

NUCLEAR TERRORISM AS A POSSIBLE THREAT TO AFRICA

by

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ABSTRACT

This study investigates *Nuclear Terrorism as a possible threat to Africa* by means of a *systematic literature review*. The danger posed by terrorist groups in acquiring and using nuclear, chemical or biological weapons is more pronounced today than in the past, as terrorist groups have shown more interest in upgrading to more sophisticated tactics in their conduct of terror activity and adapt to more modern and advanced ways and means. Africa has a significant role in preventing the possible threat of nuclear terrorism as it continues to be vulnerable to the unlawful trade and trafficking of radioactive uranium because of its deficient control and regulatory systems which are often prone to malfunction and corruption, such as the existing weak borders that are not effectively controlled in several parts of the continent; the inadequate safety of the operating uranium mining and production sites in Africa; and the prevailing weak and corrupt governing institutions.

The study's emphasis is on the full implementation of the United Nations Security Council (UNSC) Resolution 1540 (2004) as a central counter-terrorism and non-proliferation instrument in Africa and as a mutually reinforcing and inter-related legal mechanism which complements and reinforces the Nuclear Non-Proliferation Treaty (NPT). The research also revises the role of regional treaties such as the African Nuclear-Weapon-Free Zone Treaty (Treaty of Pelindaba), which supports UNSC Resolution 1540 in realising Africa's efforts in reducing the risks of nuclear proliferation, such as nuclear terrorism. The study remarks on the viewpoint and attitudes towards these initiatives and the role of the African Union (AU), and examines the progress made so far in executing the obligations of the UNSC Resolution 1540 by African member states.

While there is growing international agreement that the threat of nuclear terrorism is real, understanding *how* the threat and perceptions of it have evolved clarifies the challenges faced by governments and policymakers today. In the identification of the research theme and motivation of the research study, the paper proposes two policy questions that guide and direct the research moving forward, namely: (1) how real is the risk to Africa? and (2) what policy measures would be most effective in reducing the risk? Simply put, what is the appropriate and relevant response by African states to the issue of the possibility of the acquisition and use of nuclear weapons by terrorist organisations?

TABLE OF CONTENTS

ABSTRACT	i
TABLE OF CONTENTS	ii
LIST OF FIGURES	v
LIST OF TABLES.....	v
ACKNOWLEDGEMENT	vi
ABBREVIATIONS/ ACRONYMS/ UNITS OF MEASUREMENT	vii
CHAPTER 1: INTRODUCTION	1
1.1 Identification of the Research Theme	1
1.1.1 Africa and Global Nuclear Non-proliferation	3
1.2 Motivation of the Research Study	4
1.3 Literature Overview.....	6
1.4 Research Methodology	10
1.5 Research Structure and Demarcation of Chapters	11
CHAPTER 2: THE THREAT OF NUCLEAR TERRORISM IN THE 21ST CENTURY	12
2.1 Introduction.....	12
2.2 Defining the Threat of Nuclear Terrorism.....	12
2.2.1 What is Nuclear Terrorism?	13
2.2.2 The Threat Categories of Nuclear (or Radiological) Terrorism	15
2.2.3 Modelling and Delivering a Nuclear Device	19
2.2.4 Nuclear Weapons and the Threat of a “Dirty Bomb”	21
2.2.4.1 Sources and uses of radioactive materials.....	23
2.3 The Rising Threat of Nuclear Terrorism.....	24
2.3.1 The pursuit of nuclear material and weapons by terrorist organisations: The demand and supply margins of the nuclear market.....	25
2.4 Theoretical Perspectives on Nuclear Security: The Atomic Age	31

2.4.1 Nuclear Security and Classical Deterrence	32
2.4.2 Nuclear Security in the 21st Century	33
2.4.3 Increasing Consensus about the Threat of Nuclear Terrorism	34
2.5 Conclusion.....	35
CHAPTER 3: WEAPONS OF MASS DESTRUCTION IN AFRICA.....	36
3.1 Introduction.....	36
3.2 Defining “Weapons of Mass Destruction” (WMD)	37
3.3 The Role of International and Regional Non-proliferation Regimes	38
3.3.1 The Nuclear Non-Proliferation Treaty (NPT)	38
3.3.2 WMD non-proliferation and UNSC Resolution 1540.....	41
3.3.3 Responsibility and Obligations of the UNSC Resolution 1540.....	43
3.3.4 Implementation of UNSC Resolution 1540 and the role of the Security Council Committee.....	45
3.4 The African Union (AU) and Nuclear Security.....	46
3.4.1 The Role of African Nuclear Weapons Free Zone Treaty.....	48
3.5 Conclusion.....	49
CHAPTER 4: AFRICA AND THE THREAT OF NUCLEAR TERRORISM.....	50
4.1 Introduction.....	50
4.2 The Threat of Nuclear Terrorism in Africa.....	50
4.2.1 Border Control Mechanisms in Africa	51
4.2.2 Uranium Mining in Africa	53
4.2.3 Uranium Trafficking or Theft Incidents in Africa	55
4.3 Regional Collective Security in Africa	58
4.3.1 Response to Challenges of Implementation of Resolution UNSC 1540	60
4.3.2 Insufficient Reporting to the UNSC 1540 Committee by African States.....	61
4.3.3 The Operation of a “Power Bloc” – Recommendations for Implementation.....	65
4.3.4 South Africa’s Role in Leading Africa’s Non-proliferation Initiatives.....	68
4.4 Conclusion.....	70

CHAPTER 5: CONCLUSION	71
5.1 Overview of the Research.....	72
5.2 Outcomes	73
5.3 Evaluation.....	75
Bibliography.....	78

LIST OF FIGURES

Figure 1: Number of Nuclear Warheads Worldwide, January 2017	16
Figure 2: Number of Nuclear Warheads Worldwide, 2015.....	16
Figure 3: Total Warhead Holdings, Global Share of Russia and the U.S.....	17
Figure 4: Regular Nuclear Weapons Options for Terrorists	20
Figure 5: A Radioactive Dispersal Device (RDD) ("dirty bomb")	22
Figure 6: Diagram showing the basics of a "dirty bomb" by al Qaeda 2003.....	23
Figure 7: Accomplishments of IAEA Safeguards Implementation, 2016	41
Figure 8: Al-Shabaab influenced zones in Somalia, February 2018	52
Figure 9: Non-reporting states, 2015	64

LIST OF TABLES

Table 1: Reports submitted to the 1540 Committee.....	63
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“Fall in love with a weird one, someone not quite right in the head, life is far more interesting when love is odd” – Tophér Kearby.

ABBREVIATIONS/ ACRONYMS/ UNITS OF MEASUREMENT

AFCONE	African Commission on Nuclear Energy
ANWFZ	African Nuclear Weapon Free Zone
AU	African Union
AUC	African Union Commission
BWC	Biological Weapons Convention
CTBTO	Comprehensive Nuclear-Test-Ban Treaty Organisation
CTRRC	The Counter Terrorism Research and Resource Centre
CWC	Chemical Weapons Convention
CADSP	Common African Defense and Security Policy
DRC	Democratic Republic of the Congo
FBI	Federal Bureau of Investigation
EAC	East African Community
ECCAS	Economic Community of Central African States
ECOWAS	Economic Community of West African States
HEU	Highly Enriched Uranium
IAEA	International Atomic Energy Agency
IND	Improvised Nuclear Device
ISIS	Islamic State in Iraq and Syria (The Islamic State)
ISIL	Islamic State of Iraq and the Levant (Daesh-Sinai)
ISS	Institute of Security Studies
KG	Kilogram
KT	Kiloton
LEU	Low-Enriched Uranium
GWe	Gigawatt Electrical
MUJAO	Movement for Oneness and Jihad in West Africa
NGO	Non-Governmental Organisation
NNWS	Non-Nuclear Weapon States
NPT	Non-Proliferation Treaty
NWFZs	Nuclear Weapon-Free Zones
NWS	Nuclear Weapons States
PSC	Peace and Security Council
RECs	Regional Economic Communities

RDDs	Radiation Dispersal Devices
Resolution 1540	United Nations Security Council Resolution 1540
Resolution 1267	United Nations Security Council Resolution 1267
Resolution 1373	United Nations Security Council Resolution 1373
SADC	Southern African Development Community
tU	Tonnes of Uranium
UMA	Arab Maghreb Union
UN	United Nations
UNSC	United Nations Security Council
UNREC	UN Regional Centre for Peace and Disarmament in Africa
WMD	Weapons of Mass Destruction
WNA	World Nuclear Association

CHAPTER 1: INTRODUCTION

1.1 Identification of the Research Theme

This research investigates the threat of nuclear terrorism as a possible threat to Africa by means of a systematic literature review.

It evaluates the findings of relevant individual studies, focusing broadly on the network of global and regional non-proliferation instruments such as the (UNSC) Resolution 1540 – strengthening the UN's efforts to inhibit the proliferation of weapons of mass destruction (WMD) by non-state actors such as terrorist organisations and the African Nuclear-Weapon-Free Zone Treaty (Treaty of Pelindaba) which in the same way as Resolution 1540, “imposes binding obligations on member states to adopt legislation to prevent the proliferation of WMD and establish appropriate domestic controls to prevent their illicit trafficking” (United Nations 2004).

It highlights the Nuclear Non-Proliferation Treaty (NPT) and its safeguard and monitoring agency, the International Atomic Energy Agency (IAEA), and key global conventions in support of eliminating the usage of any kind of WMD – be it a nuclear, a biological, or a chemical weapon – such as the Convention on the Suppression of Acts of Nuclear Terrorism and the Convention on the Physical Protection of Nuclear Material.

While there is growing international agreement that the threat of nuclear terrorism is real, understanding *how* the threat and perceptions of it evolved clarifies the challenges faced by governments and policymakers today. Therefore, the systematic literature review will compare and summarise, not critique, and appropriately determine what is already known about the possible threat of nuclear terror on the continent. It will assess what the problem is and provide the corresponding response to nuclear terrorism as a possible threat in Africa. The phenomenon of nuclear terrorism is broadly described as the “terrorist use of nuclear weapons” (Wilner 2015: 36). Several African states continue to deal with threats from terrorist organisations. The continent offers both a “facilitating environment and a target-rich environment” (Cilliers 2003: 91) for various terrorist networks that seek to acquire more sophisticated measures of violence, such as the use of nuclear weapons.

The continent's vulnerability to illegal acts of terrorism is mainly because of the deficient control and regulatory systems in Africa which are often prone to malfunction and corruption, such as existing weak borders that are not effectively controlled in several parts of the continent allow easy access for various hazardous terrorist conducts on the region (Clarke and Newman 2006). It is also a result of the inadequate safety and control of the operating uranium mining and production sites in Africa. This is because of the escalating demand in nuclear energy worldwide that has drawn substantial global attention on the continent's considerable uranium deposits. Hence the focus on Africa surrounding this issue, as the high demand and interest elevates the risks to illicit acts of nuclear terror on the continent, such as the smuggling and trade of fissile materials (World Nuclear Association 2017).

The research also remarks on the prevailing weak and corrupt governing institutions and discusses the importance of the principles of *full commitment, efficient government coordination and active participation* amongst fellow African countries. It emphasises the role of regional *cooperation* in realising the full implementation of global and regional non-proliferation initiatives by the continent (Cilliers 2003; Kasprzyk 2017).

The threat of nuclear terrorism will be investigated on the broad framework of WMD non-proliferation in Africa, upon which nuclear will be dealt with as a WMD. This approach corresponds with the overall conversation on nuclear non-proliferation and disarmament *by African leaders*, as they continue to collectively support the regional and global elimination of any kind of WMD – be it nuclear, biological, or chemical weapons.

This angle also complements and reinforces Resolution 1540, as it essentially appeals to the *full* and efficient implementation of the rules and regulations advanced to *minimise* the proliferation of WMD by non-state actors (Inter-Parliamentary Union 2016).

The two most important policy questions about the issue of nuclear terrorism as possible threats in Africa are (1) *how* real is the risk to Africa? and (2) *what* policy measures would be most effective in reducing that risk? What is the appropriate and relevant response by African states to the issue of nuclear weapons in the hands of terrorist organisations?

1.1.1 Africa and Global Nuclear Non-proliferation

The study considers how the acquisition of highly enriched uranium (HEU) or separated plutonium, by way of trafficking or theft, to build crude nuclear weapons such as a “dirty bomb”, is the most likely possibility for nuclear terrorism (Shuster and Georgia 2017). Hence the need to establish robust regulation on the safety of the mining and production of nuclear materials which, if unsecured, expose the continent to high risk. It therefore endorses that the cornerstone of any practical strategy to prevent nuclear terrorism must be to refuse terrorist groups entry to nuclear weapons and nuclear weapons-usable materials. This is the only way to counteract nuclear terrorism – safeguarding these materials at source (Deshwal 2016).

The research illustrates how the increase in demand in Africa’s uranium reserves for nuclear research and technology across various sectors including food and agriculture; medicine and scientific research; consumer products; industry; and transportation has seen an increase in global interest into its uranium deposits. The African continent holds some of the world’s largest uranium deposits and is one of the world’s leading uranium suppliers (Van Wyk 2014: 382). The need to safeguard nuclear material from the hands of terrorist organisations has therefore taken on heightened significance on the continent in recent times, and this puts the continent at a key position in the issue of proliferation, and in preventing the risks of the acquisition of weapons-usable nuclear material by terrorist organisations.

Even though the vast majority of countries on the continent report to no possession, or intention to acquire any nuclear weapons and South Africa shut down its nuclear weapons programme, the risk of nuclear terror in Africa, even though low, is still significant, as risks posed by the theft and use of these nuclear materials, equipment, and technologies by terrorist organisations in the area are high. For this reason, Africa has a crucial role to play in ensuring the security of uranium mines from illegal terrorist activities.

Indeed, since South Africa’s disposal of its nuclear programme, the continent has emerged as a “champion” of global nuclear disarmament (Van Wyk 2014: 383). However, Africa’s involvement in global nuclear forums and discussions has been historically poor due to political instabilities and limited resources due to other prioritised domestic challenges such as poverty, health issues, and unemployment, which African officials prioritise over

nuclear non-proliferation commitment (Jørgensen-Dahl, Østreng, and Triggs 2016: 75). The research observes how the preoccupation with more pressing domestic challenges limits the continent's capacity to realise the full implementation of non-proliferation regimes, despite the evident ambition across the continent, and hinders the execution of Africa's vision of a nuclear-free continent (van Wyk and van Wyk 2015).

The existing weak and easily accessible borders in Africa, substantiated by its weak security measures in uranium mining and production sites, is maybe the biggest African connection on the issue of non-proliferation that links it to the overall issue nuclear terrorism. African leaders have therefore undertaken the goal towards a nuclear-free continent and engaged in important nuclear disarmament and non-proliferation regimes. This is confirmed by the fact that all African countries, except for South Sudan, are signatories to the NPT. The Treaty is regarded as the foundation of the international non-proliferation regime and aims to "prevent the spread of nuclear weapons and weapons technology, promote co-operation in the peaceful uses of nuclear energy and to further the goal of achieving nuclear disarmament and general and complete disarmament" (International Atomic Energy Agency 2017).

1.2 Motivation of the Research Study

Nuclear Terrorism as a possible threat to Africa

Nuclear Terrorism as a possible threat to Africa is a potential risk that calls for more robust research and global discourse on the nature of the phenomenon and the understanding of the threat itself on the continent.

This research is mindful of the various financial, technical, logistical, and military complications that make it extremely *unlikely* for any extremist organisation to successfully manufacture and launch a full-blown nuclear weapon to yield the aftereffects of nuclear panic and terror, and most likely death (Eaves 2016), and considers how the acquisition of HEU or separated plutonium, by way of trafficking or theft, to build crude nuclear weapons such as a "dirty bomb", is the *most likely* possibility for nuclear terrorism (Shuster and Georgia 2017).

Objectives of the research study

This research is thus aimed at:

- i. Providing the required information and focus on nuclear terrorism and highlight the inconsistencies on the issue of nuclear proliferation and non-state actors. The research supposes that although the vast majority of African countries report to no possession, or intention to acquire these nuclear weapons, the risk of nuclear terror in Africa is valid, as weapons-usable nuclear materials, equipment, and technologies could possibly be obtained and used by terrorists via illicit smuggling networks, because of the continent's weak and volatile borders, insecure uranium mining and production sites, and the available corrupt central governments in various African countries which continue to expose the continent's vulnerability to unlawful acts of terrorism (Inter-Parliamentary Union 2016: 4).

Significant progress has been made in ensuring that stockpiles of the essential ingredients of nuclear weapons around the world are secured from theft and transfer to terrorists. However, some existing inconsistencies remain still in explaining clearly *how* states can prevent the spread and use of these WMD materials and equipment by non-state actors and illustrate exactly Africa's role in this. By clarifying these irregularities, the research study provides implications for practice and policy: what is the appropriate and relevant response by African states to the issue of nuclear weapons in the hands of terrorist organisations? It also supplements how the *discipline* itself and *practice* of security and strategic studies can approach the modern security challenge of possible nuclear terrorism in Africa by:

- ii. Examining existing research in clarifying the challenge posed by WMD proliferation in Africa, and subsequently the possible threat of nuclear terror on the continent. The passage attends to the action-steps essential to reduce the inadequate implementation of the multitude of international and regional non-proliferation treaties, specifically the UNSC Resolution 1540 and the complimentary Treaty of Pelindaba, in realising Africa's efforts in reducing the risks of nuclear proliferation such as nuclear terrorism. It remarks on Africa's viewpoint and attitudes towards these initiatives, and examines the progress made so far in executing the obligations of Resolution 1540, and the various challenges faced by African leaders to the full implementation of the resolution.

With that, the research observes the significant lessons to be learned from a careful consideration of South Africa's nuclear weapons programme by the international non-proliferation system, such as the significance of *political will*, *cooperation* and *transparency*. Being the first country to ever assemble and later renounce its nuclear arsenal voluntarily, the discipline and practice of security studies could use this experience to revise and modify the traditional theory of deterrence to accommodate and explain current trends such as the example of South Africa's nuclear programme (Birch and Smith 2015).

1.3 Literature Overview

Nuclear Terrorism as a possible threat to Africa is a potential risk that calls for more robust research and discussion on the nature of the phenomenon and the understanding of the threat itself on the continent. In evaluating one security threat – terrorism – the research supports the understanding of the evolving principles and procedures in the realm of nuclear security in the 21st century by explaining the phenomenon of nuclear terrorism in the modern world.

The most often-cited pessimistic reports have been by Harvard's Graham Allison, examined in this research through the author's books: *Nuclear terrorism: The ultimate preventable catastrophe* (2004), *Nuclear Disorder: surveying atomic threats* (2010), and other publications. Allison, along with various other distinguished thinkers such as Michael Levi *On Nuclear Terrorism* (2009); Robin Frost on *Nuclear terrorism after 9/11* (2005); and Charles Ferguson, William Potter, and Amy Sands on *The four faces of Nuclear Terrorism* (2012), contend that a major nuclear attack by terrorists is more likely than we think in the foreseeable future – "within the next ten years" or "by end of the decade". Others are more sceptical of the likelihood of the threat of nuclear terrorism, including John Mueller who in his book *Atomic Obsession: nuclear alarmism from Hiroshima to al-Qaeda* (2009), alleges that "the likelihood that a terrorist group will come up with an atomic bomb seems to be vanishingly small – perhaps very substantially less than one in a million" (Mueller 2009: 7). An in-between stance is that of Cass Sunstein whose publication *Terrorism and probability neglect* (2003) points out that "if there is a yearly probability of one in 100.000 that terrorists could launch a nuclear or massive biological attack, the risk would cumulate to one in 10.000 over ten years and to one in 5.000 over twenty" (Sunstein 2003: 124); implying that the odds are unpromising. In any case, attempting to make any reliable

mathematical evaluation of the probability of a disastrous nuclear attack by terrorists is an unproductive and near useless effort, but these minimal odds should not deter necessary attention and confrontation with the threat itself.

The research study notes the significant progress that has been made in ensuring that stockpiles of the essential ingredients of WMD are secured from theft and transfer to terrorists. However, most states still need to clarify exactly how they can prevent the possible spread and use of these materials and equipment by terrorist organisations. Matthew Bunn, for example, in *Nuclear terrorism: a strategy for prevention (2010)*, presents distinctive insights into the operation of terrorist organisations and provides key recommendations on dealing with the global threat of nuclear terrorism facing the modern security environment. This is further endorsed by his joint updated publication titled *Preventing nuclear terrorism: continuous improvement or dangerous decline* (Bunn, Malin, Roth, and Tobey 2016), who present the most innovative, thoughtful, and comprehensive account of nuclear terrorism. The authors provide coordinated steps in preventing the security threat of nuclear terrorism, which could provide useful insight into counterterrorism and policy-making.

