (KES)	Budget justification
Research Assistant	2	50,000.00	200,000.00	Assist in data collection
Printing Services	500	10.00	5,000.00	Printing of questionnaires @10 per page
Printing paper	5	600.00	3,000.00	Printing proposal drafts for review
Airtime/bundles	5	1,500.00	7,500.00	5 months at 1500 per month
Binding documents	5	2,500.00	12,500.00	Binding research proposals drafts
Total			228,000.00	

Source: Author, (2023)

Appendix VII: The Concept of Bioterrorism



Source: Tinnes, J. (2020). Bibliography: defining and conceptualizing terrorism. *Perspectives on terrorism*, 14(6), 204-236.

Appendix VIII: Map of Study Area



Source: Google, (2023)

CLIMATE FRIENDLY



Women transport sugarcane waste to a company making briquet near Kibos shopping centre yesterday. The women are part of the labour force who work tirelessly to make fuel that is not harmful to the environment. [Denish Ochieng, Standard]

Kenya safe from risks of dangerous lab pathogens

- ▶ Workshop will serve as a platform for raising awareness about pathogens.
- ▶ The two-day meeting aims to raise awareness on dangers of pathogens.

HUDSON GUMBIHI, NAIROBI

Kenya's food and environment are currently safe from threats posed by pathogenic organisms, according to the national science and innovation regulator. The National Commission of Science, Technology, and Innovation (Nacosti) says it has ensured that Kenyan research institutions do not mishandle pathogens in laboratories.

Pathogens are disease-causing agents that scientists are studying in order to establish disease patterns (epidemiology) and develop preventive and curative measures.

Viruses, bacteria, fungi and protozoa are some of the known pathogens, and throughout history, the organisms have accompanied populations and caused various epidemics. Pathogens have also been used as agents of biological warfare.

It is against this backdrop that the Regional Workshop on Universalisation and Effective Implementation of the Biological Weapons Convention in Eastern Africa will be held in Mombasa.

Mary Onsarigo, a senior scientist at Nacosti, provided the assurance ahead of an international workshop to review progress on Biological Weapons Convention (BWC) imple-

mentation. The two-day workshop, which begins next Tuesday in Mombasa, aims to raise awareness about the dangers of pathogens.

The seminar comes as the country is still recovering from the effects of Covid-19, which began in the Chinese city of Wuhan in December 2019 before spreading throughout the world.

According to Onsarigo, the workshop will serve as a platform for raising awareness about pathogens and biological weapons of mass destruction in general.

"The BWC is trying to prohibit the production, acquisition, stockpiling and transfer of pathogens without valid justification. We want to encourage the use of pathogens for peaceful science like the production of vaccines," she said.

The BWC is critical in addressing the proliferation of Weapons of Mass Destruction (WMD). Established in 1972, the convention has almost reached universal membership with 184 state parties and four signatory states.

The United Nations Office for Disarmament Affairs (Unoda), through

the Implementation Support Unit (ISU) for BWC, in collaboration with the Kenyan government through Nacosti, has organised the Mombasa workshop.

Participants will demonstrate their broad understanding of BWC, implementation of the convention in their respective countries, legislations put in place as well as discuss the roles of National Contact Points (NCPs).

Member states comprise Kenya, Ethiopia, Madagascar, Mauritius, Seychelles, Sudan, Tanzania, Uganda, Comoros, Djibouti, Somalia and South Sudan. They shall develop a work plan for enhancing the implementation of BWC.

Onsarigo said Nacosti has put in place surveillance mechanisms to ensure research institutions uphold standards. "We have made sure the laboratories where pathogens are stored are well secured; neither are the organisms used for the wrong purposes," a senior scientist said, adding that Kenya does not produce pathogens in mass.

With the changing terror dynamism, Nacosti director general Prof Walter Oyawa said terrorists are moving away from the use of mass biological weapons and are instead employing simple methods like pollution of consumable products.

"We want to enlighten Kenyans to be cautious about their environment and remain alert since biosafety and biosecurity are emerging challenges," Oyawa said.

Among its various functions, Nacosti undertakes regular inspections and monitoring and evaluation of research institutions.

hunguku@standardmedia.co.ke

2019

THE year the Covid-19 pandemic started in December in the city of Wuhan in China before spreading throughout the world.

Appendix X: Plagiarism Report

Mutai Thesis			
ORIGINALITY REPORT			
12%	10%	3%	6%
SIMILARITY INDEX	INTERNET SOURCES	PUBLICATIONS	STUDENT PAPERS
PRIMARY SOURCES			
1	erepository.uonbi.ac.ke Internet Source		2%
2	www.omicsonline.org Internet Source		1%
3	docplayer.net Internet Source		1%
4	Submitted to National Defence College Kenya Student Paper		<1%
5	Submitted to Metropolitan Community College Student Paper		<1%
6	Oscar Gakuo Mwangi. "The "Somalinisation" of terrorism and counterterrorism In Kenya: the case of refoulement", Critical Studies on Terrorism, 2018 Publication		<1%
7	ir.mu.ac.ke:8080 Internet Source		<1%
8	repository.iaa.ac.tz:8080 Internet Source		<1%