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On the Use of Quality Control Methods in Monitoring Boko-Haram Insurgencies Challenges

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ABSTRACT

Nigeria's government has faced severe threats from insecurity and terrorism. A large number of Nigerians have lost their lives and property due to jihadist (Boko Haram) activities, battles between herders and farmers, banditry/kidnapping, separatist insurgency, and oil militants. This paper investigates the implications of security threats (death of various Actors and Civilians). In addition, the study employs lean-six sigma approaches and control chart technique to track insecurity as a current major challenge in Nigeria, as well as the country's security implications. For security monitoring, the DMAC method (Define, Measure, Analyze, and Control) is also proposed. This study utilizes real life data from the Nigeria Security Tracking Website from 2011 to 2022. The study reveals that insecurity is most prevalent in Borno, Zamfara, and Kaduna states, while abduction is most prevalent in the North-Central and North-West. From 2018 to 2019, the number of state actors and civilians killed by Boko Haram increased significantly. It is obvious that the Nigerian government and security agencies have failed to stop Boko Haram's attacks since 2018, and the number of State Actors and civilians killed by Boko Haram has gone out of control since 2013 and 2016 respectively.

1. INTRODUCTION

The severity of the insecurity threatens Nigeria's fundamental social structure. Human lives are lost or permanently harmed with each attack, and faith in democracy and the country is eroding (Aribisala, 2014). When President Muhammadu Buhari was elected in 2015, he ran on a promise to protect Nigerians from terrorists and criminals. However, the country became more insecure than it has in decades. The country's awful poverty, according to others, is to blame for the recent surge in insecurity. The country is currently undergoing one of the worst economic downturns in 27 years, with youth unemployment at 32.5 percent. The following are Nigeria's top five security threats.

1.1 Jihadism

Despite claiming during his first year in office that the Islamist militant group (Boko Haram) had been "technically" defeated, President Buhari now admits that his

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government is failing to end the conflict that began in the North-East.

Indeed, Boko Haram is expanding its territory, taking advantage of Nigeria's poverty and other security concerns to further its radical ideologies (Hassan, 2014). The United Nations estimates that by 2020, the group's warfare will have killed 350,000 people and displaced millions. In some cases, Boko Haram carries out murderous raids while flying its flag and imposing extreme authority on the local population (Awortu, 2015). Taxes are levied on farmlands and the sale of agricultural goods. The Chad Basin's once-thriving international fish market is now completely under the organization's control. The Islamic State's West Africa Province (ISWAP), a faction movement affiliated with the Islamic State, has recently surpassed Boko Haram in terms of numbers and capacity.

1.2 Clashes between Herders and Farmers

Long-standing conflicts between Nigerian herders and farmers over dwindling land and water, exacerbated by climate change have killed thousands. Violence, including attacks on displacement camps and kidnappings, has led several states to ban open-range grazing, fueling tensions with the federal government.

1.3 Banditry and Kidnapping

One of the most alarming concerns to Nigerian families is the kidnapping of students from classrooms and boarding places. Thousands of children have been kidnapped from their schools since December 2020, with many only being returned after a ransom payment of thousands of dollars. Some kidnappers are referred to as "bandits" in Nigeria. Thugs attack towns, kidnap inhabitants, and burn homes on fire. Due to bandit attacks, thousands of people have been forced to flee their homes and seek sanctuary in other parts of the country. Hundreds of schools have been closed in several Northern states since 2012 as a result of kidnappings involving children as young as three years old and staffs.

1.4 Separatist Insurgency

Separatist organizations, from both South-West and South-East have also been fighting Nigerian security forces. These set of separatists (South-West and South-East) are seriously agitating for their states to stand as independent countries.

1.5 Oil Militants

In the oil-producing states, security concerns are no longer new. Crude oil is Nigeria's most profitable export, and Niger Delta rebels have long wanted a larger share of the revenues. They allege that the majority of oil is produced on their land, and that the environmental damage caused by its extraction has devastated communities, making fishing and farming difficult. Militants have been pressuring the government for years by kidnapping oil workers and targeting security personnel as well as oil infrastructure such as pipelines. In 2009, ex-President Umaru Musa Yar'Adua issued a presidential amnesty program, effectively putting the Niger Delta insurgents out of business.