The nuclear proliferation experts writing on *Preventing Nuclear Terrorism* (Carter *et al.* 2007) also emphasise that the most critical and cost-effective step to prevent a nuclear terrorist attack is to secure nuclear weapons and their essential ingredients at their source. This emphasises the key objective of the International Atomic Energy Agency (2017) for Non-Nuclear Weapon States (NNWS) which is to safeguard nuclear materials and equipment and prevent the risks of nuclear proliferation.

Accordingly, Snyder's *Contemporary security and strategy*, specifically chapters seven and eight on the future of nuclear strategy (Andrew Butfoy) and nuclear weapons proliferation (Richard Gray) respectively, and more recently Butfoy's (2016) *Common Security and Strategic Reform: A critical analysis* contend that the post-Cold war modern security environment recognises the radical transformation of modern-day threats, yet the directed policy responses have not kept pace with the rapidly-evolving nuclear threat in the present-day environment.

The research will not only capture how the existing literature addresses the phenomenon of nuclear terrorism, but in looking specifically at Africa, it grounds it in a broader framework of the continent's progress in the fight against WMD, by looking at nuclear as a

WMD, and the possible threat of nuclear terrorism to Africa. For that reason, this research study explores the works of the research community of the Nuclear Threat Initiative (2015); the NPT; the African Treaty of Pelindaba; UNSC Resolution 1540 passed by the United Nations (UN); and binding treaties which all emphasise states' individual efforts to nuclear non-proliferation, nuclear disarmament, and the peaceful use of nuclear power and technologies. These efforts underline Africa's objective in the total elimination of nuclear weapons worldwide, and a nuclear free continent, and as a significant example of global nuclear disarmament. It also consults with various other writings and publications on nuclear non-proliferation and disarmament, such as the literature by Gareth Evans and Yoriko Kawaguchi (2009) in their *Report of the International Commission on Nuclear Non-Proliferation and Disarmament* on "eliminating nuclear threats".

It further exploits the writings of Koblentz (2014) and Brill & Bernhard (2015), who write extensively in their papers *Strategic stability in the second nuclear age* (Koblentz 2014) and *A convention on nuclear security: a needed step against nuclear terrorism* (Brill and Bernhard 2015) on the threat of nuclear terrorism. The reports remark on former U.S president Obama's initiative on nuclear security during the 2010 nuclear summit in Washington, underpinning the ongoing discussion on the challenges of nuclear security.

The research paper engages in a scholarly discussion to understand the relationship between international nuclear terrorism and its relevance to Africa, and the efforts made by African state officials to prevent non-state actors such as terrorist organisations from acquiring and using WMD. It does so by reviewing and comparing various studies that support this exploration, such as *Terrorism and Africa* (Cilliers 2003: 91-103); *Nuclear terrorism in Africa* by Van Wyk (2015); *Terrorism and Africa and African parliaments lead the continent's fight against Weapons of Mass Destruction* (Kasprzyk 2017). It also evaluates the research carried out by the Institute for Security Studies (2016) and the Inter-Parliamentary Union (2016) on Africa's efforts in the ban on nuclear weapons; as well as African leaders' commitments to the continent's fight against WMD. This conversation is grounded on UNSC Resolution 1540 – as an essential instrument in counter-terrorism and non-proliferation worldwide.

Furthermore, the research study pays interest to South Africa, the only nuclear weapon state to dismantle its nuclear weapons programme and give up its nuclear power to promote the country's objective of a nuclear-free continent. The research considers the

several publications by Jo-Ansie van Wyk, and some by Anna-Mart van Wyk, who write extensively on the prospects of South Africa's nuclear programmes. It also remarks on *South Africa's Nuclear Weapons Programme: from deterrence to dismantlement* (Stumpf 2001) and Nic Von Wielligh and Lydia Von Wielligh-Steyn's *The Bomb: South Africa's nuclear weapons programme* (2015), alongside the writings on various regional non-proliferation multilateral regimes such as the Treaty of Pelindaba, which observe that South Africa retains most influence in its capacity to combat the issue of WMD proliferation and possible illicit conduct of nuclear terrorism on the continent.

The main objective is to learn from previous studies and findings on the research area of nuclear security, where the discipline and practice of Security Studies could use South Africa's experience to revise and modify the traditional theory of deterrence to accommodate and explain modern trends such as the example of South Africa's nuclear programme and the role of non-state actors in nuclear security. It therefore explores the debated doctrines and strategies connected to the subject of nuclear security, more specifically nuclear proliferation and nuclear disarmament.

Furthermore, in reviewing the possible threat on the continent and the rightful instruments and mechanisms to confront this challenge, the term 'nuclear' will be purposely examined under the broader framework of WMD in the African context (nuclear as a weapon of mass destruction), along with the possible threats of biological and chemical weapons, as this is a more realistic and sensible approach because it considers Africa's broad security framework and context, and progress in its fight against WMD, emphasising the nuclear risk as the most pressing threat from the rest (Fink 2013: 4-7). Going forward, the research will demonstrate how the discipline and practice of Security Studies must look at the issue at hand, noting how the various available literature on the issue demonstrate how we are keeping up and revises the progress made so far (Zurynski 2014: 1).

1.4 Research Methodology

The analysis will be based on an extended literature review, where it makes use of both primary sources such as the NPT; the UN Resolution 1540; the Treaty of Pelindaba; and secondary sources such books, journal articles, policy documents, and news reports on global and regional nuclear security, nuclear terrorism, and WMD proliferation in Africa. It is necessary to evaluate what has been gained and what countries; international and regional organisations; and various think tanks responsible for nuclear security, still need to do regarding the challenge and risks of the possible threat of nuclear terror on the region.

It uses a reflexive and interpretive review that consists of critical analysis of the literature published in books and electronic or paper-based journal articles. It does so systematically, by examining how the various texts highlighted in the aforementioned paragraphs have conceptualised the issue of nuclear terrorism as a possible threat to Africa.

By means of a systematic literature review, the research will not only capture how the literature addresses the phenomenon of nuclear terrorism, but in examining Africa, the evaluation grounds it on a broader framework of the continent's progress on the fight against WMD, and only looking at nuclear as a WMD. In this way, it also seeks to inform the already existing information on the subject area, whilst avoiding unnecessary repetition, hence it specifically examines effective implementation on the regulations set out for governments to prevent non-state actors from accessing such WMD materials, equipment, and technologies on the continent (Siddaway 2016: 2-3).

The systematic literature review will explain, and appropriately determine, what is already known about the possible threat of nuclear terror on the continent, starting with global regimes at the top such as the NPT and its corresponding agency the AIEA; UNSC Resolution 1540 and the 1540 Committee; moving on to regional organisations and regimes such as the AU and the African Nuclear-Weapon-Free Zone Treaty (Treaty of Pelindaba), to help us understand the level of risk of nuclear terror in Africa. As it follows, this methodology aims to address the possible threat of nuclear terrorism in Africa by "*identifying, critically evaluating and integrating* the findings of [all the above-cited] relevant, high-quality individual studies addressing the research problem [at hand]" (Siddaway 2016: 1).

1.5 Research Structure and Demarcation of Chapters

This research inquiry is structured as follows:

Chapter 1: Introduction

This chapter introduces the topic of nuclear terrorism as possible threat in Africa, and the objectives of the research study itself. It also describes the literature overview and research methodology of choice to understand the relationship between global nuclear terrorism and its relevance in Africa.

Chapter 2: The Threat of Nuclear Terrorism in the 21st Century

This chapter offers conceptual and theoretical clarification, and demonstrates not just what is being dealt with, but also clarifies how the threat has evolved and transformed the rules of global nuclear security to provide a useful understanding of the phenomenon of nuclear terrorism in the modern world and therefore assist how state officials deal with it.

Chapter 3: Weapons of Mass Destruction in Africa

This chapter emphasises the full implementation of the UNSC Resolution 1540 as a central counter-terrorism and non-proliferation instrument in Africa and the complimentary role of the Treaty of Pelindaba.

Chapter 4: Africa and the Threat of Nuclear Terrorism

This chapter specifically examines in detail those facilitating conditions with the most potential for producing preventative advantage and results in determining the best strategies and methods in reducing the risks of smuggling and theft of nuclear materials in Africa.

Chapter 5: Conclusion

The final chapter deliberates on the main outcomes of the research examination and offers a brief discussion of the earlier chapters. It presents an assessment of the assumptions expressed in the first chapter and provides direction for future research.

CHAPTER 2: THE THREAT OF NUCLEAR TERRORISM IN THE 21ST CENTURY

2.1 Introduction

The possibility of a terrorist organisation obtaining nuclear weapons has been increasingly cited as a legitimate and overriding threat in global security in recent years. This chapter offers conceptual clarification; relevant theories and principles underpinning nuclear security; and clarifies the issue at hand: the *possible* threat of a terrorist organisation getting hold of and using nuclear weapons.

It contends that, aside from the theft or seizure of complete nuclear missiles, the thriving black market in weapons-usable nuclear materials such as HEU and separated plutonium is a plausible source of concern, as terrorist organisations can use these materials to assemble an improvised nuclear device (IND). It endorses that the cornerstone of any practical strategy to counteract nuclear terrorism must be to refuse terrorist groups entry to nuclear weapons and nuclear weapons-usable materials – safeguarding these materials at source.

This chapter demonstrates not just what is being dealt with, but also clarifies how the threat has evolved and transformed the rules of global nuclear security to provide a useful understanding of the phenomenon of nuclear terrorism in the modern world and support how state officials deal with it. It engages in a discussion about nuclear security in the 21st century that includes non-state actors seeking nuclear capability and explains the different ways the threat of nuclear terrorism is intensified today. The analysis therefore examines three cases depicting terrorists' fascination with acquiring and using nuclear devices as well as nuclear materials to produce those devices. The three incidents evaluated herein are considered to support the understanding of the threat of nuclear terrorism.

2.2 Defining the Threat of Nuclear Terrorism

The recent global surge of terrorism has drawn attention to the captivating nuclear dimension of the problem. The possibility of a terrorist organisation obtaining nuclear weapons has been increasingly cited as a legitimate and overriding threat in global

security in recent years, as terrorist organisations continue to be absorbed in causing massive nuclear devastation and indiscriminate casualty. The anxiety that terrorists will match this intent with capability continues to intensify worldwide.

“There remains a very real danger that terrorists could get and use a nuclear bomb, turning the heart of a major city into a smouldering radioactive ruin” (Bunn 2010). The UN Secretary-General considers nuclear terrorism as “one of the most serious threats of our time” (United Nations 2017). Similarly, former U.S president Barack Obama has also been candid in his remarks that: “there is no graver danger to global security than the threat of nuclear terrorism, and no more immediate task for the international community than to address that threat” (Obama 2009).

“We must ensure that terrorist[s] never acquire a nuclear weapon. This is the most immediate and extreme threat to global security. The technology to build a bomb has spread, and terrorists are determined to buy, build or steal one” – former president Barack Obama, during his address in Prague, Czech Republic on nuclear disarmament (Obama 2009).

Aside from the possible theft or seizure of nuclear weapon systems, the thriving black market in weapons-usable nuclear materials such as HEU and separated plutonium are plausible sources of concern, as they can be used to assemble a traditional nuclear bomb, such as an IND (Namboodiri 2014: 249-251).

Information on how to manipulate nuclear material to fabricate an IND which would emit a nuclear explosion, or how to build a radiation device such as a radiological dispersal device (RDD) – also known as a “dirty bomb” – to disperse harmful radioactive material, is readily available globally. Hence the only way to counteract nuclear terrorism is to safeguard these materials at source and ensure that these terrorist groups are prevented in any way from getting hold of nuclear material (Brill and Bernhard 2017: 8).

2.2.1 What is Nuclear Terrorism?

Simply put, nuclear terrorism is the “terrorist use of nuclear weapons” Wilner (2015:36: 3). Several specialists, such as the experts from the Counter Terrorism Research and Resource Centre (CTRRC) prefer the definition of nuclear terrorism as the “use or threat of using radioactive materials” by terrorist groups (Bunn, Malin, Roth, and Tobey 2016: 182).

This description coincides with the expansive definition of nuclear terrorism by the International Convention for the Suppression of Acts of Nuclear Terrorism adopted on 13 April, 2005 during the 91st plenary meeting of the United Nations General Assembly by resolution [A/RES/59/290](#), described as “an offense committed if a person unlawfully and intentionally uses in any way radioactive material ... with the intent to cause death or serious bodily injury; or with the intent to cause substantial damage to property or to the environment; or with the intent to compel a natural or legal person, an international organisation or a State to do or refrain from doing an act” (United Nations 2005).

This research considers and adopts the above-cited legal definition as the foundational description of nuclear terrorism. It is worth noting that despite the shared overlapping similarities between nuclear and radiological terrorism, they are in fact different types of threats, although very often, authors examining either nuclear terrorism or radiological terrorism use their features synchronously without restrictions as seen with the cited definitions above, due to their shared attributes.

Distinctively, nuclear terrorism traditionally concerns the terrorist use of nuclear weaponry in which “large amounts of energy are released when HEU or plutonium atoms split during the process of fission” (Bohigas 2014). The outcome wrought from even a basic, unrefined, “crude” nuclear weapon would be incredibly destructive because of the pressure, heat, and radiation produced. Radiological dispersal equipment, on the other hand, exposes mankind to radiation, for example, by the denotation of a “dirty bomb”; whereby “radioactive laboratory waste or civilian nuclear fuel rods would be wrapped around a conventional explosive and detonated, spreading poison and contamination” (Bohigas 2014). The denotation of a radiological device would result in immediate evacuation and decontamination of the proximate area (Hutchinson 2003: 33).

Although critical and fatal, the major life-threatening impact would be by means of long-term health outcomes such as the development of cancer diseases. In short, unlike an IND, the rapidity of a nuclear attack, and the inability to escape such an explosion, and most importantly the significant potential for devastation and sudden death distinguishes the choice in the terrorist use of nuclear weapons over radiological devices (Clarke and Newman 2006: 126).

It is the lethal and destructive power of nuclear weapons that make them particularly interesting to this research analysis as opposed to the radiological threat, as its immediate and irreversible destructiveness make it an urgent matter of discussion.

Given the considerable availability of radioactive material, and the relative simplicity of assembling a radiological “dirty bomb”, the probability of an event involving the use of radioactive substances is *more likely* than the terrorist use of nuclear weapons – although the latter has higher consequence (Cann, Davenport, and Parker 2016). This has led to a trade-off in the definition of nuclear terrorism to also include the use of a radiological device such as a “dirty bomb”, noted in the subsequent sections of this analysis, as one must resist to conforming to traditional ways of thinking when considering acts of nuclear terrorism, since nuclear material is easily manipulated and used to build a “dirty bomb”. The passage below discusses the feasible examples of acts of nuclear terrorism.

2.2.2 The Threat Categories of Nuclear (or Radiological) Terrorism

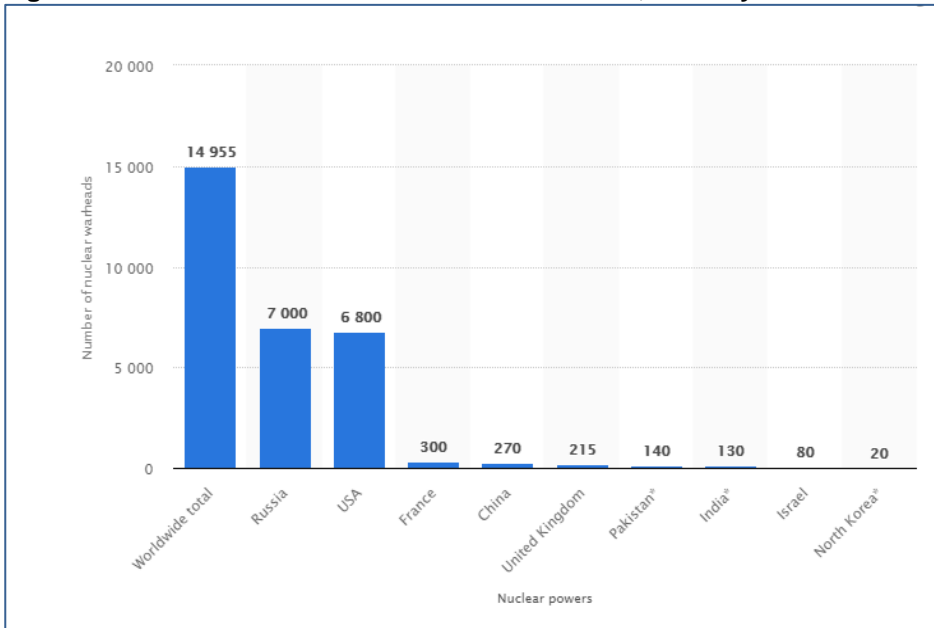
In defining nuclear terrorism, the research distinguishes between three nuclear and radiological threat categories used in the analysis and correlates the elements of nuclear and radiological threats in its evaluation of nuclear terrorism.

The first nuclear threat is the possible theft or seizure of nuclear weapons by terrorist organisations from a nuclear armed state – especially undeclared nuclear states such as Pakistan, and emerging nuclear powers such as North Korea – without the stability and security of the more experienced declared nuclear powers, with high-level safe-guarding mechanisms (Butfoy 2016).

In their published annual nuclear forces database, Kile and Kristensen (2017) from the Stockholm International Peace Research Institute (SIPRI) reveal a decline in the overall number of nuclear weapons worldwide. While the current nuclear armed countries continue to modernise and maintain their nuclear armoury, the nine nuclear weapon states (NWS), the United States (U.S), Russia, France, the United Kingdom (UK), China, Israel, Pakistan, India, and North Korea, where only five countries – the U.S, Russia, China, the UK, and France – from the total nine countries currently have *legally* recognised militarised nuclear capability. Together, these states have control over 14,935 nuclear capacity (see figure 1) compared to the estimated 15,395 by the end of 2015 (see figure 2). Russia has the world’s largest nuclear warhead stockpile possessing 7,500 warheads, followed by the

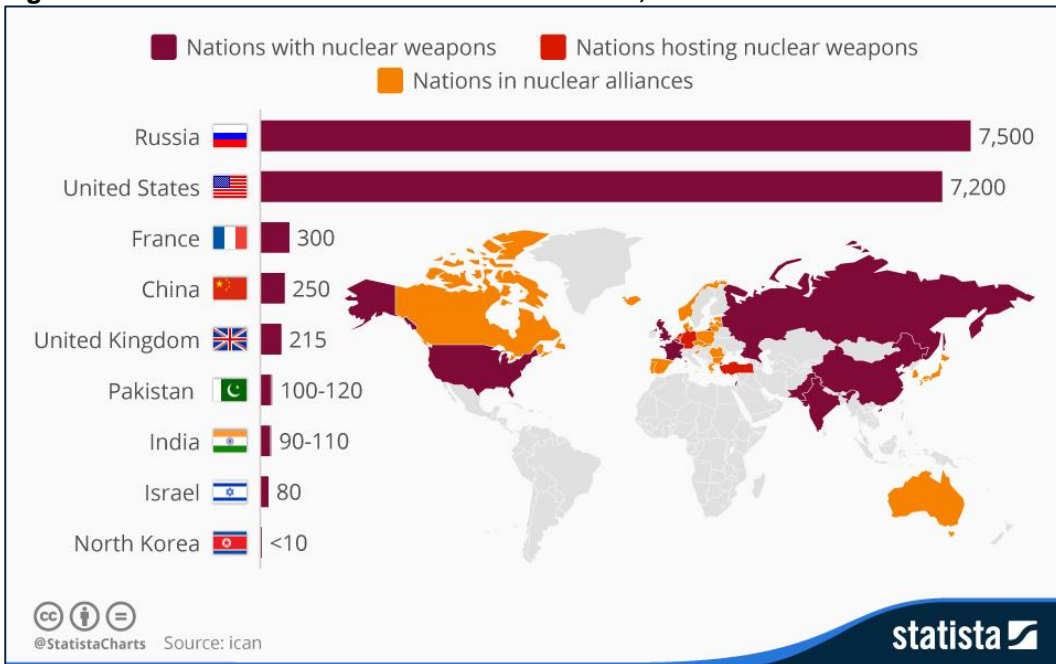
U.S at a close 7,200, both controlling more than 90% of all the existing nuclear warheads (see figure 3), with over 1,800 on high-alert (Kile and Kristensen 2017; McCarthy 2015).

Figure 1: Number of Nuclear Warheads Worldwide, January 2017



Source: Statista (2017)

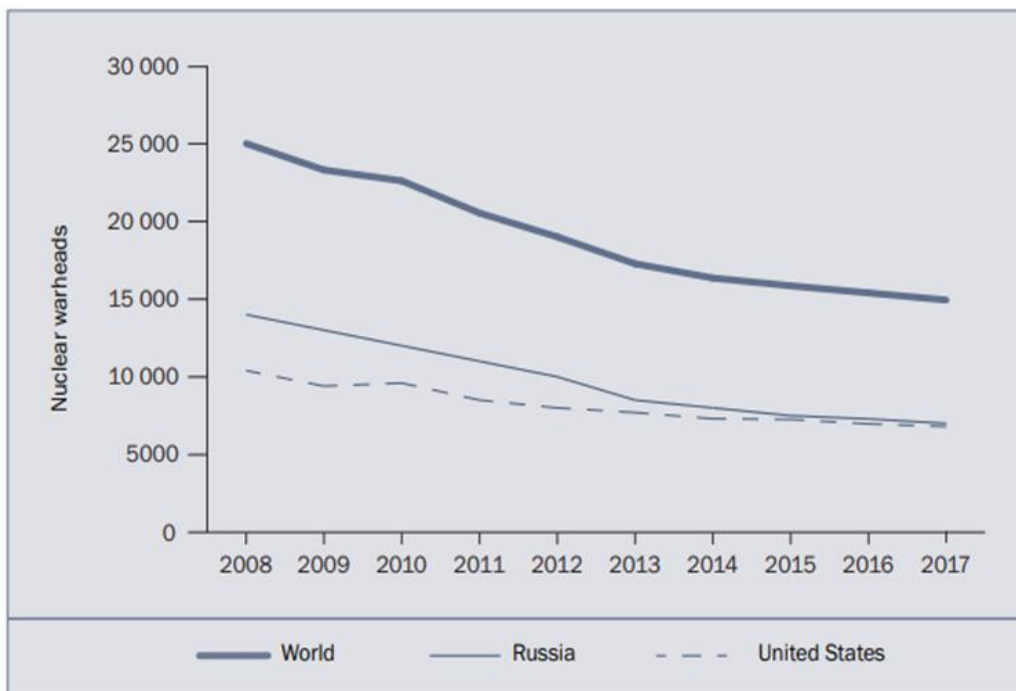
Figure 2: Number of Nuclear Warheads Worldwide, 2015



Source: McCarthy (2015)

It is worth noting that not a single nuclear weapon retaining country is prepared to surrender their nuclear capability any time soon. All the nuclear states illustrated above are either expanding or implementing new nuclear weapon systems or have at least declared their intention to do so (Kile and Kristensen 2017). Half of all the declared warheads controlled by Russia and the U.S are “still operationally deployed and on high alert status ready to be launched immediately within a decision window of just 4-8 minutes for each president, in the event of perceived attack” (Evans and Kawaguchi 2009: 75)

Figure 3: Total Warhead Holdings, Global Share of Russia and the U.S



Source: Kile and Kristensen (2017: 5)

The illustration above shows the sum of warhead holdings of all the nine nuclear-weapon states compared with the U.S and Russia’s holdings between 2008 - 2017.

The system is more vulnerable than ever before, and without guarantee of no occurrence of a possible nuclear attack with the emerging undeclared nuclear states. These economies are unstable and unpredictable, hence vulnerable and at a higher risk of possible seizure and theft from sophisticated and eager terrorist organisations interested in obtaining and using these weapons. The volatile nuclear states include Pakistan and India who, together with Israel, were enlisted as well-developed and qualified *undeclared* nuclear-armed states by 1998. Several experts such as Evans and Kawaguchi (2009) reporting on *Eliminating Nuclear Threats* for the International Commission on Nuclear Non-

Proliferation and Disarmament, argue that the politically and economically unstable North Korea is potentially the most susceptible to miscalculation and mistakes and, more importantly, to the risk of theft and seizure of its nuclear weapons amongst the new nuclear weapon states. The country is reported to be in possession of some half-dozen nuclear explosive devices, all in the hands of fragile and impulsive leadership behaviour (Evans and Kawaguchi 2009: 74; Ross 2016).

These undeclared nuclear states are possibly terrorists' first target, as evidenced by the startling leak about A.Q. Khan's global nuclear smuggling network and al-Qaeda's Osama bin Laden's interaction with Pakistani's retired nuclear experts, Abdul Majid and Sultan Bashiruddin Mahmood, charged to have offered their knowledge and expertise in advising al-Qaeda on fabricating a crude nuclear device. Both events have raised anxieties about the possibility of terrorist groups obtaining nuclear weapons. Even though nuclear weapons are more protected and locked than nuclear materials (making the threat of nuclear terrorism by the theft of a fully developed nuclear weapon highly unlikely), still, even the slightest possibility of terrorists obtaining a fully developed nuclear weapon makes this possible threat valid and of serious concern, as it has the highest consequence (Borger 2001; Stone 2009).

The A.Q. Khan Smuggling Network

The infamous Khan network led by Abdul Qadeer Khan, otherwise known as A.Q. Khan, is widely considered the biggest global nuclear trafficking network to exist to date. The network operated for over two decades during the 1980's and 1990's before it was exposed in October 2003 when uranium-enrichment gas-centrifuge components meant for the Libyan secret nuclear weapons program were captured. The network managed to elude world-class intelligence intervention and established non-proliferation organisations such as the NPT, designed to detect such illicit activity through its monitoring agency, the IAEA (Albright and Hinderstein 2005: 111-112). This confirms an imperfect global non-proliferation system, which failed to expose and end the Khan operation for over 30 years. The network traded nuclear equipment and the know-how to manufacture nuclear weapons to North Korea, Iran, and Libya. Various reports on the case describe how Iran owes its well-developed nuclear programme to the network's influence and assistance in enabling the country to enrich uranium using gas separators. Furthermore, various reports believe the network also assisted al Qaeda's Bin Laden to acquire nuclear secrets prior to

the Taliban's collapse in Afghanistan in 2001 (International Institute for Strategic Studies 2017).

The second threat entails the making of an IND through the acquisition and use of sufficient nuclear material such as "uranium-235 (U-235) and plutonium-239 (P-239) which are products of the nuclear energy enrichment process" (Ellis 2014: 2). A "gun-type" IND, for example, could produce an explosion capacity equivalent to the bombs that devastated Hiroshima and Nagasaki. The analysis focuses particularly on the security of HEU as it poses a bigger risk in Africa owing to the continent's abundant uranium reserves, and also because of the relative ease of manipulating HEU to assembling and using a "gun-type" IND such as the one used on Hiroshima, compared to the more technically challenging plutonium based "implosion-type" bomb used on Nagasaki (Federation of American Scientists 2017).

2.2.3 Modelling and Delivering a Nuclear Device

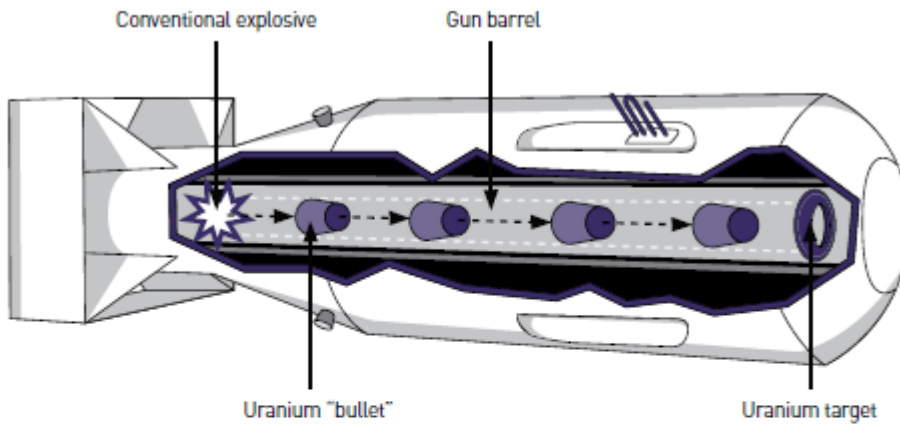
In the least likely case of even the most advanced, well-funded and well-organised terrorist group obtaining a completely functioning nuclear weapon, it would require that they build one (more plausible). The various policymakers of the International Commission on Nuclear Non-proliferation and Disarmament in their account on *Eliminating Nuclear Threats* consider that such a group would most probably go for an uncomplicated, straightforward gun design than a complex, high-tech, and more advanced implosion-type nuclear weapon – see Figure 4 (Policymakers 2009: 41).

Information on how to assemble a crude nuclear device such as the kind used in bombing Hiroshima is readily available online, and the engineering expertise on how to fabricate one is not beyond the capacity of any sophisticated, well-organised terrorist organisation. Indeed, assembling such a nuclear device is not an enormous technological task; any group of engineers could easily design and fabricate one without any undue complication (Policymakers 2009: 40).

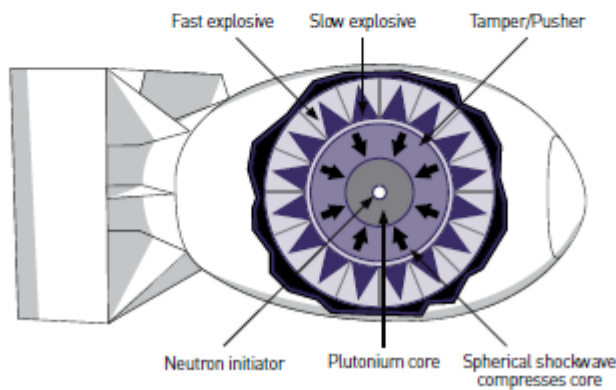
The main challenge for any non-state organisation interested in building such a nuclear bomb would be obtaining the necessary fissile material such as HEU or separated plutonium needed to generate a nuclear explosion. As it stands, there is no single existing free market for these materials, hence the terrorist group would be required to either steal it or obtain it on the black market via various possible smuggling networks like the A.Q Khan network (Bohigas 2014).

Figure 4: Regular Nuclear Weapons Options for Terrorists

BASIC NUCLEAR WEAPON DESIGNS: "GUN" AND "IMPLOSION"



"Gun-assembly" nuclear weapon



"Implosion-type" nuclear weapon

Source: Policymakers (2009: 41)

The terrorist group would require some 50 kilograms (kg) of weapons-grade enriched uranium (ninety percent U-235) to build a 15 kiloton (kt) *gun-assembly* atomic bomb – similar to the one used on Hiroshima – and at least 15 kg of HEU or 5 kg of plutonium (far less nuclear material) for an implosion-type *weapon* of the same capacity (Evans and Kawaguchi 2009: 41). Developing the two different elements of a gun-type nuclear device within the delicate tolerances required to generate a highly-critical nuclear explosion would be a demanding but achievable task, whereas assembling an implosion-type device which requires less nuclear material would be a more demanding and near-impossible route for terrorists seeking to develop and use it (Policymakers 2009: 42).

The two threats of nuclear terrorism described in this section – obtaining a nuclear weapon from a country's nuclear arsenal and building an IND from stolen weapons-usable fissile material such as HEU – are the least possible events. Both cases are least likely to

happen because of the strict safe-guarding systems of nuclear weapons and the relatively high security for nuclear material (Bunn et. al 2016: 185).

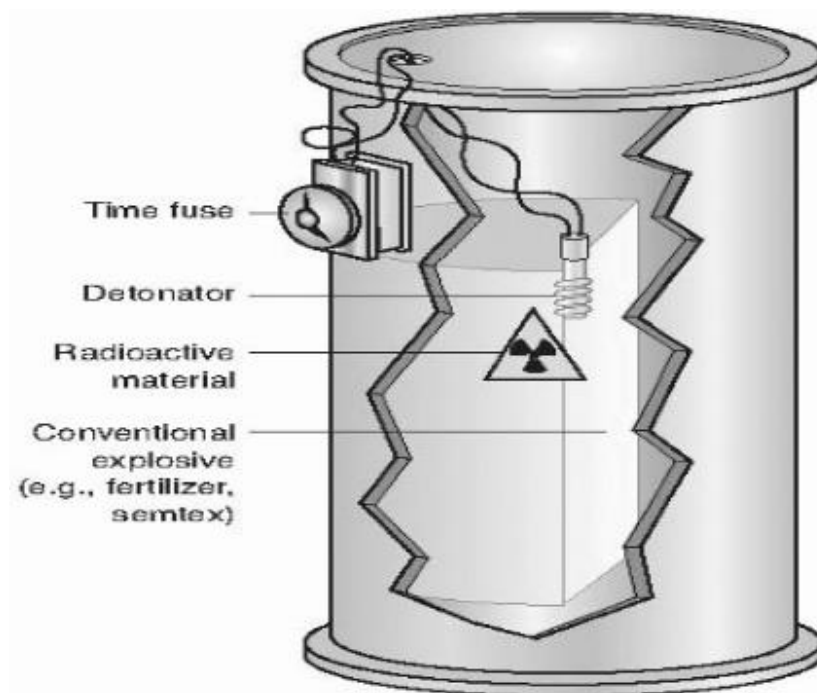
However, they pose the biggest threat because of their sudden and irreversible massive obliteration and deadliness if terrorists were to obtain and use such a nuclear weapon or acquire fissile material to fabricate an IND (Bunn 2010). The study distinctively considers the dangers of the possible theft and illegal trade and trafficking of nuclear material, particularly HEU, as it is contextually more relevant to the investigation of the threat of nuclear terrorism in Africa – where the security and control of uranium mining sites on the African continent is significant in preventing the global threat of nuclear terrorism.

The final threat entails the dispersal of radioactive material, and even though linked to nuclear terrorism, it is in fact a radiological threat. This is of interest for this analysis as it is the *most likely* act of terror owing to the relative availability and use of radioactive materials for industrial purposes, hence the possible sabotage of a nuclear power plant to get hold of these fissile materials. This is in fact the distinguishing overlap in defining nuclear and radioactive threats, as *nuclear material* could be combined and used with traditional explosives in building a *radioactive* “dirty bomb”.

2.2.4 Nuclear Weapons and the Threat of a “Dirty Bomb”

The so-called “dirty bomb” is just one type of radiological dispersal device (RDD), weapons which combine conventional explosives, i.e. dynamite to disseminate radioactive materials (see figure 5 below), and in so doing intensifying the damage and injury caused by such an explosion (Nuclear Control Institute 2017). The terms RDD and “dirty bomb” are notably often used interchangeably by many public reports and the media. The capacity of such a device to cause considerable harm is largely “dependent on the type of radioactive material used and the means used to disperse it” (Medalia 2003).

Figure 5: A Radioactive Dispersal Device (RDD) ("dirty bomb")



Source: Radiology Key (2016), see direct hyperlink in bibliography

The Radioactive Dispersal Device above is simply made up of a small amount of radioactive material attached to a conventional explosive substance, i.e. Semtex (an all-purpose plastic explosive) or fertiliser. Once the explosive substance explodes, the radioactive material scatters all over the place, spreading over a wide area (Radiology Key 2016).

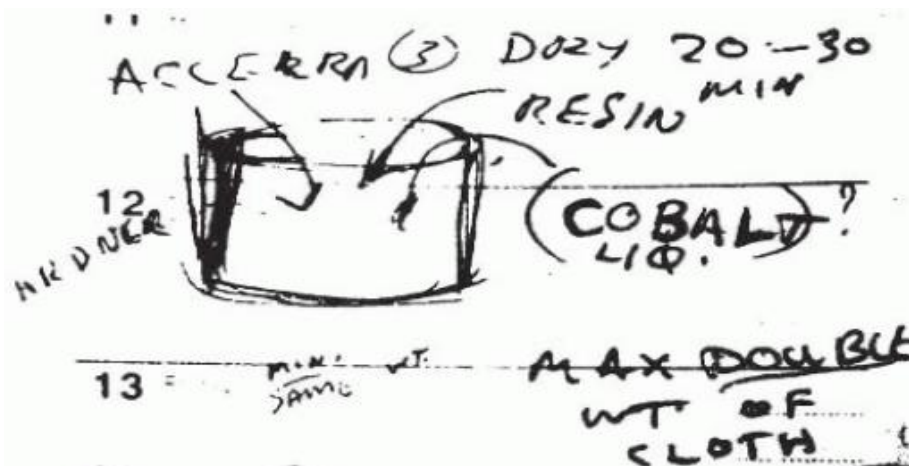
It is worth noting that a “dirty bomb” is nowhere like a nuclear bomb or nuclear weapon. With nuclear bombs, fusion and fission of particular “slightly radioactive materials release energy in a huge explosion” Medalia (2003). On the other hand, RDDs simply “scatter radioactive material; their main physical effect is contaminating an area” (Medalia 2003). A nuclear weapon therefore generates an explosion over a million times more powerful compared to that of a “dirty bomb”. The mist of radiation from a nuclear weapon, for example, could spread to hundreds of kilometres, whereas that of a “dirty bomb” would be scattered within metres of the explosion (Bunn and Braun 2003: 716).

Most RDDs do not discharge enough radiation to cause serious illnesses or deaths. Nevertheless, an explosion resulting from a “dirty bomb” would generate chaos and disruption, and this is the kind of anxiety and panic desired by terrorists seeking to use such a weapon (Nuclear Control Institute 2017).

“Dirty bombs” simply cause disruption in dispersing radiological material and contaminating an area (which is also their primary physical side-effect), whereas an explosion from a nuclear bomb would be more catastrophic and potentially fatal. This has led some experts to insist that a “dirty bomb” is a “Weapon of Mass *Disruption*” rather than a Weapon of Mass *Destruction* (Medalia 2003) – where fear and contamination are the main goals from the potential perpetrators. This is the most likely scenario as the terrorist weapon of choice (based on capability, “dirty bombs” are easier to make than nuclear devices), hence the relevance and interest in the “dirty bomb” in this section of nuclear threats, even though technically a radiological threat (Nuclear Control Institute 2017).

Despite the various predictions of a scenario involving the terrorist use of a “dirty bomb”, owing to its simplicity, so far, the imagined possible events have not transpired. The British intelligence, for example, uncovered a diagram (see figure 6 below) displaying the principle of a “dirty bomb” in Herat, Afghanistan back in 2003, and established that al Qaeda had successfully constructed a small “dirty bomb”, even though the device was never found (Radiology Key: 2016).

Figure 6: Diagram showing the basics of a "dirty bomb" by al Qaeda 2003



Source: Radiology Key (2016), see direct hyperlink in bibliography

2.2.4.1 Sources and uses of radioactive materials

Radioactive materials that could be used in “dirty bombs” range from sources of nuclear fuel from power plants to hospital radiation sources used in medicine (such as therapy and

beam radiation equipment to treat cancers); research facilities; construction sites; and industrial activities such as industrial radiography (Nuclear Control Institute 2017).

The increasing worldwide demand for nuclear energy for industrial, medical, research uses, and power production, calls for the need to secure nuclear materials at their source, and for continued multilateral engagement on the issues of nuclear security, disarmament, and nuclear terrorism as approximately 150 cases of loss of weapons, theft, and illicit trafficking are reported annually (Foss 2017: 36).

“Theft of potential nuclear bomb materials is not just a hypothetical worry; it is an ongoing reality” (Bunn 2008) and the pervasive consequences of such an attack would be felt especially by those least able to afford it. Michael (2012: 83) points out that even though the threat of nuclear terrorism is quite low, it is nevertheless “so consequential as to merit consideration”, and the potential destruction and loss stemming from nuclear terrorism could be disastrous. Hence preventative measures far outweigh any response that could undo the widespread damage by such an incident (Brill and Bernhard 2015: 16).

This research focuses on the likelihood that a terrorist organisation could illegally purchase fissile material available on the black market, or possibly steal it from a civilian and/or military facility and use it to assemble an IND. Most specialists on the topic of nuclear security and nuclear terrorism, such as the researchers from the Belfer Center for Science and International Affairs at Harvard Kennedy School namely Bunn, Malin, Roth, & Tobey (2016), have progressively come to believe this to be a more plausible scenario for terrorists pursuing nuclear weapons compared to the theft of a nuclear weapon attained from a country’s nuclear arsenal in their work *Preventing Nuclear Terrorism: Continuous Improvement or Dangerous Decline?* (Bunn et al. 2016: 185).

2.3 The Rising Threat of Nuclear Terrorism

Threats of nuclear terrorism originate from various sources, ranging from nuclear smugglers, or hackers able to launch damaging cyber-attacks, to high level and well-funded terrorist organisations with crucial inside information and means to carry out their plans. So far, there are no openly-proven incidents of terrorist use of nuclear weapons, by even the most sophisticated and well-organised terrorist organisations. The history of nuclear terrorism encompasses only attacks on nuclear repositories and structures, and *threats* of the use of nuclear bombs by terrorist groups (Bohigas 2014).

The threat of nuclear terrorism today is intensified in two ways. Firstly, the broadened and multiple uses of nuclear expertise and technology in the noted industrial applications of radio isotopes, especially in the production of electricity (Medalia 2003), and the increasing number of shipments of nuclear material. These sources could serve as possible targets for theft or attacks by terrorist groups seeking nuclear material. Secondly, terrorist organisations are increasingly becoming more sophisticated in their methods and tactics as they seek to obtain weapon-usable nuclear material to build non-traditional nuclear bombs (Heinonen 2017).