2. METHODOLOGY

2.1 Source of Data

The data was sourced from the Nigeria Security Tracker (NST) monitors violence linked to political unrest and public dissatisfaction. Compiling weekly reports from local and international media, the dataset spans from May 29, 2011, to March 31, 2022. While the NST provides crucial

insights into regional and religious divisions, it faces challenges like inconsistent death tolls, reporting gaps, and potential media manipulation. To mitigate these limitations, the tracker continuously updates its records by synthesizing information from diverse, multi-faceted sources.

2.2 The Concept of Six-Sigma

Introduced at Motorola by Bill Smith in 1986, Six Sigma is a process improvement methodology aimed at achieving near-perfection. By reducing manufacturing variation to achieve 3.4 defects per million opportunities, businesses eliminate waste, save money, and enhance customer satisfaction. Six Sigma is a data-driven strategy that enhances quality by reducing defects. It translates customer needs into measurable Critical to Quality (CTQs) variables, using statistical analysis and precise data to ensure error-free processes, products, and services (Prasad, 2012). The DMAC (Define, Measure, Analyze, and Control) model for monitoring Nigeria's insecurity concerns is shown below.



Figure 1: DMAC Model

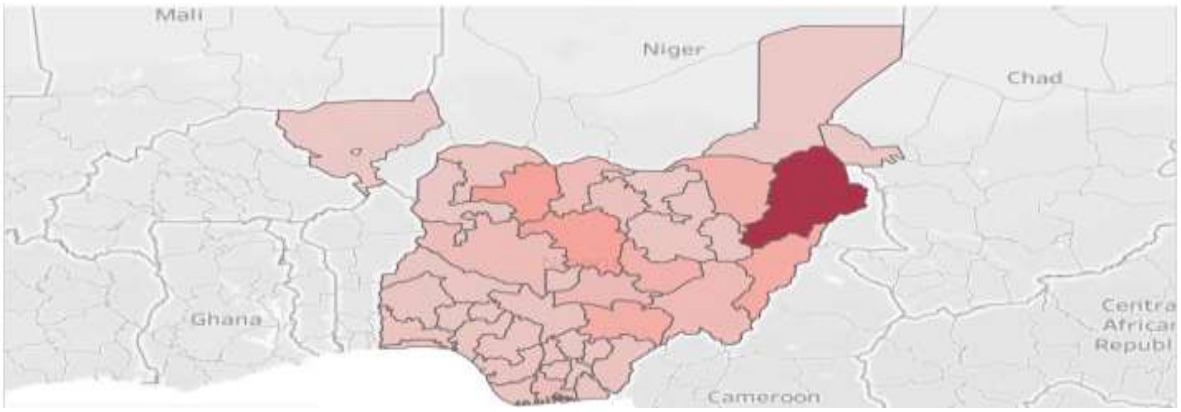


Figure 2: Deaths by State from May 2011 to January 2022

2.3 Map of Deaths by State

Deaths by state are depicted on the map. The Northeastern Nigerian state of Borno is the epicenter of Boko Haram-related violence, which has spread to neighboring Adamawa and Yobe states, among others. More deaths in that state are represented by darker coloring as shown in the figure below.

2.4 Fish-Bone Diagram

A cause-and-effect diagram, also known as a "fishbone" diagram is a tool that visually structures problem-solving. By placing the effect at the head and categorizing potential causes along the "bones," it provides an organized brainstorming framework to identify and analyze the root sources of issues. (Bose, 2012)

2.5 Pareto Chart

A Pareto chart is a vertical bar graph used to prioritize problem-solving by identifying the most impactful factors. Based on the 80-20 rule, it visually ranks contributors from largest to smallest, allowing teams to address the critical 20% of causes that trigger 80% of problems effectively (Ankunda, 2011).

2.6 Descriptive Statistics

Descriptive statistics organize data and describe variable relationships, vital for Lean Six Sigma analysis. They establish the foundation for inferential testing through visuals like histograms and trend plots (Huebner et al., 2016).