Three cases have been chosen for the evaluation of the dynamics of nuclear markets and the trafficking routes that can be controlled in preventing terrorist groups from gaining nuclear materials. Despite other terrorist organisations' fascination with getting hold of and using nuclear devices and nuclear materials to produce those devices, the two terrorist organisations evaluated in this section, Aum Shinrikyo and al Qaeda, have perhaps shown the most dedication to accessing nuclear materials and nuclear components. A significant body of open-source text – even though some of it is contradictory and unreliable – is available for analysis, although because of the prejudice and irregularities, no absolute premise can be made from such a review (Daly, Parachini and Rosenau 2005).

Whereas two of the cases assess terrorist groups that had the capacity and intention to acquire nuclear capability, the third case investigates the incident involving the disappearance of nuclear fuel rods from a nuclear reactor in Kinshasa, Democratic Republic of the Congo (DRC), where traffickers sought to smuggle and sell them as ingredients for a nuclear device (Daly, Parachini and Rosenau 2005). This case has been especially considered because of its contextual relevance to the study of the threat of terrorism as a possible threat in Africa. Together, the three cases provide useful insight into the dynamics of the challenges concerning the demand and supply of nuclear materials and nuclear weapons.

2.3.1 The pursuit of nuclear material and weapons by terrorist organisations: The *demand* and *supply* margins of the nuclear market

Implementing a useful and successful comprehensive strategy against the acquisition and use of nuclear capability begins with a complete, systematic understanding of the track record of the phenomenon (nuclear terrorism), hence the research considers and profiles

three cases of two terrorist groups' attempts to obtain nuclear capability. The three incidents evaluated herein are considered to support the understanding of the threat of nuclear terrorism. The analysis focuses less on the description of the events, but the implications of the three occasions for contending nuclear terrorism.

First and foremost, it is worth emphasising that terrorist organisations operating on apocalyptic ideologies continue to be preoccupied by causing massive devastation and loss. The main reason for opting for nuclear capability over chemical or biological weapons is no doubt because of the potential for sizable destruction and devastation and most likely instant death that comes with a nuclear explosion like that of Hiroshima and Nagasaki. Additionally, the rapidity of a nuclear attack, the inability to escape such an attack, and the haunting aftermath make the perfect recipe for a terrorist organisation seeking to cause the ultimate annihilation on mankind (Clarke and Newman 2006: 126).

The opportunities and incidents involving the pursuit of these deadly weapons has increased over the last decade, owing to the current sizable production of nuclear material for commercial use worldwide, and the vulnerable nuclear material storage facilities and mining sites in poor, weak, and unstable regions of the world such as various parts of the African continent. The cases illustrated below demonstrate some of the exploited nuclear market dynamics and trafficking routes that can be controlled in preventing terrorist groups from gaining nuclear materials and devices (especially non-traditional weapon designs).

On the *demand* margin of the nuclear market, the terrorist pursuit of nuclear weapons is driven by a theological or political belief system that supports and elevates mass destruction (also highlighted in earlier sections of the analysis on *why* terrorist organisations seek nuclear capability over other alternative strategies). Some of these organisations, such as al Qaeda, had the appropriate financial advantages and physical assets, as well as considerable organisational and human resources (Albright 2002).

Additionally, these groups relished and benefited from refuge and protection in unregulated "grey zones" – lawless shadow areas – or as "guests" of the local leaders, in which they could carry out their plots and strategies (Kristensen and Norris 2014: 98). For example, Aum Shinrikyo in Japan were legally allowed to operate in a rather accommodating environment without state intervention, due to the lenient Japanese legal protections for religious groups operating in the country (Daly, Parachini and Rosenau

2005). This risk further highlights the role defective control mechanisms where an inadequate justice system without legally-binding rules against potentially harmful operational religious groups overlooks the operations of non-state subnational groups and religious organisations (Cann, Davenport and Parker 2016), discussed in Chapter 4 of the report under *Other Control and Regulatory Mechanisms*, page 57.

On the *supply* margin of the nuclear market, the prospects of such organisations of getting hold of nuclear material and the knowledge of fabricating a nuclear device are potentially abundant (Daly, Parachini and Rosenau 2005). The principal designer of Pakistan's nuclear programme and leader of the world's largest nuclear smuggling network, A.Q. Khan, exposed how members of staff working from a state weapons nuclear programme can easily use their access, as well as their knowledge and experience for personal enrichment and profit (Kerr 2010). The incident involving the disappearance of the nuclear fuel rods in the DRC also demonstrates the "supply side" of the nuclear market, and the possible tracks that could be used by terrorist organisations pursuing nuclear capability (Daly, Parachini and Rosenau 2005).

2.3.1.1 The cases of Aum Shinrikyo, al Qaeda, and the Kinshasa Reactor: implications of the three incidents for preventing Nuclear Terrorism

The Case of Aum Shinrikyo

In the early 1990's, Aum Shinrikyo, a religious group from Japan centred on an apocalyptic ideology of massive destruction and devastation for religious ends, recruited approximately 300 nuclear experts and engineers to assist them in obtaining WMD (Mettraux 1995: 1140). The group identified Russia's nuclear stockpile as a potential source of nuclear weapon-usable material and components and embarked on discussions with senior nuclear scientists and officials. Aum Shinrikyo failed in their efforts to gain this nuclear expertise and capacity, and as a result, the group opted to building one, rather than purchasing a nuclear weapon (Daly, Parachini and Rosenau 2005).

Aum Shinrikyo members then began investigating uranium mining sites in Australia and exploited the internet to gather sensitive data on the conduct and dynamics of their nuclear facilities and the control mechanisms, without any success (Danzig *et al.* 2011).

This evaluation advocates that two factors were at play and worked against Aum Shinrikyo's prospects on acquiring nuclear capability. First, the technical limitations accompanying the task of building a nuclear weapon, even a simple traditional nuclear weapon, became obvious to the leaders of the group, who then opted to rather commit to a rather feasible and simpler mission, and allocate its substantial funds to obtaining chemical weapons, i.e. the release of the highly toxic nerve agent Sarin, which was used by the group in their 1995 chemical attack on the subway system in Tokyo (Tu 2002).

Secondly, despite the allegedly flexible and lenient security in various Russian nuclear storages, and Aum Shinrikyo's elite connections and high-level associations in government, Russian authorities were still reluctant to cooperate with the group and meet its demands. So even though various Russian officials benefited from their interaction and close relationship with the group, it was still not enough to prevail over the protection of Moscow's nuclear programme (Daly, Parachini and Rosenau 2005; Repp 2005: 157).

The Case of al Qaeda

The second case evaluates al Qaeda's nuclear undertakings. Like Aum Shinrikyo's, al Qaeda had the suitable incentive, funding, and human capital to pursue nuclear capability. And just like Aum Shinrikyo, al Qaeda pursued a two-fold approach in their attempts to obtain a nuclear programme (Albright and Higgins 2003: 51). Firstly, al Qaeda tried to acquire nuclear weapon-usable materials to use in building a bomb in the mid-1990's in Sudan. However, the terrorist group fell victim to weapons-grade materials scams including "Red Mercury" and radiological waste (Foss 2017: 36). Secondly, under the shelter of the Taliban in Afghanistan, the group then began a much more determined attempt in obtaining nuclear capability and consulted with two Pakistani nuclear experts from a civilian nuclear programme – Abdul Majid and Sultan Bashiruddin Mahmood – on making a crude atomic device (such as the one shown earlier in Chapter 2, Figure 4) (Khan and Moore 2001). The documents recovered by the Federal Bureau of Investigation (FBI) following the 2001 terrorist attacks suggest minimal progress in their attempts in designing and building a nuclear weapons programme, despite the high interest (Albright 2002).

The terrorist organisation is said to have also tried purchasing nuclear weapons via the black market in Russia and Central Asia (Smigielski 2003: 2). In his statement, Pakistani reporter Hamid Mir, who at the time was writing Osama bin Laden's biography, recounted how Egyptian-born doctor Al-Zawahri, believed to be the brains behind the 9/11 terrorist attacks and bin Laden's right-hand man, bragged about how they had purchased "smart briefcase bombs" from the black market, and boasted that "if you have \$30 million, go to the black market in central Asia, contact any disgruntled Soviet scientist and ...dozens of smart briefcase bombs are available. They have contacted us, we sent our people to Moscow, to Tashkent, and to other Central Asian states, and they negotiated, and we purchased some suitcase bombs" (Badkhen 2004; Mir 2001).

Nonetheless, several open-source accounts suggest that the group was unsuccessful in their acquisition of nuclear weapons. This has been confirmed by the time that has passed without any recollection of a single recorded event involving a nuclear attack by the group. The analysis offers a few reasons for al Qaeda's failure in their quest for nuclear capability. Firstly, getting hold of nuclear weapon-usable fissile material is more daunting than the group expected. Secondly, manufacturing a nuclear weapon, even a non-traditional nuclear device, is a highly demanding technical task. Finally, Moscow's nuclear weapons programme and reserves are evidently better secured than assumed by various nuclear-proliferation experts (Albright, Buehler and Higgins 2002: 23-24; Daly, Parachini and Rosenau 2005).

The Missing Nuclear Reactor Rods in Kinshasa

The third case assesses the missing two nuclear reactor rods from the research reactor in Kinshasa in the DRC, formerly known as Zaire. The two nuclear fuel rods disappeared in the late 1970's and went missing for over two decades (Broodryk and Stott 2011: 5). Nonetheless, the two nuclear reactor rods containing small quantities of low-enriched uranium (LEU) – which can be refined to weapons-usable HEU through a vigorous and demanding process – would have been extremely hard to use in a nuclear device (Fleckner and Avery 2005).

However, in the late 1990's, an Italian trafficking network linked to Italian organised crime, had acquired one of the nuclear reactor rods (Capannesi *et al.* 2010: 17). The smuggling network managed to find four buyers for one of the nuclear rods, but as it turned out, these

buyers were in fact undercover law enforcement agents who trapped the traffickers in what is now known as *Operation Gamma* (Broodryk and Stott 2011: 5-6). Still, some unresolved questions regarding how the Italian smuggling network obtained the nuclear reactor rods in the first place remain, and the mysterious whereabouts of the second rod, and seemingly the lack of effort from the IAEA in embarking on a rigorous search and locating the second missing rod, all raise questions on the existing nuclear protection system (Daly, Parachini and Rosenau 2005; Fleckner and Avery 2005).

In examining the three recounted cases, the research study observes that first and foremost, access to various useful resources, including the right connections in government, and the protection of a state, does not guarantee a productive pursuit of nuclear capability. It is therefore highly unlikely that a state will support terrorist organisations pursuing nuclear capability. Secondly, even the most well-organised terrorist organisations have fallen victim to scams, as seen in the case of al Qaeda who were victims to weapons-grade materials scams. Thirdly, Russian nuclear officials are not as corrupt as supposed by the rest of the world, and as various Western reports contend. In fact, Moscow's nuclear programme and weapons-usable fissile material is under rigid security. Lastly, the implication from the analysis of the three cases suggest that strong protection and control mechanisms minimise the opportunities of non-state actors for gaining nuclear weapons and fissile material that can be used to make non-traditional nuclear devices (Daly, Parachini and Rosenau 2005).

Additionally, the most recent case involving attacks and sabotage on nuclear plants and installations involves the recent terrorist attacks in Brussels, 2016. Belgian police revealed that the terrorist group – also connected to the horrific November 2015 Paris attacks – had monitored a senior official at a Belgian nuclear research and development facility via secret video surveillance, with a large amount of nuclear and radiological material in view, including HEU and radioisotopes. The Belgian nuclear facility could have been the initial target of the Brussels suicide bombers, suspected to have been planning on setting off a “dirty bomb”. This is by far the most definitive indicator to date, that terrorist organisations are seeking to gaining access to nuclear materials, and it is unsettling as it is evidently “not impossible” that a well-organised terrorist organisation could possibly produce a “primitive” nuclear bomb – if they acquired the necessary nuclear material (Mendick and Samuel 2016).

2.4 Theoretical Perspectives on Nuclear Security: The Atomic Age

The First Nuclear Age: Soviet-American relations, WWII and the 1950s and Massive Retaliation Strategy

The world's first encounter towards “unleashing the power within the atomic nucleus” (Prickrell 2006), started in 1905, when the well-known theoretical physicist, Albert Einstein, through his equation $E= mc^2$, proved that “even tiny quantities of mass are equivalent to immense amounts of energy” (Prickrell 2006).

While the bombing of the Japanese city of Hiroshima by the U.S on 6 August, 1945 is usually recognised as the beginning of the nuclear era, the beginning of the nuclear age had actually been three weeks earlier on 16 July, 1945, when the U.S, through the *Manhattan Project*, tested a new 18.6-kt plutonium-based nuclear weapon, the *Trinity Bomb*, in New Mexico during World War II (WWII) (Bracken 2002: 4).

Following the American nuclear attack on Japan, and the end of WWII, various historians remark that the nuclear bombings had a two-pronged implication and objectives. Firstly “to bring the war with Japan to a *speedy* end and spare American lives” (Gilbert and Mayes 1989: 295), and, secondly, to show the Soviet Union the new weapon of mass destruction – in a way to display their new warfare capacity and, in turn, *deter* the adversary against a potential attack on the US and Allied states (Wyden 1984: 27).

As seen through the description above, it is certainly the rapidity of nuclear weapons; the ability to strike and annihilate your enemy without potentially striking back, guaranteeing total victory; and the capacity to result in massive destruction and death, which distinctively make the nuclear weapon more appealing to potential nuclear terrorists seeking nuclear capability for their apocalyptic desires.

The Second Nuclear Age: Nuclear Proliferation and Deterrence Strategy

The second nuclear age simply refers to nuclear powers of the post-Cold war system and involves the “spread of nuclear weapons to countries for reasons other than the Soviet-American Cold War rivalry, which was the defining aspect of the first nuclear age” (Bracken 2003: 399).

The emergence of new nuclear powers such as China, Pakistan, India, and North Korea is the fundamental difference between the first and second nuclear age. The era, defined by an unpredictable “multipolar nuclear order”, has accommodated not only the emergence of new, vulnerable nuclear states, but also non-state actors seeking nuclear capability. Hence the creation of non-proliferation regimes such as the UNSC Resolution 1540 (2004), set up to prevent acts of nuclear terrorism (Joyner 2011).

Additionally, the current nuclear era is characterised by the emergence of various other regions apart from Asia and the Middle East, such as West and Central Europe, South America, Africa using nuclear power for electricity generation. This has seen a gradual shift involving approximately 11% of global electricity produced by an estimated 450 nuclear power reactors in over thirty countries worldwide, with a collective size of over 370 gigawatts (GWe) (Evans and Kawaguchi 2009:48). This trend is as a result of the expanding energy demand known as the nuclear renaissance that has seen an increase in the need for “new generating capacity” (World Nuclear Association 2018).

South Africa is the only African country generating electricity using nuclear power reactors, with two working nuclear reactors at present-day, which generated upto 7% of its overall electricity production in 2017. The country is seeking to expand its nuclear power capacity, but currently limited by the financial demands (World Nuclear Association 2018). The research observes that the current global nuclear system, founded on the theory of deterrence, makes it virtually impossible to get rid of nuclear arms completely, but rather in managing the challenges of nuclear proliferation through the new long-term strategy of nuclear non-proliferation, which seeks to curb the escalation and spread of nuclear weapons.

2.4.1 Nuclear Security and Classical Deterrence

Thomas Schelling describes deterrence as “persuading a potential enemy that he should in his own interest avoid certain courses of activity” (Schelling 1980:3). The objective is to prevent undesired behaviour and coerce an adversary to comply with one’s preferences. The strategy follows a straightforward logic: convince the target that the magnitude of the costs and risks far outweigh any prospective benefits (Carter *et al.* 2007).

In this way, states accumulate nuclear power to threaten and “deter” a potential adversary from possible retaliation (Rhodes 2000: 237). At its most basic, nuclear deterrence is designed to deter an act of violence by the threat of destructive and fatal nuclear warfare,

which both parties wouldn't survive, also known as Mutual Assured Destruction (MAD), just as the Western bloc used their nuclear superiority to stop the worldwide spread of communism during the US-Soviet rivalry. Hence, classical deterrence theory is a product of the Cold War (Bracken 2002: 5).

The fundamental assumption in traditional nuclear deterrence theories supposes the opponent to be "rational and willing to engage in cost-benefit calculations when making policy decisions" (Schelling 1980). It assumes that the enemy would be deterred by the prospect of devastating nuclear retaliation (Allison 2004a: 66). This assumption of rationality is inadequate, and misleading given the now evolved and complex security environment that may be unique to the context of the prior Cold War era, such as the network of terrorist groups seeking to implement nuclear technology, and other WMDs to their strategy and operation (Gray 2003).

2.4.2 Nuclear Security in the 21st Century

The current security environment is characterised by various emerging non-traditional security threats which cannot be fully addressed by the established nuclear deterrence paradigm, such as rogue non-state actors, namely highly sophisticated terrorist groups seeking nuclear capability, as described in this report on the emerging threat of nuclear terrorism. Success in counterterrorism requires two things: diminishing a group's capability to organise acts of violence and undermining a group's motivation to employ violence (Wilner 2011). Counterterrorism and nuclear tactics options today will require greater flexibility and accurate interpretations concerning the motivations of non-state adversaries such as terrorist organisations (Koblentz 2014; Lowther 2009).

These new actors view their defenceless suicidal conduct of war as legitimate violence. The unsettling consensus is that deterrence cannot be applied to combat terrorist organisations that do not confine to the accepted customs of nuclear combat, founded under standards of deterrence (Sageman 2004). It is not a practical strategic principle when dealing with the prospect of nuclear weapons in the hands of extremists who are irrational. Hence, applying deterrence to terrorism requires expanding the theory's scope beyond its current focus on punishment and nuclear weaponry (Kraft 2008: 22-25).

The cornerstone of any practical strategy to prevent nuclear terrorism must be to refuse terrorist groups entry to nuclear materials or nuclear weapons. On this basis, this research work progresses on the conviction that preventing nuclear terrorism calls for a

comprehensive strategy that “denies access to weapons and materials at their source, detects them at borders, defends every route by which a weapon could be delivered, and addresses motives as well as means” (Allison 2004a: 69).

Securing nuclear weapons and nuclear materials is by far the most affordable and effective strategy for lowering the risk and preventing the threat of nuclear terrorism (Levi 2009: 5-6). Accordingly, this study rests on the conviction that the best strategy in preventing extremists from getting hold of these hazardous materials – whether through theft or illicit trade in black markets – is simply securing nuclear weapons and weapons-usable nuclear materials at source.

2.4.3 Increasing Consensus about the Threat of Nuclear Terrorism

The gradually increasing international agreement at present is that the threat of nuclear terrorism is real, and one that needs urgent attention. Expert studies contend that a nuclear terrorist attack, especially one involving fissionable materials, would result in destructive global economic, political, environmental, and humanitarian repercussions. Even at a smaller scale, an explosion in a small town, for example, would instantaneously result in the death of tens of thousands of civilians, tear down infrastructure, and the radiation would result in the area to be inoperative for ages (Brill and Bernhard 2015: 16).

Even though the act of nuclear terrorism has not materialised so far, one must take into consideration that these terrorist groups have openly articulated their desire to gain access to the deadly weapons. So far, at least five terrorist organisations, including the Islamic State (ISIS), al Qaeda, Aum Shinrikyo, Lashkar-e-Taiba, and al-Shabaab have demonstrated an interest in obtaining and using nuclear weapons (Heinonen 2017). It is highly unlikely for even the most sophisticated terrorist organisation to steal a fully-developed nuclear weapon. The most plausible move would be the possible theft or seizure of weapons-usable nuclear material such as HEU or separated plutonium – at least 50 kg and 25 kg respectively, to build a non-traditional nuclear bomb (Bohigas 2014).

For this reason, a credible global security regime on nuclear proliferation and the possible threat of nuclear terrorism is required to effectively address the remaining gaps in international nuclear security establishments and procedures. The next passages discuss the importance of full implementation of the existing non-proliferation mechanisms as the appropriate means to regularly and systematically identify, evaluate, and address existing

gaps in the adequate control and security of nuclear stockpiles, especially the uranium provisions in Africa, which could easily be obtained and exploited by interested terrorist groups for their catastrophic objectives.

2.5 Conclusion

This chapter primarily explored the research's central focus on the likelihood that a terrorist organisation could illegally purchase fissile material available on the black market, or possibly steal it from a civilian and/or military facility and use it to assemble an IND. Most specialists on the topic of nuclear security and nuclear terrorism have progressively come to believe this to be the most plausible scenario for terrorists pursuing nuclear weapons compared to the theft of a complete nuclear weapon attained from a country's nuclear arsenal.

In defining nuclear terrorism, the analysis distinguished between three nuclear and radiological threat categories used in this analysis and linked and compared the elements of nuclear and radiological threats in its evaluation of nuclear terrorism. It noted that nuclear weapons are known for their capacity of generating mass casualties, even though they differ greatly in their destructive power, lethality, and their potential purpose – whether they are used to cause psychological impact like the “dirty bomb” or death like the fusion or fission bomb. Nuclear weapons are, no doubt, the ultimate WMD on the account of their substantial destructive powers and the preferred weapon of choice for terrorists.

The evaluation described the logic of deterrence in the 21st century security environment which includes non-state actors seeking nuclear power and further examined three cases depicting terrorist organisations' fascination with getting hold of and using nuclear devices and nuclear materials to produce those devices. The three incidents evaluated herein are considered to support the understanding of the threat of nuclear terrorism. It argued that information on how to manipulate nuclear material to fabricate an IND which would emit a nuclear explosion, or radiation device to disperse harmful radioactive material, is readily available worldwide, therefore the only way to counteract nuclear terrorism is to safeguard these materials at source and ensure that these terrorist groups are prevented in any way from getting hold of nuclear material. Hence the need for the appropriate nuclear strategy and policy, and the full implementation of counter-terrorism and non-proliferation instruments set to prevent the spread and use of WMD, such as the established international and regional non-proliferation treaties discussed in the subsequent chapter.

CHAPTER 3: WEAPONS OF MASS DESTRUCTION IN AFRICA

3.1 Introduction

Significant progress is taking place to prevent the spread of nuclear, biological, and chemical weapons. This will in turn prevent access to essential *nuclear material* such as weapons-usable HEU and separated plutonium, *technologies*, and *expertise* from potential nuclear smuggling networks on the continent.

The chapter discusses the role of the Treaty on the Non-Proliferation of Nuclear Weapons also known as the Nuclear Non-Proliferation Treaty (NPT) as the cornerstone of the international non-proliferation regime, and the key role played by the IAEA under the Treaty, in which it ensures that states adhere to the established international commitments and safeguards of nuclear non-proliferation and disarmament.

It will emphasise the full implementation of the UNSC Resolution 1540 as a central counter-terrorism and non-proliferation instrument in Africa and a mutually reinforcing legal mechanism which complements and supports the NPT. It also revises the role of regional treaties such as the Treaty of Pelindaba, which supports UNSC Resolution 1540 in realising Africa's efforts in reducing the risks of nuclear proliferation such as nuclear terrorism. The research considers the continent's position and the role of the AU towards the established global non-proliferation initiatives, and further examines the progress made so far in executing the obligations of the UNSC Resolution 1540 by African member states.

For the purposes of analysis, the threat of nuclear terrorism will therefore be investigated on the broad framework of WMD non-proliferation in Africa, whereby nuclear will be dealt with as a weapon of mass destruction. This approach corresponds with the general conversation on global nuclear disarmament and non-proliferation by African leaders, as they continue to collectively support the elimination of any kind of WMD – be it nuclear, biological, or chemical weapons.

3.2 Defining “Weapons of Mass Destruction” (WMD)

In the publication for the Center for the Study of WMD on “*Defining Weapons of Mass Destruction*”, Carus (2012: 14) defines WMD as “...atomic explosive weapons, radioactive material weapons, lethal chemical and biological weapons, and any weapons developed in the future which have characteristics comparable in destructive effect to those of the atomic bomb or other weapons mentioned above.”

Hence, WMD are normally described as “any military grade chemical, biological, radiological, or nuclear (CBRN) weapons capable of creating large-scale destruction against people, infrastructures, and property” (Ellis 2014: 2). This analysis adopts the category of “*WMD as nuclear, biological, and chemical weapons (NBC)*” compared to the other alternatives that include “WMD as chemical, biological, radiological, and nuclear weapons (CBRN)” or “WMD as CBRN and high explosive weapons (CBRNE)” (Carus 2012: 15).

The highly demanding process of developing and using these weapons is monitored by a variety of international agencies and mechanisms such as the Comprehensive Nuclear-Test-Ban Treaty Organisation (CTBTO), which has been “building a global network of monitoring stations that could detect any violations” (Castelvecchi 2015). The network has expanded to now comprise an estimated 300 stations and has made its data accessible to various scientists. It uses detection frequencies and sensors that warn member states of any device set off anywhere in the world. In fact, their sensors were instrumental in verifying the nuclear device set off in North Korea in 2013 (Bauer and O’Reilly 2016: 137).

The proliferation of WMD continues to be a significant threat to global peace and security as they can possibly fall into the wrong hands of terrorist organisations. The African continent continues to realise its active role and contributions to the implementation of UNSC Resolution 1540 through the collective efforts of regional organisations such as the AU.

3.3 The Role of International and Regional Non-proliferation Regimes

Significant progress to prevent the spread of nuclear, biological, and chemical weapons; and disassembling nuclear smuggling networks, is taking place on the continent. This will in turn prevent terrorist groups' access to essential *nuclear material* such as weapons-usable HEU and separated plutonium, *technologies*, and *expertise* (Winner 2005: 131).

International and regional non-proliferation conventions establish the rightful platform for the opportunity to advance a sustainable forum for state officials and the international community to tackle some of the existing gaps in global nuclear security mechanisms to stop possible acts of nuclear terrorism. The NPT, for example, has made some considerable progress in strengthening its nuclear security recommendations through the IAEA to “prevent the spread of nuclear weapons and weapons technology, promote co-operation in the peaceful uses of nuclear energy and to further the goal of achieving nuclear disarmament and general and complete disarmament” (Jørgensen-Dahl, Østreng, and Triggs 2016: 75). These are reinforced and complimented by various important international and regional initiatives and instruments such as the UNSC Resolution 1540 and the Treaty of Pelindaba (2009).

The pending section will examine the role and function of crucial international and regional non-proliferation initiatives and the action-steps essential to reduce the proliferation of WMD and the multitude of international and regional non-proliferation treaties applied as strategies and policies to reduce the risk of nuclear acts of terror, namely: the UNSC Resolution 1540 – strengthening the UN’s efforts to inhibit the proliferation of WMD by non-state actors such as terrorist organisations – as well as the Treaty of Pelindaba which in the same way as UNSC Resolution 1540, “imposes binding obligations on member states to adopt legislation to prevent the proliferation of WMDs and establish appropriate domestic controls to prevent their illicit trafficking” (United Nations 2004).

3.3.1 The Nuclear Non-Proliferation Treaty (NPT)

The Treaty of the Non-Proliferation of Nuclear Weapons, also known as the Nuclear Non-Proliferation Treaty (NPT) opened to participation on 1 July 1968 and came into force on 5 March 1970. A review summit takes place every five years. The original Treaty was meant to last for 25 years but was extended in 1995 (Turner 2013: 73). The Treaty has become the main component of the international nuclear non-proliferation regime since its

implementation in 1970. At present, only Israel, Pakistan, and India are not participants to the Treaty, and North Korea – who had been a member since joining in 1985, but subsequently withdrew in 2003 (Dunn 2009: 145).

The Treaty seeks to “prevent the spread of nuclear weapons and weapons technology, promote co-operation in the peaceful uses of nuclear energy and to further the goal of achieving nuclear disarmament and general and complete disarmament” (Jørgensen-Dahl, Østreng, and Triggs 2016: 75).

Member states assemble to examine the implementation of the three pillars of the Treaty – *disarmament* (Article I), *non-proliferation* (Article II), and *the peaceful uses of nuclear energy* (Article III) – and propose recommendations to sovereign states on how to improve the process. For example, through the IAEA’s recommendations on safety services – which range from operational safety and radiation; engineering safety and transport; and waste safety. The IAEA specialists assist member states on successfully implementing the applicable legal and regulatory structure and advise on how to guarantee the most effective safety and security standards, for example in the operation of nuclear reactors for power production (International Atomic Energy Agency 2016).

These recommendations serve to strengthen states’ capacities in executing effective strategies to “deter, detect and respond to a criminal act, or an unauthorised act, with nuclear security implications, involving nuclear or other radioactive material that is out of regulatory control” (International Atomic Energy Agency 2011). They are proposed to promote international cooperation to ensure that the missing or lost nuclear material is located back under regulatory control, and that legal action is taken against the suspected offenders (Luongo 2014: 185).

The recommendations should be adopted in conjunction with the commitments undertaken by member states to international and regional non-proliferation regimes such as UNSC Resolution 1540, and are not in any way proposed to modify, overrule, or disregard the obligations carried out by these related non-proliferation instruments. It is important to note that the recommendations herein are offered for competent states to consider, and not in any way *obligatory* or set to intrude with the rights and authority of sovereign of states (International Atomic Energy Agency 2017).

The International Atomic Energy Agency

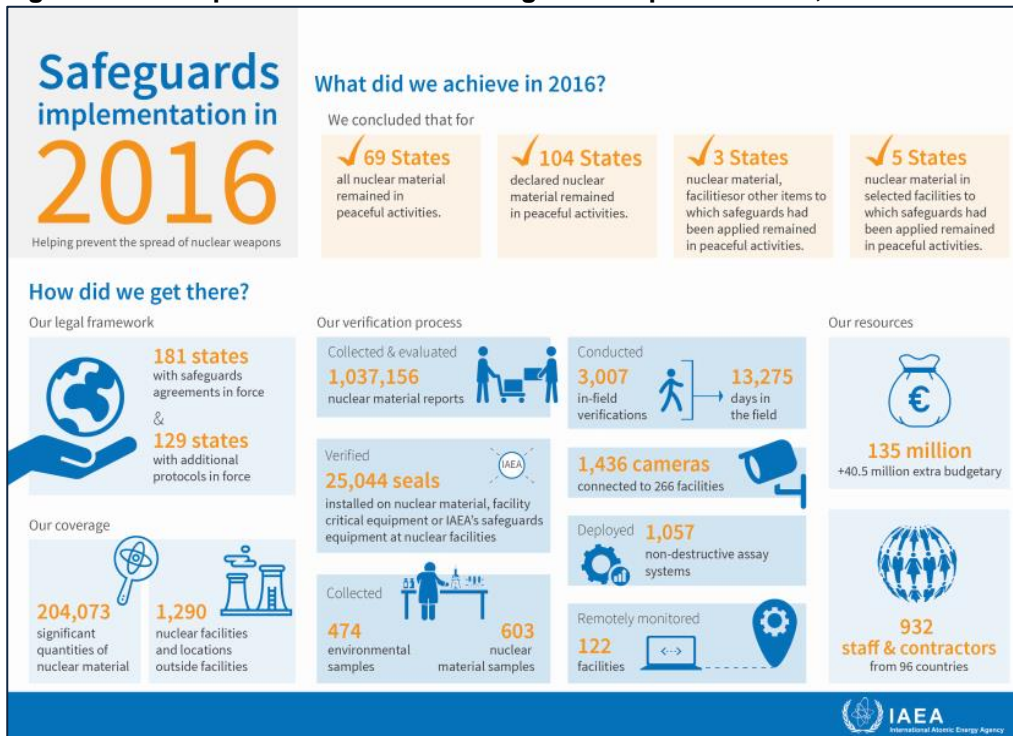
The IAEA is not party to the NPT but plays a key role under the Treaty. The agency is responsible for the safeguards system of the Treaty under Article III and currently monitors and safeguards the activities of more than 190 countries on the issue surrounding the protection of nuclear materials and nuclear weapons ensuring that states adhere to the established international commitments and safeguards “not to use existing nuclear programmes for nuclear weapons purposes” (The International Atomic Energy Agency 2015).

The agency’s verification role also facilitates the transfer of nuclear technology for peaceful use (Godsberg 2014: 2015). Hence, the IAEA safeguard mechanism operates as a monitoring instrument, much like the noted CTBTO and works as an early warning structure that warns the international community of potential proliferation through early detection of possible diversion of fissile material and misuse of nuclear weapon technology (Hubert, Broodryk and Stott 2010: 12).

Although the NPT is the foundation of the international non-proliferation regime, it is certainly not the only arrangement, as an increasing number of mutually reinforcing and inter-related legal institutions, programs, instruments, and initiatives complement and reinforce the NPT and its accompanying IAEA safeguards system (Martin 2011). These arrangements vary in their individual efficiency, and even though not all of them seize the attention of political officials, they still make a substantial collective contribution to the non-proliferation objectives. This is largely because of their (potentially) universal application that embraces even non-member states to the NPT (Evans and Kawaguchi 2009: 93).

The NPT and its IAEA safeguards system have nonetheless been symbolically robust platforms for total disarmament and has made significant accomplishments in preventing the global spread of nuclear materials and nuclear weapons (non-proliferation) to date (shown in figure 7 below) (Jørgensen-Dahl, Østreng, and Triggs 2016: 75).

Figure 7: Accomplishments of IAEA Safeguards Implementation, 2016



Source: International Atomic Energy Agency (2016), see direct link in bibliography

Another crucial nuclear non-proliferation arrangement initiated by the NPT which is central to this analysis and focuses on the role and objective of a key universal binding initiative to all UN member states is the UNSC Resolution 1540.

3.3.2 WMD non-proliferation and UNSC Resolution 1540

The possibility of acquisition of WMD by non-state actors is a major threat to international peace and security at present. Recent terrorist developments demonstrate strong eager and intent from global terrorist networks on causing destruction, disorder, and death on a larger scale than previously imagined. This is illustrated by the previously-cited cases of Aum Shinrikyo and al Qaeda who have in the past possibly shown the most dedication to acquiring and using nuclear materials and nuclear components. Similarly, the recently witnessed attacks in Europe and elsewhere encouraged and subsidised by ISIS in the last months equally prove sophisticated terrorist groups' extent, capability, and willpower to create the most possible chaos and harm as possible (Brill and Bernhard 2017: 9).

This was also especially proved by the revelations of the infamous Khan network which was involved in the smuggling of nuclear expertise to al Qaeda (Corera 2006: 196). The Khan network proved the possibility for devious scientists, engineers, and businessman to engage in a global trade for nuclear components and capabilities. Other transnational

illegal networks similar to the Khan smuggling network may come to play in the future, as the dominant elements that led to the network persist: “buyers with cash and people with access to classified nuclear know-how, trafficking skills and experience at designing and building nuclear facilities” (Albright, Brannan, and Stricker 2010: 87).

These dealings highlight the proliferation of WMD via covert operations, and the “ease with which non-state actors have been able to operate and transfer technology between countries as well as the potential for non-state actors” (Laufer 2005).

That means a well-funded, sophisticated terrorist organisation could exploit these conditions and manage to buy a complete nuclear weapon design from illicit trading networks seeking profits. This would simplify the demanding mission of assembling the required improvised nuclear weapon, such as a crude nuclear bomb and in turn elevate the probability of a nuclear attack by terrorists (United Nations 2008).

The only current limitation to this possibility is accessing enough weapons-grade nuclear material to use in building the crude nuclear device but given the large amounts of uranium obtainable in various unstable and underdeveloped regions in Africa because of the inadequate control and regulatory mechanisms in many African states, that limitation will not hold in the long run (Brill and Bernhard 2015: 16; Sanger 2010).

Nuclear trafficking networks have become more sophisticated and proven to adapt to counteract the security measures set against them. Hence the need for the global response to be highly effective in preventing the proliferation of WMD and ensuring necessary improvements and reforms to prevent the emergence of similar smuggling networks in the future, in turn minimising the threat of the acquisition of nuclear material and nuclear weapons by terrorist organisations seeking this capability (Albright, Brannan, and Stricker 2010: 87-88).

Traditional global WMD non-proliferation regimes such as the NPT (1968), Biological Weapons Convention (BWC) (1972), and the Chemical Weapons Convention (CWC) (1993) were not designed to deal with these types of proliferation factors and were mainly directed at the prevention of WMD to states, not non-state actors (Dye 2007: 11).

As a result, when confronted with the critical threat of the acquisition of WMD by terrorist groups, as well as having witnessed the revelations from the A.Q Khan nuclear black-market operation in 2004, responding to these developments, the international community

adopted a new approach of global legislation by implementing the UNSC Resolution 1540 which makes it “possible to enact rules that *legally bind all* UN members immediately and automatically” by calling for all nation states to set up controls over WMD (Asada 2008; Crail 2006: 357).

“The United Nations Security Council unanimously adopted resolution 1540 (2004) under Chapter VII of the Charter of the United Nations on 28 April 2004. [The resolution is] legally binding on all UN member states and obliges [individual countries] to take a range of steps aimed at preventing the proliferation of nuclear, chemical and biological weapons, their delivery systems and related materials, especially by non-state actors” (Oosthuizen and Wilmshurst 2004).

UNSC Resolution 1540 therefore primarily calls on *all* states to adopt effective laws and regulations to prevent non-state actors from gaining access to WMD. The two defining elements here are terrorism and WMD non-proliferation. By recognising that the proliferation of WMD and their means comprise a great threat to global peace and security, the UN Security Council set the following binding rules under Chapter VII of the Charter: (1) member states must avoid providing any kind of assistance to non-state actors seeking to acquire, manufacture, use, or transfer WMD and their means of delivery; (2) all member states are to implement and enforce suitable, effective rules that prevent non-state actors from developing, acquiring, using, and transferring WMD and their means of delivery, specifically for terrorist activities, and avoid any kind of interaction in assisting, funding, or participating in these activities as an accomplice; (3) all member states are to set up and enforce effective domestic control mechanisms to minimise the spread of WMD and their means of delivery (United Nations 2004).

The term “means of delivery” used here refers to “missiles, rockets and other unmanned systems capable of delivering nuclear, chemical, or biological weapons, that are specially designed for such use” (Steyn 2005).

3.3.3 Responsibility and Obligations of the UNSC Resolution 1540

The three primary obligations call on nation states to avoid providing support of any form to non-state actors attempting to acquire, assemble, transport, possess, or use WMD and their means of delivery; prevent this kind of activity by non-state actors in their domestic legislature, especially assistance directed to the illicit activities of terrorist organisations;

and to implement domestic actions to prohibit the proliferation of WMD, their means of delivery, and related materials (United Nations 2004).

This includes adopting effective domestic control and regulatory mechanisms for African borders to prevent the smuggling of nuclear materials, implementing effective control of uranium mining sites in Africa, and adopting appropriate physical protection measures for nuclear materials – such as the noted monitoring and safeguarding agencies, the IAEA and the CTBTO, which reinforce suitable measures for the production, storage, use, and transportation of nuclear materials for industrial and domestic use (Oosthuizen and Wilmshurst 2004).

In this way, the Resolution “fills the existing *gaps* in the global non-proliferation regime” (Crail 2006: 359). It does this by, firstly, addressing WMD proliferation of new non-state actors beside sovereign states, such as illicit networks and terrorist organisations. Although traditional proliferation instruments such as the NPT, BWC, and the CWC function to achieve the same objective, these regimes were founded upon state-centric approaches in preventing potential WMD threats, and are fundamentally based on *cooperative* methods and means, and are not “*binding*” (obligatory) to all member states, or “universal” (includes all states that are signatories to the UN charter). The main role for UNSC Resolution 1540 is essentially creating “*binding* obligations regarding all three weapon types and avoid the *negotiation* processes and *voluntary* commitments under these treaties” (Bosch & Van Ham 2007: 4; Heupel 2008: 96).

Secondly, the Resolution is applicable to all existing states, regardless of their membership in other international and regional multilateral agreements. Therefore, all states are accountable for the Resolution’s proliferation mandate, and member states cannot “opt out” of the agreement (Crail 2006: 360). Additionally, UNSC Resolution 1540 assembles the wide scope of multilateral WMD duties and controls together, such as “border and export controls, prohibitions for proliferation and material protection and physical security” (Crail 2006: 360).

Lastly, UNSC Resolution 1540 sets up a universal system of restrictions, security measures, and border controls over WMD to identify and prevent them from landing in the hands of non-state actors (Woodward 2007). The “universality” aspect of the Resolution is distinctive and imperative. It is important that *all* member states establish and enforce

“appropriate and effective” regulations to the full implementation of the Resolution, and that it remains their highest objective to prohibit the proliferation of WMD to non-state actors (Gallagher 2015: 471).

3.3.4 Implementation of UNSC Resolution 1540 and the role of the Security Council Committee

The Security Council Committee – pursuant to UNSC Resolution 1540 (2004) – reported in the letter (S/2017/126) to the Security Council, issued by the Chair of the Committee, Mr. Sacha Sergio Llorentty Solíz, on 10 February 2017, on the implementation of UNSC Resolution 1540 for the period 1 February 2017- 31 January 2018. The report noted that even though progress has been made in the implementation of UNSC Resolution 1540, more work remains to be done to achieve the goals of full implementation of the Resolution, and this is a long-term mission that requires collective action at international, regional, and national level (United Nations Security Council Committee 2017).