2.7 Control Chart

Control charts monitor processes over time using historical data to establish central, upper, and lower limits. Braimah et al. (2014) note these are essential quality tools, specifically utilizing the CUSUM chart to detect process deviations faster than standard methods.

2.7.1 CUSUM Chart Statistics

CUSUM is a statistic for counted data is given by:

$$S_i = \max(0, X_i - k + S_{i-1}) \quad (1)$$

where X_i is the attribute to be controlled and k is the target value. If $S_i > h$ (the decision interval), the system is said to be out of control. The CUSUM control chart process entails collecting samples of size 'n' and plotting the cumulative sum:

$$S_m = \sum_{i=1}^{N}(y_{i-}k) \quad (2)$$

versus the sample number, with y_i denoting the sample mean, k denoting the reference value, and h denoting the decision bounds. A visual procedure known as the V-mask CUSUM, was also used to determine out of control situations. To generate the reference and decision (h and k) values, the following statstics are computed (Gohel and Sarkar, 2017):

$$S_{hi}(i) = \max(0, s_{hi}(i-1) + X_i - k_1 \quad (3)$$

$$S_{lo}(i) = \min(0, S_{lo}(i-1) + X_i - k_2) \quad (4)$$

where $S_{hi}(0)$ and $S_{lo}(0)$ are 0 and when ever either $S_{hi}(i)$ or $S_{lo}(i)$ exceeds h, the process is said to be out of control. The following statistics are also calculated from the historical data to determine the value of h and k (José, Pedro and José, 2020).

$$k = \frac{k_2 - k_1}{Ink_2 - Ink_1} \quad (5)$$

where

$$k_1 = \mu + f\sigma \quad (6)$$

is the out-of-control mean,

$$k_2 = \mu - f\sigma \quad (7)$$

is the in-control mean and f is the shift size ($f \geq 1$).

3. RESULTS AND DATA ANALYSIS

Fishbone Diagram

In order to prioritize the major security threats in Nigeria, fishbone diagram was developed to depict the root causes of insecurity in Nigeria as shown in the Figure 2 below.

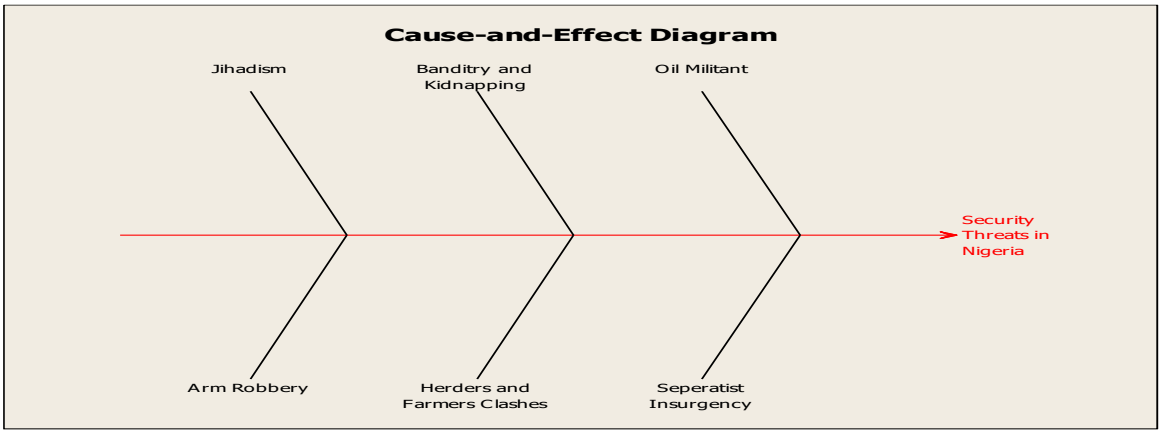


Figure 3: Cause and Effect Diagram of Security Threats in Nigeria

Deadliest Boko Haram Attack state

Boko Haram's ties to states could exacerbate regional security concerns. Therefore, there is the need to prioritize the deadliest states attack in order to bring both national and international attention to these states to help curb this insurgence. The figures below prioritize states and regions based on severity of attacks.