The UNSC Resolution 1540 appeals on member states to authorise and implement applicable and effective domestic laws to combat the spread of WMD by non-state actors. Parliaments are obliged to establish the required legal framework to carry out this responsibility, especially since not a single state will be immune to the consequence of possible acts of nuclear terror (Kasprzyk 2017).

States must report on action-steps they have adopted to ensure the non-proliferation of nuclear, chemical, and biological weapons and related materials. This legal responsibility is one of the Resolution’s defining strengths. It brings in a high level of assistance to African member states with inadequate information and resources, and leaders benefit from the assistance provided by the Committee and its team experts (Asada 2008: 315).

Together with the AU, and the UN Regional Centre for Peace and Disarmament in Africa (UNREC), the Committee assists in distinguishing the existing implementation gaps and organizing the required resources for the full implementation of UNSC Resolution 1540 by member states (United Nations Security Council Committee 2017).

3.4 The African Union (AU) and Nuclear Security

The IAEA's Illicit Trafficking Database (ITDB) recounted approximately 1,773 trafficking and theft incidents worldwide by member states and non-member states between January 1993 and December 2016; only one known trafficking case of LEU; and one incident of nuclear fuel theft from a research reactor in Africa (International Atomic Energy Agency 2017).

Apart from the previously cited two misplaced nuclear fuel rods (discussed in Chapter 2, page 29), which went missing in the Kinshasa research reactor in the DRC, where only one was recovered, verified cases of natural uranium smuggling have been relatively low in Africa, with just twelve such cases happening between 1994 and 2005. These incidents occurred in Tanzania (four cases), Kenya (two cases), the DRC (two cases), South Africa (two cases), and Namibia (two cases). Most of these cases involve stolen uranium ore, typically piled in containers from unknown sources (Broodryk and Stott 2011).

The responsibility of safeguarding nuclear and radioactive materials ultimately depends on individual countries. Nonetheless, these countries typically rely on various accredited global instruments and principles to guide and direct their control and supervision of nuclear and other radioactive materials, and the related technologies. Nonetheless, African leaders identify the proliferation of nuclear, chemical, and biological weapons as a common threat facing all member states that should be confronted collectively to ensure that these materials are secured from possible seizure or theft by terrorist organisations (Broodryk and Stott 2011).

Africa has continuously articulated its full commitment and obligation to a world free of destructive and indiscriminating nuclear weapons. The AU – through the Common African Defense and Security Policy (CADSP) – identified the proliferation of WMD “as a common threat facing all Member States and should be addressed in a collective manner” (African Union Peace and Security 2015).

In this manner, the AU Commission seeks to:

“Promote and enhance international efforts towards global disarmament and international peace and security through the support and promotion of regional disarmament efforts and initiatives using approaches freely arrived at among the States of the region and taking into account the legitimate requirements of States for self-defence and the specific characteristics of each region” (African Union Commission 2016).

This was expressed in the report adopted by the AU Commission on arms control, disarmament, and non-proliferation by the chairperson of the commission on 29 March 2016 during its 584th session in Addis Ababa, Ethiopia. The aim of the report is to reinforce the duty bestowed on the Peace and Security Council (PSC) in applying its authority documented under Article 7, paragraph 1(n) of the Protocol regarding its establishment and obligations in reinforcing the implementation of regional mechanisms on arms control and disarmament (African Union Commission 2016).

Africa has made a considerable effort to reinforce the capability of African states in successfully preventing the proliferation of nuclear weapons and weapons-grade nuclear material and their means of delivery to terrorist organisations.

This is especially seen with the platform the AU has advanced for raising awareness (campaigns) consultations and training which have been set forth for the same function: “ensuring that states undertake all necessary steps to prevent nuclear, chemical or biological weapons (or the materials needed to produce them) from being acquired, trafficked or used” (Kasprzyk 2017).

The Peace and Security Department for the AU Commission merits recognition for its contributions in advancing a working framework towards nuclear non-proliferation in Africa and reinforcing the obligations and action-steps of UNSC Resolution 1540.

Similarly, Dr Tarek Sharif, the Head of the Defence and Security sector, has continuously alluded to one of the organisation’s biggest achievements in the non-proliferation of WMD, noting the continuous engagement of the AU in proliferation issues involving UNSC

Resolution 1540 and the UNSC 1540 Committee which has reinforced its non-proliferation capacity and raised its profile on biological, chemical, and nuclear weapons issues (African Union Commission 2016).

Regional organisations such as the AU take into consideration the varying features of each region, and with that, seek to promote and reinforce the full implementation of international and regional non-proliferation regimes such as the UNSC 1540 Committee and the Treaty of Pelindaba (2009), discussed in the following section. These global and regional binding mechanisms remain the cornerstone for effective, transparent, and coherent action control of the unlawful trafficking and trade of weapons-useful nuclear materials and are fundamental in ensuring the non-proliferation of WMD (Kasprzyk 2017).

3.4.1 The Role of African Nuclear Weapons Free Zone Treaty

The implementation of the African Nuclear Weapon-Free-Zone Treaty – now known as the Treaty of Pelindaba or Pelindaba Treaty – was ratified on 15 July 2009. The notion of an African Nuclear Weapon Free Zone (ANWFZ) was initiated by the Organisation of African Union (OAU) in the 1960s, highlighting the continent's support of a world free of nuclear weapons. It originated with the preoccupation of African countries on the domestic applications of nuclear energy since the start of the nuclear era (African Union 2006: 2).

The Treaty of the Pelindaba is an innovative enhancement of Nuclear-Weapon Free Zones (NWFZ) and the principle of non-proliferation. The African Union (2006: 4) recognises five improvements in the Treaty of Pelindaba as a NWFZ instrument. First and foremost, as stated in Articles 3, 4, and 5, it prohibits any form of research into nuclear weapons of any kind in such territories (NWFZ's). Secondly, just like the example of South Africa, it requires that nuclear states dismantle the weapons obtained before consenting to the Treaty, seen in Article 6. Thirdly, as stipulated in Article 7; it forbids states from discarding radioactive matter and radioactive waste in the NWFZ territories. Lastly, the Treaty reinforces the peaceful use of nuclear science and technology for industrial purposes, revealed in Article 8 (Broodryk and Stott 2009).

The main goal of all the existing NWFZs is essentially to “provide a legally binding instrument between two or more states to establish a specific region as free from nuclear weapons and to institute a series of verification and compliance mechanisms and security guarantees by all nuclear weapons states (NWS) (Van Wyk 2012: 267).

The Treaty of Pelindaba has certainly advanced a determining contribution to the institutionalisation of NWFZs as operational systems, for example, delivering for an instrument of compliance through the creation of a regional commission, the African Commission on Nuclear Energy (AFCONE), with well-defined duties. AFCONE continues to reinforce the obligations under UNSC Resolution 1540 to prohibit the proliferation of WMD and the weapons-usable nuclear materials and to cooperate with the 1540 Committee and the UNREC, in recognising the existing implementation gaps and organising the required resources for the full implementation of UNSC Resolution 1540 for African states (Mukai 2005: 80).

3.5 Conclusion

The proliferation of nuclear, biological, and chemical weapons and their means of delivery continues to be a significant threat to global peace and security. Member states from the African region continue in their efforts and contributions to realising the full implementation of international and regional non-proliferation mechanisms to prevent the risks associated with the proliferation of these weapons and their acquisition and use by non-state actors.

This chapter discussed the role the NPT as the cornerstone of the international non-proliferation regime and the key role played by the IAEA under the Treaty, in which it ensures that states adhere to the established international commitments and safeguards of nuclear non-proliferation and disarmament in order to prevent the spread of nuclear weapons and promote peaceful uses of nuclear energy. It contended that even though the NPT is the foundation of the international non-proliferation system, it is certainly not the full structure, as an increasing number of mutually reinforcing and inter-related legal institutions and instruments complement and reinforce the NPT and its accompanying IAEA safeguards system.

This is essentially the policy chapter and emphasised the full implementation of the UNSC Resolution 1540 as a central counter-terrorism and non-proliferation instrument in Africa as well as the role of regional treaties such as the Treaty of Pelindaba (which complements and supports UNSC Resolution 1540) in realising Africa's efforts in reducing the risks of nuclear proliferation through collaborative mechanisms such as the UNSC 1540 Committee and the AU. It examined the progress made so far in executing the obligations of the agreements.

CHAPTER 4:

AFRICA AND THE THREAT OF NUCLEAR TERRORISM

4.1 Introduction

The need to safeguard weapons-usable nuclear material from terrorist organisations has taken on heightened significance on the continent in recent times. African leaders identify nuclear, chemical, and biological proliferation as a common threat facing the international community. The expanding demand in nuclear energy across the globe has seen a rising global interest in Africa's considerable uranium deposits. This means that the continent is vulnerable and at high risk to the unlawful trade and trafficking of weapons-usable radioactive uranium.

This chapter observes that this is mainly because of the deficient control and regulatory systems in Africa which are often prone to malfunction and corruption, such as existing weak borders that are not effectively controlled in several parts of the continent; the inadequate safety and control of the operating uranium mining sites in Africa; and the prevailing weak and corrupt governing institutions. The pending passage discusses the importance of the principles of *full commitment, efficient government coordination, and active participation* in realising Africa's full implementation of global and regional non-proliferation initiatives.

The research specifically examines in detail these facilitating conditions because they have the most potential for producing preventative advantage and results in determining the best strategies and methods in reducing the risks of smuggling and theft of nuclear materials in the African context. In doing so, this has the potential to prevent the possible threat of nuclear terrorism on the continent. The evaluation will address various capacity and resource challenges preventing effective and complete implementation of UNSC Resolution 1540 in Africa and the action-steps essential to reduce the inadequate implementation of the multitude of international and regional non-proliferation treaties, specifically the UNSC Resolution 1540.

4.2 The Threat of Nuclear Terrorism in Africa

Africa continues to present both a "*facilitating* environment and a target-rich environment" (Cilliers 2003: 91) for various terrorist networks that seek to acquire more sophisticated

measures of violence, hence the need to prioritise initiatives preventing terrorists from obtaining nuclear materials. The region needs to strengthen its control and safety mechanisms and measures and various other facilitating conditions which make the region conducive to illicit activity in order to minimise the risks of terrorist organisations obtaining nuclear materials.

"[These] facilitating conditions are the social and physical arrangements of society that make specific acts of terrorism possible" (Clarke and Newman 2006: 126). Indeed, exploring these conditions is essential in identifying preventative measures against terrorist from obtaining, transporting, and using these nuclear materials and components.

4.2.1 Border Control Mechanisms in Africa

A key conducive condition to the threat of possible nuclear terror in Africa, crucial to this research analysis, is the issue of the inadequate border control mechanisms found in various parts of the continent. The existing weak borders that are not effectively controlled, especially in weak and under-developed regions of the world, allows easy access for various terrorist networks to conduct their hazardous affairs, including the smuggling of fissile materials.

Border control systems in Africa, for instance, are not effectively regulated because they are often understaffed, underpaid, and under-skilled. In addition to the lack of manpower, other contributing factors to the issue of Africa's weak and porous borders are the prevailing unresolved border conflicts, the existing outdated, old-fashioned control equipment for monitoring the entry ports, and the inadequate infrastructure. As a result, the control system is often prone to malfunction and corruption, and in turn elevates the threat of illegal terrorist activity in most of these vulnerable states as a potential breeding ground and safe place for various extremist groups (Clarke and Newman 2006: 126).

Several parts of the continent are ungoverned territory, wrecked by internal border wars and territorial disputes. This makes the unwatched area vulnerable to hazardous terrorist activity as the unguarded territory leaves room for exploitation (Pan 2005).

This is especially the case in the North-Eastern parts of the continent (the Horn of Africa) prone to terrorist attacks, such as Somalia, Sudan, Djibouti, Ethiopia, Kenya, and other regions with heavy Muslim influence and strong ties to international terrorist organisations like al Qaeda. A highly skilled terrorist organisation like al Qaeda often recruits and funds

the various affiliated extremist groups such as Somalia-based militant group al Shabaab, which often attacks high-prolife areas locally as well as neighbouring countries such as Kenya, as noted in the subsequent passages (Khazan 2013).

A case worth noting is the unexpected horrific attacks by the Somali-based militant group al Shabaab at the Westgate shopping mall in Nairobi, Kenya – a relatively stable and thriving economy with increasing incidents of terrorist attacks – which killed about 68 people in 2013. This confirmed the potential risks of terrorist organisations taking advantage of unstable and easily accessible borders found in many African countries. Kenya was a target because it shares a stretched, unprotected border with Somalia (see figure 8 below), commonly used by traffickers to transport weapons and other illicit activities (Anderson and McKnight 2014: 3).

Although the previously cited terrorist attack in Nairobi by al Shabaab in 2013 can be said to be part of a broader distribution of terrorist groups in the region, the Kenyan case is especially interesting as it shows a country which has historically been both a target and victim of aggression by the bordering Somalia, owing to the Somali-Kenyan conflict that has been a recurring internal challenge since the colonial period. The country’s recent invasion of southern Somalia under *Operation Linda Nchi* in 2011 is in fact said to have ignited a series of fatal attacks by the Somali-based al Shabaab in Kenya, some of which are highlighted below (Anderson and McKnight 2014: 2).

Figure 8: Al-Shabaab influenced zones in Somalia, February 2018



Source: BBC (2018), see direct hyperlink in bibliography

The al-Qaeda-affiliated extremist group al Shabaab is also said to have carried out East Africa's most horrific attack, involving a truck bombing that killed over 500 civilians in Mogadishu, Somalia's capital in October 2017. The group also claimed responsibility for the deadly attacks on a Kenyan military base in el-Ade, a Somalian town, killing an estimated 180 soldiers, and conducted numerous attacks in Kenya, including a massacre that killed over 148 students in 2015 at Garissa University, a Christian university in Kenya, near the border shared with Somalia (BBC 2018).

The cited border control and regulatory factors are the reasons terrorist groups successfully conquered Mali and used the country as a station for planning their attacks on the natural gas factory in Algeria and the strikes on the uranium mining site in Niger. This has also raised fears from many global leaders in the West who worry that the next successful terror attack in Europe or the U.S could easily have been planned in Africa and executed by a well-organised terrorist organisation with strong ties to African terrorist groups, i.e. al Qaeda and al Shabaab (Khazan 2013). The research contends that weak and vulnerable borders are a potential port to illicit trafficking of weapons-grade nuclear materials, such as HEU, by terrorist networks. Poor border control and heavy affiliations with sophisticated international terrorist groups interested in getting hold of, and using nuclear weapons, makes the continent vulnerable and a target to potential acts of nuclear terrorism.

4.2.2 Uranium Mining in Africa

Another related and crucial condition that is conducive for potential nuclear acts of terror is the security and control of uranium mining and production sites. The continent is supplemented with ample uranium deposits (Broodryk and Stott 2011) and countries such as South Africa, Namibia, and Niger are some of the world's leading suppliers of radioactive uranium which, once combined with high explosives, can be used to fabricate a "dirty bomb" (Shuster and Georgia 2017).

The increase in energy production across the globe has seen a rising global interest in Africa's considerable uranium deposits, as various states in different parts of the world such as Western and Central Europe, South America, Asia and Africa (noted in Chapter 2, page 32) seek uranium-fuelled nuclear power for generating electricity using nuclear power reactors, to meet their energy needs, and as an efficient and clean alternative to fossil fuel (World Nuclear Association 2018).

The continent stockpiles 18% of the world's available uranium. The mining of uranium in Africa began in the DRC when the Shinkolobwe mine in Katanga drew interest from the then-colonial Belgium in 1915, when scientists used the radium obtained from uranium for radiotherapy against specific cancers. The Shinkolobwe operation was shut down in 1937 and later revived by the U.S military who bought an estimated 30,000 tonnes of uranium (tU) from the mine to produce the first atomic bombs between 1942 and 1944 used in the U.S bombings of Hiroshima and Nagasaki in 1945 (Dasnois 2012).

The focus on the continent's uranium reserves has increased overtime with mining processes taking place in "Namibia (8% of global production), Niger (7%), Malawi (1.2%), and South Africa (1%)" (Postar 2017:401). Other significant producers of uranium include Kazakhstan (39% of total world production from mines in 2016), then Canada (22%), and Australia (10%) (World Nuclear Association 2017). Africa controls 8.5%, 16% and 14.7% of world reserves in Namibia, Niger, and South Africa, respectively. Uranium mining in Africa has gained sizeable attraction over time, owing to its accessible uranium, low labour costs, and the current flexible regulations (Dasnois 2012; Mutua 2015).

Following a decade of deteriorating mine production to 1993, the World Nuclear Association (2017) reported a current increase in uranium output to meet nearly all the demand for power generation at present. The World Nuclear Association (2017) reference scenario forecasts world uranium demand at an estimated 67,867 tU in 2017, mostly derived directly from mines.

Uranium from the continent represents approximately one fifth of world production at present. However, uranium production in Africa is inflicted with various security challenges as it is the main element required for nuclear weapons. The security repercussions of Africa's uranium production are worth considering in this discussion on the region's non-proliferation efforts and risks to potential threats of nuclear terror. For this reason, Africa has a crucial role to play in ensuring the security of uranium mines from illegal terrorist activities. The depreciation of security in many mining sites such as the unlawful uranium mining at the Shinkolobwe mine in the DRC, for example, where "the source material for the atomic bombs that were dropped on Hiroshima and Nagasaki originated" is particularly concerning (Broodryk and Stott 2011).

Similarly, the suicide bombings in 2013 at the Somair uranium mining site in Arlit, the French-owned mine in Niger, by Islamist militant group the Movement for Oneness and

Jihad in West Africa (MUJAO) reported to be affiliated to al Qaeda, demonstrates the vulnerability of the African region to possible acts of terror in sensitive areas such as the targeted operations of uranium mines that could potentially be victim to the plans of affiliated well-organised terrorist groups such as al Qaeda which seek to explore the mines, granted that uranium is the primary element required for nuclear weapons (Deutsche Welle 2018).

The ongoing territorial conflicts, political instability, and the prevailing weak central governments in various African states prone to corruption, represents the most crucial nuclear security challenge on the continent at present. The research identifies nuclear trafficking incidents in Africa as potential proliferation threats, and remarks on the defective implementation of laws and regulations in African uranium mining which cultivate the risk of uranium trafficking by terrorist organisations seeking to acquire and use this to assemble crude nuclear weapons such as a “dirty bomb”.

4.2.3 Uranium Trafficking or Theft Incidents in Africa

The decline of security in uranium mining and production sites because of political instability presents one of the most urgent security challenges in Africa at present. This is because the possible acquisition of HEU, or separated plutonium, by way of trafficking or theft, to build crude nuclear weapons such as a “dirty bomb” – remarked to be the most likely possibility for nuclear terrorism – and the vulnerability of Africa’s abundant uranium reserves and mines could attract illicit terror activity in the region (Postar 2017: 402).

The recovery of 170 kg of uranium yellowcake, also known as Urania (radioactive uranium powder obtained during uranium ore processing) which was stolen from the Rossing Mine in Namibia in 2009 by two workers in the facility; the additional 324 kg of uranium which was stolen in August 2011; nine samples of nearly 1,000 kg of uranium yellowcake from a suspected Sierra Leonean that were to be sold to Iran through American operatives in 2013; and the 1 kg of uranium yellowcake (from a larger batch of the radioactive material allegedly embezzled from a Namibian uranium mine) seized in Durban, South Africa in 2013 smuggled through a Mozambican border (Philip and Erasmus 2013); all these cases elevate the issue of consolidation and/or elimination of vulnerable fissile material and preventing easy access for rogue terrorist organisations such as al Qaeda seeking to obtain this nuclear material, and with strong affiliations in various parts of the continent such as Northeast and Western Africa (Postar 2017:404).

Nevertheless, despite public concern about the possibility of terrorist organisations getting hold of low-grade Uranium, most nuclear scientists agree that the risk is minimal, as this material would demand substantial conversion and processing into high-grade uranium usable in nuclear weapons. Interested terrorist groups would require large amounts of Uranium converted only by means of a high-level refinement process to produce small amounts of enriched uranium used in nuclear explosives (Mutua 2015).

However, compressing a sub-critical sphere of plutonium to produce separated weapons-grade plutonium, even though demanding, can be used *alternatively* to produce an “implosion-type” nuclear bomb. This type of IND, shown in Figure 4 in chapter 2, requires far less nuclear material (about 5 kg of plutonium for a crude design), but requires accurate processing and forming of plutonium core, which is more complicated compared to the design and use of a “gun assembly”, which uses highly enriched uranium, and far more feasible for a terrorist organisation seeking an IND to cause terror and destruction. However, it needs more fissile material than an implosion design (about 50 kg of HEU), depending on the form and design (Evans and Kawaguchi 2009: 41).