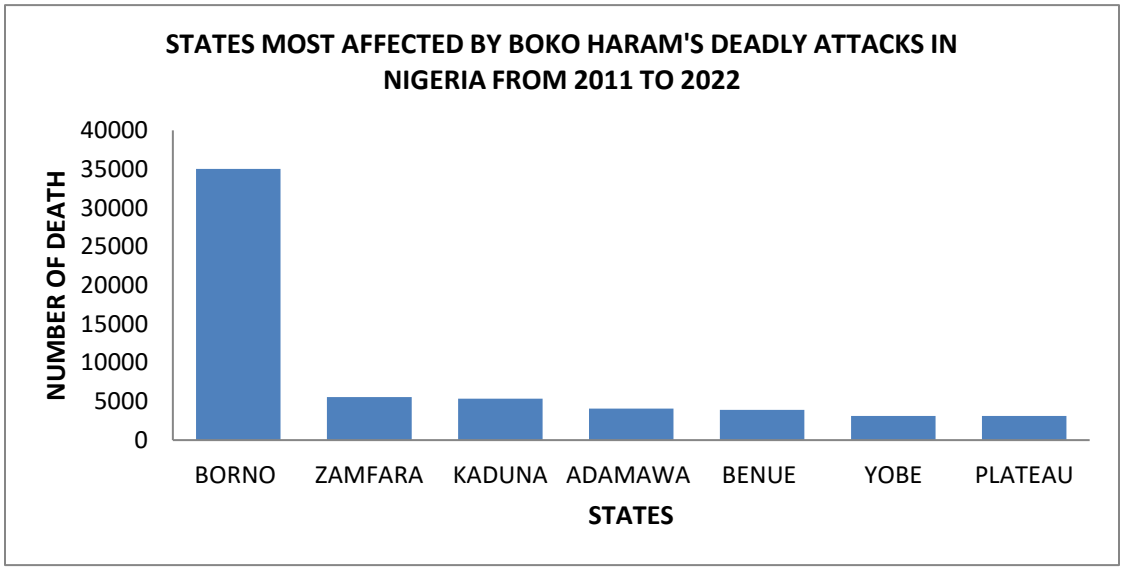


Fig. 4: States most affected by Boko Haram's deadly attacks in Nigeria from 2011 to 2022

The conflict of Boko Haram has largely been restricted to the Muslim-majority Northern States. Since 2014, Boko Haram has increased its attacks, which are concentrated in Borno State, in order to become the country's most prevalent terror group. Borno is by far the most-deadliest state, with over 34 thousand people killed by Boko Haram. Among the incidents covered by the media in 2014, the kidnapping of 276 female students from a secondary school in Borno gained international attention.

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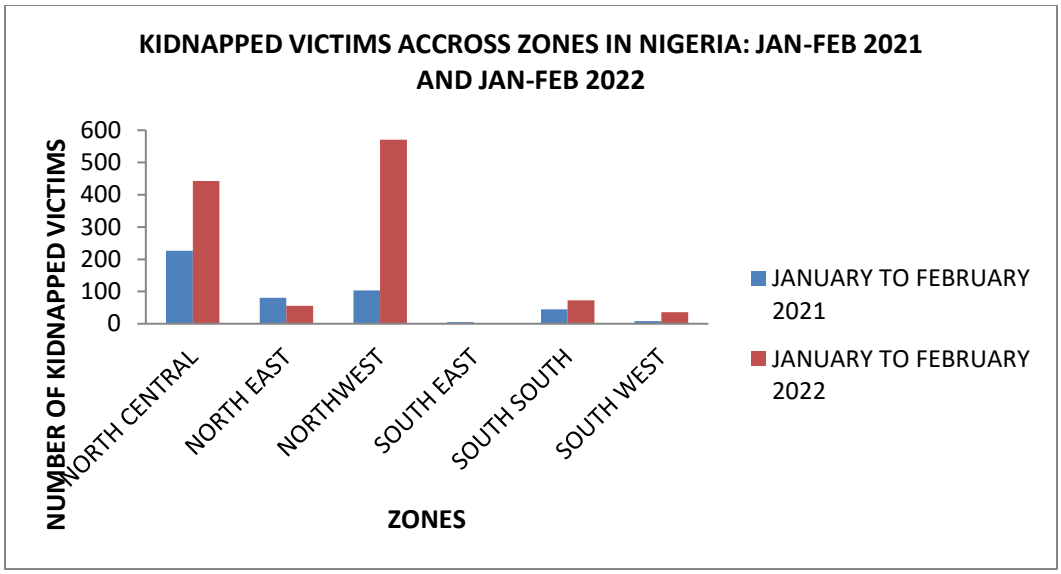