Nonetheless, nuclear experts have pointed out that the technologies and materials needed to build weapons-usable HEU and/or separated plutonium from scratch is beyond the realm of even the most sophisticated terrorist organisations (Policymakers 2009:40), despite the revelations of the A.Q Khan smuggling network (discussed in previous chapters) which is said to have offered their knowledge and expertise in advising al-Qaeda on fabricating a crude nuclear device (Sanger 2010).

These developments showed that highly organised terrorist groups can possibly buy a complete nuclear weapon design from illicit trading networks seeking profits, and this would simplify the demanding mission of assembling the required improvised nuclear weapon, such as a crude nuclear bomb (Fitzpatrick 2007). The only current limitation to this possibility is accessing enough weapons-grade nuclear material to use in building the crude nuclear device but given the large amounts of uranium obtainable in various unstable and underdeveloped regions in Africa because of the inadequate control and regulatory mechanisms in many African states, that limitation will not hold in the long run (Albright, Brannan, and Stricker 2010: 87).

The Khan smuggling network has shown how sophisticated nuclear trafficking networks can easily adjust and become accustomed to counteracting the security instruments set

against them. Hence the need for highly effective improvements and reforms to prevent the emergence of similar smuggling networks, and the full implementation of the established global non-proliferation instruments set to prevent the spread of nuclear material and nuclear weapons, and their possible acquisition by interested terrorist organisations (Albright, Brannan, and Stricker 2010: 87-88).

A combination of factors such as the incredibly high-level expertise to make the Urania conversion and enrichment process, and large amounts of funding, make it a difficult and an unlikely route for interested terrorist groups seeking the material to develop crude nuclear weapons (Swart 2015:758). Nonetheless, the projected increase in uranium developments in Africa, and the relative ease of trafficking of low-grade Urania across Africa's weak and easily accessible borders, as seen with the Durban example where low-grade Urania was easily trafficked through the Mozambican border, present a serious security challenge on the continent's non-proliferation objectives for a nuclear-free Africa, as the security gaps in countries like Mozambique, even though without regular acts of terror, and in no possession of uranium stockpile, can easily be manipulated by terrorist networks to gain access to the country of interest (in this case South Africa). These vulnerable states (with weak and unstable borders) play an important role in preventing possible nuclear terrorism, as the weak borders shared with countries of potential interest (i.e. South Africa and Namibia, both in possession of uranium) increases the risk of possible threat of nuclear terrorism on the continent (Winde *et al.* 2017).

Other Control and Regulatory Mechanisms

Other related conditions that are conducive for these nuclear acts of terror include the prevailing inadequate justice systems and limited law enforcement capacity available to many African states. This is another example of defective control mechanisms, and a common facilitating condition to the possible threat of nuclear terrorism in Africa. Various parts of the continent have limited law enforcement and monitoring capabilities for nuclear material and lack the capacity to prevent and combat the threat itself (Clarke and Newman 2006: 127). In addition, as previously highlighted, the risks of illicit activities from terrorists seeking to exploit the existing security gaps are higher than ever, noting the increase in nuclear material production in Africa and the fact that various underdeveloped regions in Africa are without an adequate justice system to protect them. The currently existing justice system in various corrupt African countries overlooks illicit trade and trafficking of

illegal substances – including possible nuclear substances and nuclear knowledge and expertise (Kibaroglu 2014: 211).

Another crucial conducive condition includes weak state institutions which lack accountability and transparency; in other words, a weak central government and civil service that is susceptible to corruption (Clarke and Newman 2006: 127). The continent scored poorly on the recently published Corruption Perceptions Index 2017 ranking over 180 countries worldwide. Sub-Saharan Africa ranked amongst the worst performing regions, scoring an average of 32 on the 100 point-scale (where 0 is highly corrupt and 100 is the perfect clean score). Somalia (at the bottom of the list) and South Sudan had the lowest scores of 9 and 12 respectively (Transparency International 2018).

The evaluation will emphasise the principles of *full commitment*, *efficient government coordination*, and *active participation* amongst fellow African countries in subsequent sections against the analysis of the role of regional (and sub-regional) cooperation in realising the full implementation of global and regional non-proliferation initiatives by the continent.

All the identified challenges influence the management and control by nuclear regulatory bodies, facility operators, and organisations in charge of emergency planning and response. Collaboration in response to nuclear and radiological accidents such as the collective efforts of regional organisations is fundamental in alleviating risks and dealing with the consequences.

4.3 Regional Collective Security in Africa

A variety of challenges have been in the way of the full implementation of UNSC Resolution 1540. Its establishment has been obstructed in its effectiveness by considerable delays and complications. Even though UNSC Resolution 1540 is distinctive in its universal coverage, this has created challenges to the implementation of the resolution, one such challenge being the extent to which the threat of WMD proliferation is relevant to individual states.

“The potential danger of a non-state actor being in possession of, and using, a WMD varies greatly between countries,” observes Dye (2007: 12). For example, most Western countries, particularly the U.S and European states, perceive this threat to be a significant

security challenge, compared to the global South for example, where many developing countries prioritise other issues such as unemployment, poverty, conflicts, diseases, and other domestic issues which they deem to be more concerning to their national security (Bosch & Van Ham 2007:3).

Hence the common concerns surrounding the question as to whether it is more essential for some states (for example those in possession of WMD programmes) to implement UNSC Resolution 1540 rather than the other states without nuclear programmes, and not directly involved by the potential spread of these weapons? Some reports argue that it seems unrealistic to demand that poor developing countries with insufficient resources and limited capacity, and members to several other international non-proliferation conventions prioritise the implementation of UNSC Resolution 1540 over the more relevant and eminent issues such as the spread of HIV/AIDS (Dye 2008: 20).

The terrorist developments on the continent witnessed in recent times in Somalia, Kenya, Niger, and other parts of the continent such as the cited massive car bomb explosion in Mogadishu, Somalia in 2017 which left over 500 people dead, demonstrate strong eagerness from global terrorist networks in causing disorder and destruction at a larger scale than previously imagined (Winde *et al.* 2017). These events emphasise the importance and relevance of Africa's engagement in the arrangements set up to prohibit the proliferation of WMD by terrorist networks and minimise the threat of nuclear terrorism (Wirtschaftler and Gadiaga 2015).

Furthermore, the expanding demand in nuclear energy across the globe has seen a rising global interest in Africa's considerable uranium deposits and therefore places Africa at a key position in realising the security of nuclear and radioactive materials from terrorist organisations. This is a crucial role for the continent as it is vulnerable to the unlawful trade and trafficking of radioactive uranium because of its vulnerable mining sites and weak borders (Kaspersky 2017).

Interestingly, the reported sufficient border controls in individual country reports submitted to the UNSC 1540 Committee were most probably put in place to control the illegal trade of small arms and narcotics, not WMD or fissile materials. Although these initiatives could contribute to the non-proliferation of WMD on the continent, specific focus on border controls to curb the possible spread of these weapons by non-state actors need to be implemented in national legislation (Heupel 2008: 96). The continent's poor border control

and regulation, and their vulnerable uranium mines amid the evidently elevated terrorist activity on the continent, warrants more attention in the WMD non-proliferation agenda of many African countries.

4.3.1 Response to Challenges of Implementation of Resolution UNSC 1540

The existing insecure borders in Africa, substantiated by its weak security measures in uranium mining and production sites, is maybe the biggest African connection on the issue of non-proliferation that links it to the responsibility of full implementation of UNSC Resolution 1540, and the overall issue nuclear terrorism. Even if it is not in possession of these dangerous WMD, the continent still has a crucial role in preventing the spread of these weapons and their possible acquisition and use by terrorist organisations.

It is therefore up to state officials working with various willing experts and competent actors (discussed in detail below) to educate and change the attitudes of Africans on the issue of WMD non-proliferation and bring about a sense of urgency in their contribution to stop the spread of these dangerous weapons and prevent them from falling into the hands of terrorist groups.

Bringing together nation states to execute the Resolution's requirements depends largely on implementing a *division of labour approach* to the process. This approach would be founded on the UNSC 1540 Committee and other *associated representatives* such as regional organisations like the AU and the UNREC; sub-regional organisations such as Regional Economic Communities (RECs); regional regimes like the Treaty of Pelindaba; state actors; and non-governmental organisations (NGOs) such as the South African-based Institute of Security Studies (ISS) who are all mutually engaged in a concerted effort to maximise the full implementation of the Resolution. These participants must improve their attempts to fully address the issue of full implementation, and the discussed challenges involved, to establish and maintain momentum, and overcome these challenges (Dye 2008: 20).

The UNSC should reinforce the structural foundation and operational framework of the UNSC 1540 Committee. Correspondingly, the Committee should continue to function as an *intermediary for assistance* with the implementation of the Resolution, and continue to generate matrices for each member state, tracking their progress on the implementation of UNSC Resolution 1540. These matrices build on the aspect of *accountability* from the various African states often prone to corrupt central governments (Kasprzyk 2017).

The Role of REC's in the Division of Labour Approach

The delegation of roles and division of tasks between sub-regional organisations such as RECs and other associated institutions ought to be the first preference in reducing the risks of the spread and use of WMD by terrorist organisations. The approach towards extensive continental integration and teamwork could prove more efficient for the diverse African continent. The REC's concerned include: the Southern African Development Community (SADC); the Economic Community of West African States (ECOWAS); the East African Community (EAC); the Economic Community of Central African States (ECCAS), and the Arab Maghreb Union (UMA). The research highlights the transformative and crucial role of REC's towards continental integration and cooperation in the implementation of global and regional treaties as means of nuclear non-proliferation in Africa, such as UNSC Resolution 1540 and the Treaty of Pelindaba (Kasprzyk 2015).

The collaboration amongst key African states and participating actors such as regional and sub-regional organisations; NGO's; and REC's requires greater transparency in executing the objectives of non-proliferation. This approach reduces the challenge of weak and vulnerable African central governments due to corruption and malfunction, which make the continent vulnerable to the threat of nuclear terrorism.

The report proposes that transparency and openness will benefit regional and global non-proliferation mechanisms and will enhance their foreign relations not only in the realm of peace and security, but in other important sectors such as economy and development. This will call for *full commitment, efficient government coordination, and active participation*, as well as strong and lasting political leadership that is open and accountable (African Economic Outlook 2017).

4.3.2 Insufficient Reporting to the UNSC 1540 Committee by African States

A wide cooperation gap persists between member states and the Committee, whereby most African states hardly report on their progress in implementing the resolution, even amongst the most affected by terrorist attacks such as Somalia, Algeria, Tanzania, and Kenya (Inter-Parliamentary Union 2016).

Although there has been an increase in the total number of submissions of the first national reports, seventeen countries are yet to submit their reports to the Committee as of 2017, which still shows progress when compared to the 25 reports submitted in the

previous round of reviews in 2011. However, the Committee revealed that of the remaining seventeen non-reporting countries, thirteen are African states (United Nations Security Council Committee 2017).

These revelations expose the attitudes of African states towards the issue of the non-proliferation of WMD, as most of the national reports submitted to the Committee are incomplete. All the submitted reports simply state that these countries are in no possession of WMD and therefore cannot provide any kind of assistance to non-state actors seeking these weapons. Namibia, for instance, does nothing more than simply stating this in a one-page document (Namibian report to UNSC 1540 Committee 2005).

The lack of effort by African states is concerning, as countries like Namibia for instance could easily fall victim to smuggling routes used to transport nuclear material, as seen in the previously cited smuggling case where 1 kg of uranium yellowcake (said to be from a larger batch of the radioactive material allegedly embezzled from a Namibian uranium mine) which was seized in Durban, South Africa in 2013 (Philip and Erasmus 2013).

Namibia is not immune to the involvement of possible terrorist smuggling networks of nuclear material or technologies, as the country holds one of Africa's biggest uranium reserves and is susceptible to possible theft of nuclear material (noted in the Durban case cited above) (Philip and Erasmus 2013). The country has a significant role to play in ensuring the safeguarding of its uranium stockpiles and security of its borders as a target to possible uranium smuggling activities, and thus should provide sufficient reporting on the issue of nuclear non-proliferation than noted above.

The insufficient, poor reporting to the UNSC 1540 Committee by African States (excluding South Africa), illustrated in Table 1 below, is indicative of more work that needs to be done in ensuring all member states are held accountable. Additionally, when reporting on existing non-proliferation initiatives, and intended action-steps in implementing the Resolution, most African states have previously just listed the treaties and conventions they are members to, as well as present national legislation that relates to the provisions of the Resolution (United Nations Security Council Committee 2017).

Most of the legislation recorded is insufficient, outdated, and vague to effectively confront newly emerging WMD threats. This has drastically delayed progress towards the full implementation of UNSC Resolution 1540 (Dye 2008: 20). Kenya, for example, simply noted that "the development, acquisition, manufacture, possession, transfer, transport and

use of nuclear materials – and by extension nuclear weapons – is controlled by its Radiation Protection Act (1982)” (Kenyan report to UNSC 1540 Committee 2005). The Act is incomplete and still under review, and the country makes no mention of chemical and biological weapons in its report (World Nuclear Association 2007). Similarly, Libya passively noted their current domestic provisions to regional non-proliferation efforts under an outdated Act ratified in 1988 which prohibits the spread and use of WMD (Libyan report to UNSC 1540 Committee 2005).

Table 1: Reports submitted to the 1540 Committee

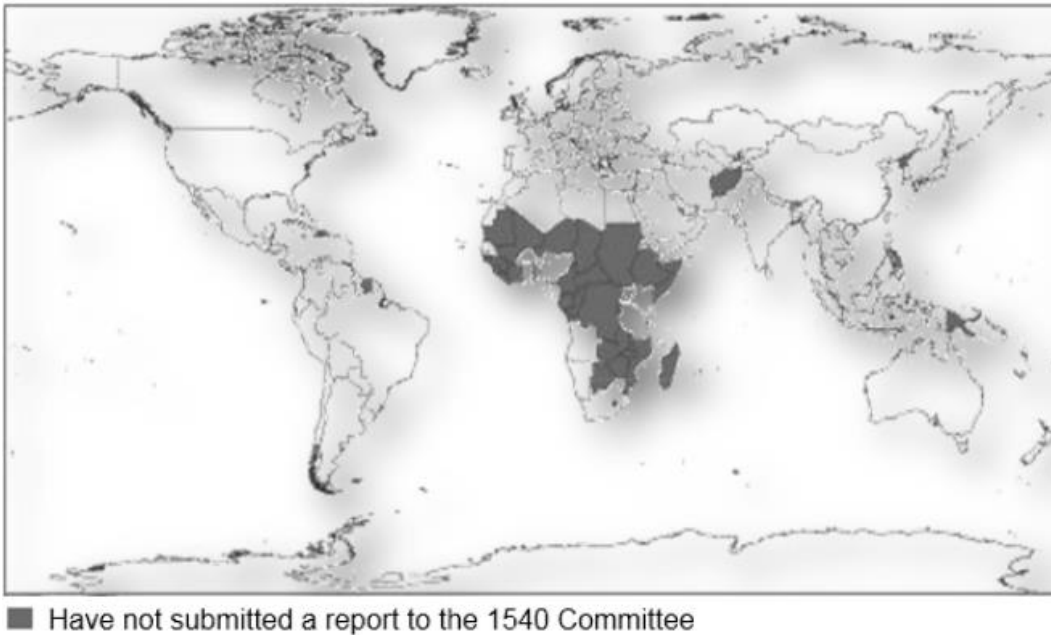
<i>Country</i>	<i>Date of submission of first report</i>	<i>Date of submission of additional report</i>
Algeria	November 2004	September 2005
Angola *	October 2004	
Benin *	March 2005	
Burkina Faso	January 2005	
Djibouti	March 2005	
Egypt	October 2004	March 2006
Eritrea	June 2006	
Ghana	November 2004	
Kenya *	July 2005	
Libya *	April 2005	December 2005
Mauritius	April 2007	
Morocco *	October 2004	September 2005
Namibia	October 2004	April 2006
Nigeria	October 2004	
Senegal	March 2005	
South Africa	January 2005	January 2006
Tanzania	August 2005	
Tunisia	November 2004	
Uganda *	September 2005	

* African countries that have asked for assistance with the implementation of UNSCR 1540

Source: United Nations Security Council Committee (2017)

Table 1 illustrates the poor reporting to the UNSC 1540 Committee by African states, even though all states expressed full support for the Resolution. Figure 9 also demonstrates the number of non-reporting states in a map, which are nearly all developing countries; and the majority are from Africa. This has severe implications on the continent vulnerable to possible acts of nuclear terrorism, as it demonstrates the lack of engagement and urgency on the issue by African leaders in preventing the risks associated with nuclear proliferation such as the threat of nuclear terrorism.

Figure 9: Non-reporting states, 2015



Source: Nuclear Threat Initiative (2015)

The submission of voluntary national implementation action plans by at least four African states – Niger (14 March, 2014); Senegal (25 September, 2015); Togo (6 July, 2015); and Malawi (3 February, 2016) – is plausible, and an “important contribution to the general increase in measures that states have taken to prevent non-state actors, including terrorists, from gaining access to nuclear, chemical and biological weapons and their means of delivery” (United Nations Security Council Committee 2017).

More work needs to be done by capable states like Kenya, Namibia, and Egypt who are all affected by the potential threat of nuclear terror acts in their respective territories. Kenya shares borders with Somalia and has witnessed several terror attacks by al Shabaab (discussed in previous sections) (BBC 2018). Similarly, Egypt is prone to violent acts of terrorism in the North from extremist affiliated with Daesh-Sinai (operations of ISIS) (Dye 2008: 20).

Evidently, these countries are not exempt to the risks posed by the proliferation of WMD, hence their reporting needs to be convincing and reflective of their domestic realities. Regional organisations such as the AU, REC’s, and NGO’s should cooperate and put pressure on these states to fulfil their obligations as per the requirements of the Resolution. The sense of urgency and insistence is lacking, and individual countries and international organisations should explore more methods to accommodate pressing

complaints and objections which undermine the legitimacy of the Resolution (Institute for Security Studies 2016).

4.3.3 The Operation of a “Power Bloc” – Recommendations for Implementation

The paper proposes that the key role to full implementation must be taken by the regional hegemons with more influence, capacity, and experience such as South Africa, Nigeria, Egypt, and Kenya. South Africa is the only country to have developed nuclear weapons. In addition, South Africa, alongside Egypt, Nigeria, Ghana, Morocco, and Libya, has operating nuclear reactors at present. These capable countries should be at the forefront in ensuring the full implementation of the Resolution and formulate a “*power bloc*” which is discussed below, leading the continent towards the non-proliferation of nuclear, biological, and chemical weapons. They should set up the appropriate mechanisms that are country-specific for the different regions they represent.

These mechanisms should specifically address the decline of security in uranium mining and production sites because of political instabilities; the fragile border control mechanisms found in various parts of the continent that are not effectively regulated because they are often understaffed, underpaid, and under-skilled; the prevailing inadequate justice system and limited law enforcement available to many individual African states; and the dominating weak central governments and civil service that is susceptible to corruption (United Nations 2018). The current border controls operating in the various individual countries in Africa were mostly put in place to control the illegal trade of small arms and narcotics, not WMD or fissile materials. The bloc must ensure the implementation of border controls to address the security and control *specifically* preventing the possible spread of these weapons by non-state actors (Heupel 2008:96).

These prominent countries need to model a reciprocal, competent, and ongoing collective system that holds individual states accountable to the initiatives by UNSC Resolution 1540, in the form of a *power bloc* which entails the more developed and powerful regional leaders from the various parts of the continent and would utilise a *division of labour approach*. This approach would entail collaborating with other assisting participants such as regional organisations, REC’s, and NGO’s which work together to realise the non-proliferation efforts of the various individual states in their regions and would also prevent “reporting fatigue” (United Nations Security Council Committee 2017).

The proposed power bloc must implement the suggested *division of labour approach* in their operation and mandate. This is to share the labour and resources involved in realising the full implementation of UNSC Resolution 1540, as they can jointly raise funds to promote Africa's interests and attempts at global and regional non-proliferation. The division of labour approach should be legally binding to all participants, where the reporting collaboration of the power bloc and the assisting representatives involved *institute* their partnership and form an alliance joined by the common objective of regional nuclear non-proliferation.

The design of the power bloc should take the form of a unifying platform of regional integral design and must aid and support the various governments of individual African countries which are prone to terror attacks and at a high risk of the threat of nuclear terrorism. It must educate African leaders from these areas to the possible dangers of non-proliferation and the valid risks of their governments to the threat of nuclear terrorism, hence the importance of the full implementation of the regimes aimed at preventing the spread of WMD.

The small size of this bloc would enable an efficient, working system between the countries, and would be more specific in allocating individual tasks to member states in assisting the smaller neighbouring countries in implementing the mandate of UNSC Resolution 1540. These countries are unable to give attention to, and implement UNSC Resolution 1540, despite being signatories to the Resolution, and are at a high risk of terror attacks and the threat of nuclear terrorism. This is because of limited available resources and capacity, as they are for the most part preoccupied with prevailing domestic political instabilities and economic woes and use whatever available state funds to address ongoing domestic challenges (United Nations Security Council Committee 2017). The alliance of assisting representatives such as regional organisations (the AU), RECs; NGO's (ISS), and the individual states forming the power bloc must therefore work closely with the UNSC 1540 Committee in realising Africa's non-proliferation objectives.

The reciprocal power bloc of regional leaders initiative would make use of their comparative advantages that would also assist in getting rid of the problem of "reporting fatigue" (Hersman 2016: 33), as it is more private and subjective, and would focus specifically on regional non-proliferation agendas, compared to the broad and vague nature of the currently-existing regional mechanisms in Africa like the AU Commission,

where nuclear security is just one of many issues on the agenda. This alliance would see to working closely with AU subordinates like the Peace and Security Council (PSC), where the PSC is just a participant and not the supervisor of the bloc. It will engage with the UNSC 1540 Committee, which will facilitate the provision of outside assistance to many states lacking adequate legal and technical expertise, and the sufficient human and financial resources to implement the Resolution (Heupel 2008: 97).

Additionally, it will engage vigorously with civil society, business communities, interest groups, and training organisations to educate the public about the risks of the spread of nuclear, biological, and chemical weapons in Africa, and present the case of the possible risks of illegal terrorist activities on the planet, as well as the importance of the non-proliferation of WMD.

This would ultimately assist in eliminating the prevailing domestic challenges in the way of full implementation in many African states, as they would collectively present functioning implementation reports from the various regions – including the lack of resources and inadequate capacity to perform and carry out the mandated duties which would ensure that the issues of border controls, safety of African uranium mines, and weak and corrupt central governments are dealt with accordingly.

Most of African governments are preoccupied with combating pressing challenges (that are more immediate) such as unemployment, health crises (i.e. HIV/AIDS), poverty, national debts, conflicts, and other political and economic issues that are publicly perceived as more tangible, and *real*, than the issue of WMD proliferation (Inter-Parliamentary Union 2016).

These challenges generate more public interest and are prioritised by governments – explained by the phenomenon of *securitisation*, in which the noted issues have been “securitised” and treated as national security concern. These issues are taken to be an existential threat and require high priority on the policy agenda as well as high-level state resources, hence they are distinguished as national security matters (Wæver 2011; Williams 2003).

The lack of involvement from individual states points to the fact that nuclear security is currently not a high priority on the African agenda. The proposed power bloc working with the *assisting representatives* must work with the parliamentarians from individual African states in explaining what is at stake and why the full implementation of UNSC Resolution

1540 (and other complimentary regional non-proliferation treaties such as the Treaty of Pelindaba) are not only important, but relevant and necessary. Most of these state leaders are uninformed about their country's bearing and relation to the overall threat of nuclear terrorism – specifically the threat of nuclear trafficking by terrorist organisations on the continent – and view it as insignificant and thus disconnected to the conversation on non-proliferation.

However, none of these disconnected African states should consider themselves immune from the consequence of a possible nuclear attack by a terrorist group, or to the involvement of terrorist smuggling of nuclear equipment, material, or technologies on their territory. The continent is at high risk of illicit trade and trafficking of nuclear (and other radioactive) material because of its significant role in uranium mining and production, substantiated by the weak security measures in mining sites, and poor border controls and corrupt central governments in many of these detached African states.

By convincing African parliamentarians and the public on the necessity of the full implementation of non-proliferation establishments, and elevating the significance of the issue, the bloc must present one crucial detail: that the effective implementation of these regimes contributes to sustainable economic development, as security and development have indeed been proven to be inextricably interlinked (Snider and Molnar 2012: 165). In this way, the public and officials alike will realise the long-term benefits of the full implementation of non-proliferation treaties that deal with preventing the acquisition of weapons-usable nuclear materials and nuclear equipment by terrorist organisations.

4.3.4 South Africa's Role in Leading Africa's Non-proliferation Initiatives

South Africa has redefined its role overtime, following the termination of its nuclear programme on 26 February 1990 (Von Wielligh and Von Wielligh-Steyn 2015: 263) and its reformed nuclear diplomacy after its democratisation in the early 1990's, which subsequently saw it accede to the NPT and ratify the IAEA's Safeguards Agreement. The country remains one of the very few states to have dismissed its nuclear weapons programme – others being Libya, Brazil, Ukraine, and Argentina (Goodson 2012: 210). South Africa's nuclear experience holds significant lessons. It not only establishes standards for nuclear retraction for other rising nuclear states, but most importantly, the country subsequently recognised that its nuclear devices were not only unnecessary, but counterproductive to accomplishing its political, economic, and military objectives (de

Villiers, Jardine, and Reiss 1993: 99). This may ultimately be the important message and lesson for emerging and aspiring nuclear powers.

Since South Africa's disposal of its nuclear programme, the continent has emerged as a "champion" of global nuclear disarmament and non-proliferation and the country has reformed its identity as a leader in this front in hosting the final IAEA drafting summit, and even in naming the ANWFZ Treaty after its nuclear control center outside Pretoria (Pelindaba) (Broodryk and Stott 2009).

South Africa has proven its dedication in promoting and reinforcing the norms and implementation of established non-proliferation regimes in the post-Apartheid period and has been widely accepted as a capable leader by other African countries. It continues to be an "accommodator, mediator or bridge builder in nuclear matters" (Van Wyk 2014: 95). This is manifested in the country's participation and significant contribution to several NPT and IAEA summits, where it often expresses and promotes the interests of developing countries and NNWS (van Wyk and van Wyk 2015: 34).

Furthermore, the country's substantial reporting to the UNSC 1540 Committee is unmatched by any other African country. It ensures effective implementation of all the non-proliferation regulations stipulated in UNSC Resolution 1540 to prevent non-state actors from gaining access to WMD (Smedts 2010: 17).

The country has a leading role in pushing the non-proliferation and implementation agenda for the proposed power bloc and the *assisting representatives*. South Africa continues to use its position to lead the continent in advancing the proposed norms of *political will*, *transparency* and *international cooperation*, and expresses solidarity and collaboration in achieving the collective objective of non-proliferation (Stumpf 2001: 68).

The research endorses that these principles should be paired with the legally-binding obligations and a *strong security culture* from the power bloc of regional leaders and the associated representatives that will reinforce the importance of full implementation of the non-proliferation initiatives in Africa and promote accountability from individual African states.

4.4 Conclusion

In the wake of nuclear renaissance, nuclear power has gained substantial renewed interest as a preferred climate-neutral approach to meet the high energy needs of many highly industrialised states. The expanding demand in nuclear energy across the globe has seen a rising global interest in Africa's considerable uranium deposits. This increases the vulnerability of the continent's uranium mining and production operations to possible uranium trafficking. This risk and focus makes the African region an interesting area of discussion on the challenges of securing nuclear materials and decreasing the risk of diversion of HEU/or low-grade Urania to nuclear weapons programmes.

It has put Africa at a key position in realising the security of nuclear and radioactive materials from terrorist organisations. The weak security measures in uranium mining and production sites because of political instabilities and conflicts – exemplified by the cited case of the terrorist attacks in the French-owned uranium mine in Niger (in Chapter 4, page 53) – is maybe the biggest African connection on the issue of non-proliferation that links it to the responsibility of full implementation of UNSC Resolution 1540, and the overall issue nuclear terrorism.

The chapter remarked on the existing weak and easily accessible borders in Africa that are often understaffed and lack the appropriate monitoring equipment and illustrated the consequence of such vulnerable borders to dangerous and deadly acts of terrorism by looking into the various related cases of terrorist attacks in several parts of the continent.

The report examined a variety of challenges that have been in the way of the full implementation of UNSC Resolution 1540. It argues that this will require full commitment and strong leadership, efficient government coordination, and active participation amongst member states. It therefore recommended a collaboration of regional leaders from the capable countries in each region to form a power bloc.

This alliance will collaborate with associate representatives which includes REC's and NGO's which engage vigorously with civil society, business communities, interest groups, and training organisations to educate the public about the high risk of nuclear proliferation in Africa. In this approach towards extensive *continental integration and teamwork* this chapter emphasised the crucial role of RECs (part of the associated representatives), stressing that there is more to be said about the transformative and crucial role of REC's in achieving full implementation of the existing global and regional non-proliferation treaties.

CHAPTER 5: CONCLUSION

The danger posed by terrorist groups in acquiring and using nuclear, chemical, or biological weapons on the African continent is more pronounced now than in the past, as terrorist groups have shown more interest in upgrading to more sophisticated tactics in their conduct of terror activity and adapt to more modern and advanced ways and means. To understand the real threat posed by the possibility of the terrorist use of WMDs on the continent, one needs only to consider the progress made by various terrorist organisations such as al-Qaeda and Daesh-Sinai (operations of ISIS), with strong affiliations with al-Shabaab and Boko Haram, operating in various North-Eastern and Western African regions. The continent therefore has a significant role to play in realising the security of nuclear and radioactive materials from these active terrorist organisations and preventing the possible threat of nuclear terrorism in Africa.

This research investigated nuclear terrorism as a possible threat to Africa by means of a systematic literature review. It evaluated the findings of relevant individual studies focusing broadly on WMD in Africa; UNSC Resolution 1540 as a central counter-terrorism and non-proliferation instrument in Africa; and the network of global and regional instruments and conventions such as the African Nuclear-Weapon-Free Zone Treaty (Treaty of Pelindaba), the Convention on the Suppression of Acts of Nuclear Terrorism, and the Convention on the Physical Protection of Nuclear Material in support of eliminating the usage of any kind of weapon of mass destruction – be it a nuclear, a biological or a chemical weapon.

In the identification of the research theme and motivation of the research study, the paper proposed two policy questions that guide and direct the research, namely: (1) how real is the risk to Africa? and (2) what policy measures would be most effective in reducing that risk? Simply put: what is the appropriate and relevant response by African states to the risk of nuclear weapons in the hands of terrorist organisations? This embraces the research objectives and focus and provides clarity on the risks posed by WMD proliferation in Africa, and subsequently the possible threat of nuclear terror on the continent.

5.1 Overview of the Research

Chapter 1 introduced the topic of nuclear terrorism as possible threat in Africa, and the objectives of the research study itself. It also investigated the literature overview and research methodology used in the research, an extended literature review, as it engages in a progressive scholarly discussion to understand the relationship between international nuclear terrorism and its relevance in Africa.

Chapter 2 offered conceptual clarification and shed light on the relevant theories and principles underpinning nuclear security. The evaluation accounts for the logic of deterrence in the 21st century security environment which includes non-state actors seeking nuclear power. It demonstrated not just what is being dealt with, but also clarified how the threat has evolved and transformed the rules of global nuclear security to provide a useful understanding of the phenomenon of nuclear terrorism in the modern world and assist how state officials deal with it.

Chapter 3 is fundamentally the policy chapter, and therefore attends to the action-steps essential to reduce the inadequate implementation of the multitude of international and regional non-proliferation treaties, specifically the UNSC Resolution 1540 (2004) which aims to strengthen the UN's efforts to inhibit the proliferation of WMD by non-state actors such as terrorist organisations, as well as the Treaty of Pelindaba which in the same way as UNSC Resolution 1540, "imposes binding obligations on member states to adopt legislation to prevent the proliferation of WMDs and establish appropriate domestic controls to prevent their illicit trafficking" (United Nations 2004).

Chapter 4 pointed out how the continent is vulnerable and at high risk to the unlawful trade and trafficking of weapons-usable radioactive uranium because of the prevailing poor control and regulatory mechanisms in Africa, especially the poor security measures in uranium mining and production sites, hence the relevance and importance of Africa surrounding the issues of non-proliferation and the overall issue of nuclear terrorism, and the responsibility of full implementation of UNSC Resolution 1540. It evaluated a variety of challenges that have hindered the full implementation of UNSC Resolution 1540 and proposed recommendations to overcome the marginal contributions by African states to the adequate implementation of the non-proliferation objectives under UNSC Resolution 1540.

5.2 Outcomes

i. How real is the risk to Africa?

This research was mindful of the various financial, technical, logistical, and military complications that make it extremely unlikely for any extremist organisation to successfully manufacture and launch a full-blown nuclear weapon to yield the aftereffects of nuclear panic and terror, and most likely death (Eaves 2016). Even though these extremist groups lack the resources to make this happen themselves, the continuing vulnerability to theft or possible seizure of nuclear materials, and the availability of sensitive equipment and materials in the nuclear black market, create a serious risk that terrorist organisations may eventually obtain the wherewithal to produce and detonate a nuclear device, or more plausibly, the trafficking of radioactive uranium, which once combined with high explosives, can be used to fabricate a “dirty bomb” (Carter *et al.* 2007: 2).

The research confirmed that a “dirty bomb” is the most conceivable device of choice for terrorist organisations, who are not seeking to manufacture a sophisticated device, because of the various financial and technical complications that make it extremely unlikely for any terrorist organisation to successfully manufacture and launch a full-blown nuclear weapon.

The existing weak and easily accessible borders in Africa, and the inadequate security measures in uranium mining and production sites, is maybe the biggest African connection to the issue of non-proliferation that links it to the responsibility of full implementation of UNSC Resolution 1540, and the overall issue of nuclear terrorism. Hence the need to safeguard nuclear material from the hands of terrorist organisations has taken on heightened significance on the continent. African leaders identify the proliferation of nuclear, chemical, and biological weapons as a common threat facing all member states and a threat that should be confronted collectively to ensure that these materials are secured from possible seizure or theft by terrorist organisations.

For this reason (and in response to the opening question), even though the vast majority of countries on the continent report to no possession, or intention to acquire any nuclear weapons for these organisations to steal, and also with the shutdown of South Africa’s nuclear weapons programme, the risk of nuclear terror in Africa, even though low, is still significant, as risks posed by the theft and use of these nuclear materials, equipment, and

technologies by terrorist organisations in the area are high due to the weak control and regulatory mechanisms which expose Africa's mining and production sites and borders to illicit terrorist activity and possible acts of nuclear terrorism.

ii. What policy measures would be most effective in reducing the risk by African states?

The research reveals that the recognised nuclear conventions such as the Convention on the Suppression of Acts of Nuclear Terrorism, the Convention on the Physical Protection of Nuclear Material, and global non-proliferation instruments such the NPT establish the rightful platform for the opportunity to advance a sustainable forum for state officials and the international community to tackle some of the existing gaps in global nuclear security mechanisms to stop acts of nuclear terrorism.

Although the NPT is the foundation of the international non-proliferation system, it is certainly not the full structure, as an increasing number of mutually reinforcing and inter-related legal institutions and instruments complement and reinforce the NPT and its accompanying IAEA safeguards system. In investigating the threat of nuclear terrorism in Africa, the evaluated the findings of relevant individual studies focusing broadly on WMD in Africa and discussed the various available international and regional non-proliferation initiatives, specifically the UNSC Resolution (1540) (2004) and the African Nuclear-Weapon-Free Zone Treaty (Treaty of Pelindaba) (2009).

To answer the question of the most effective policy measures in reducing the risk of African states, the research proposed a division of labour approach instituted in the UNSC 1540 Committee and other associated representatives such as regional and sub-regional organisations such as REC's; regional regimes such as the Treaty of Pelindaba; and state actors and NGOs such as the ISS who are to engage in a concerted effort to maximise the full implementation of UNSC Resolution 1540. They are to engage vigorously with civil society, business communities, interest groups and training organisations to educate the public about the high risks of nuclear proliferation in Africa. These participants must improve their attempts to fully address the various domestic challenges preventing the full implementation UNSC Resolution 1540 by sharing the available resources.

The members must collaborate their efforts and execute united progressive reporting mechanisms to the UNSC 1540 Committee representing the different regions and individual country profiles to overcome the slow and poor implementation of the resolution.

The reporting needs to be convincing and reflective of their domestic realities, and these representatives will ensure the lacking sense urgency and insistence and assist individual countries in exploring more methods to accommodate pressing complaints and objections which undermine the legitimacy of the Resolution. This mutual collaboration will thus ensure accountability and transparency – which is hardly the case in individual states in Africa prone to corruption and malfunction – and see to the continent’s proliferation goals and elevate the issue of nuclear terrorism to the significant and relevant level it deserves.

5.3 Evaluation

Given the wide range of varying and complex factors involved, it is virtually unfeasible to make a credible approximation of the extent of the threat of nuclear terrorism. That is a firm estimation of *how likely* it is that even the most well-organised terrorist organisation could get hold of or assemble and deliver a nuclear weapon; a non-traditional improvised nuclear bomb; or (the more probable) radiological bomb such as a “dirty bomb”, and when this is *most likely* to take place.

In any case, attempting to make any reliable mathematical evaluation of the probability of a disastrous nuclear attack by terrorists is an unproductive and near useless effort, but these minimal odds should not deter necessary attention and confrontation with the threat itself. Hence, even though the odds are near nothing, this does not mean that there is no cause for concern, as history has taught us that even the least likely events, such as the global financial crisis repeatedly discarded as impossible, can prove otherwise.

The research endorses that even though there is widespread perception that the threat of nuclear trafficking by terrorist organisations on the African continent is insignificant and the risk of a WMD attack on the region is minor (if any), noting the fact that there is no African state in possession of any WMD for terrorists to steal or use, not a single African state should consider itself immune from the consequence of a possible nuclear attack by a terrorist group or to the involvement of terrorist smuggling of nuclear equipment, material, or technologies on their territory. The continent is at high risk of illicit trade and trafficking of nuclear (and other radioactive) material such as weapons-usable HEU and LEU considering its role in uranium mining and production, substantiated by its weak security measures in mining sites, poor border controls, and the prevailing corrupt central governments in many African countries. Therefore, even if it is not in possession of these dangerous WMD, the continent still has a crucial role in preventing the spread of weapons-

usable nuclear materials to manufacture nuclear weapons, and their possible acquisition and use by terrorist organisations.

Because of the catastrophic aftermath of a possible denotation of a nuclear device by terrorist organisations, every possible preventative measure against the threat of nuclear terrorism is worth considering, and every safety precaution should be taken by nation states, as it only takes *one* successful attempt from terrorists' end, hence *protection* against such an occasion must thrive *all* the time. The research has therefore focused on preventative strategies to counter the threat of nuclear terrorism in discussing the latticework of international and regional nuclear instruments and proposed a mutual division of labour approach towards extensive continental integration and teamwork as there is more to be said about the transformative and crucial role of *collaborative* means in achieving full implementation of the deliberated global and regional non-proliferation agreements.

Recommendations for future research

Future researchers must bear in mind that the nature of nuclear terrorism in twenty to thirty years will be vastly different from the present. The politics of nuclear security, war, and peace will see future trends with even greater cyber influence as terrorist organisations adapt to modern techniques and approaches to offset counter-terror state intelligence in their quest for more anonymity and far-reaching rapid strategy in order to conduct and execute their plans effortlessly with much bigger impact. In such a scenario, the threat of nuclear terrorism has an even bigger potential to unfold when weighed against the elements of cyber terrorism. This is an area of nuclear terrorism that awards further inquiry given the ever changing, complex security environment that presents unique challenges to the present one.

In addition, future researchers should note that the historical account of the pursuit of nuclear capability by terrorist organisations is limited and complicated by missing crucial information. This is because of the unavailable sizeable amount of data on the cases of terrorist attempts in obtaining nuclear weapons, or weapons-usable nuclear materials and other related cases linked to the threat of nuclear terror. The incompleteness and vagueness that comes with the secretive nature of the topic makes it difficult to examine the nature of the threat and the extent of the potential risks. This makes predicting new developments concerning nuclear attacks by terrorist organisations problematic. This was

the main challenge during the research process and it tends to obscure knowledge as the available reports on some cases are biased and distorted.

Similar limitations applied when investigating South Africa's nuclear programme. Because of the secretive makeup of a country's nuclear weapons programme, primary sources were unavailable based on confidentiality, therefore secondary sources lead the analysis of the related passage. Because of the limited and vague information available, much of the country's nuclear history remains unknown, and the various revelations in several official accounts about the history of South Africa's nuclear programme vary in their description and can be one-sided and misleading in information.

Lastly, as the first country to ever assemble and later renounce its nuclear arsenal voluntarily, the discipline and practice of Security Studies could use South Africa's experience to revise and modify the traditional theory of deterrence to accommodate and explain current trends such as the example of South Africa's nuclear programme and the role of non-state actors in nuclear security. The current security environment is characterised by various complicated emerging threats such as the threat of nuclear terrorism which cannot be fully addressed by the established nuclear deterrence paradigm. An investigation into this element is also a potential area of further inquiry, in which the present (and rather outdated) nuclear theories are explored and possibly amended to account for exceptional cases like South Africa and new actors such as terrorist organisations.

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