Fig. 5: Kidnapped victims per geopolitical zone in Nigeria

The pattern of kidnappings remained consistent in the north, where victims were frequently abducted in large groups during attacks on rural communities and schools. Gunmen have become more aggressive, and mass abductions of commuters on highways have emerged as the latest form of operation. This is not just a problem in the North; highways in the South-East, South-West, and South-South have all become hotspots. The findings were divided into six geopolitical zones in Nigeria: South-West, South-East, South-South, North-Central, North-East, and North-West. North-Central, North-West and North-East are now prevalence for kidnapping activities.

Deaths by Perpetrator

From May 2011 through 1st of January April 2022, these graphs illustrate the number of deaths across the country, broken down by perpetrator.

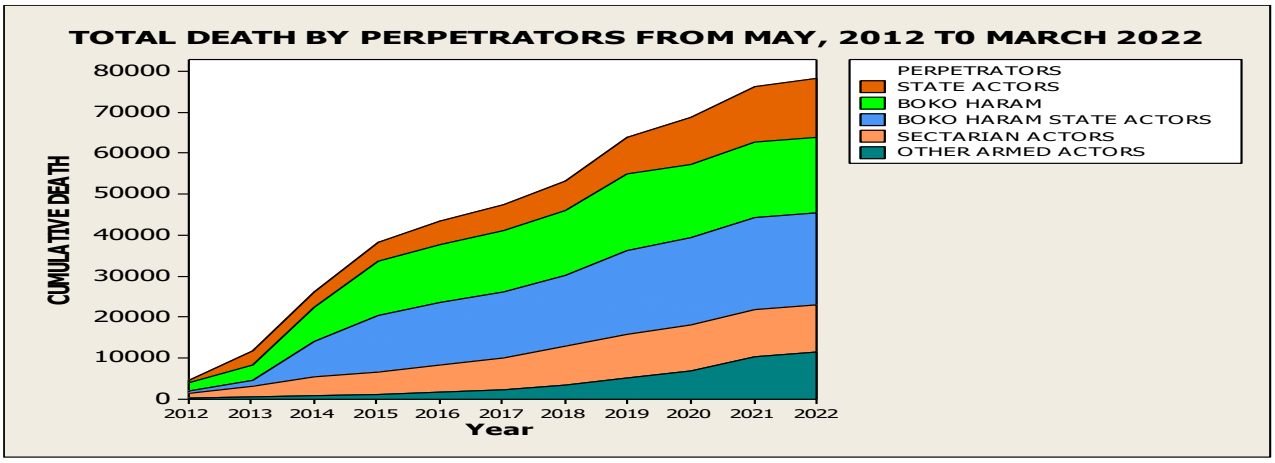


Figure 6: Deaths by Perpetrators

Among perpetrators are Boko Haram, state security services, and sectarian groups (excluding Boko Haram). To avoid counting deaths twice, it is important to distinguish between incidents involving only one culprit and those involving several perpetrators. As a result, Boko Haram and State Actor killings are listed together under the term "Boko Haram State Actor," which refers to events involving a combat. These five groups' deaths were mainly reported.

Impact of the Boko-Haram Clashes

The graphs below depict how Nigeria's long-running war against Boko Haram has gone. The next set of graphs show the number of incidents each month and years as well as the total number of individuals killed in the conflict, which includes Boko Haram, State Actors, and Civilians.

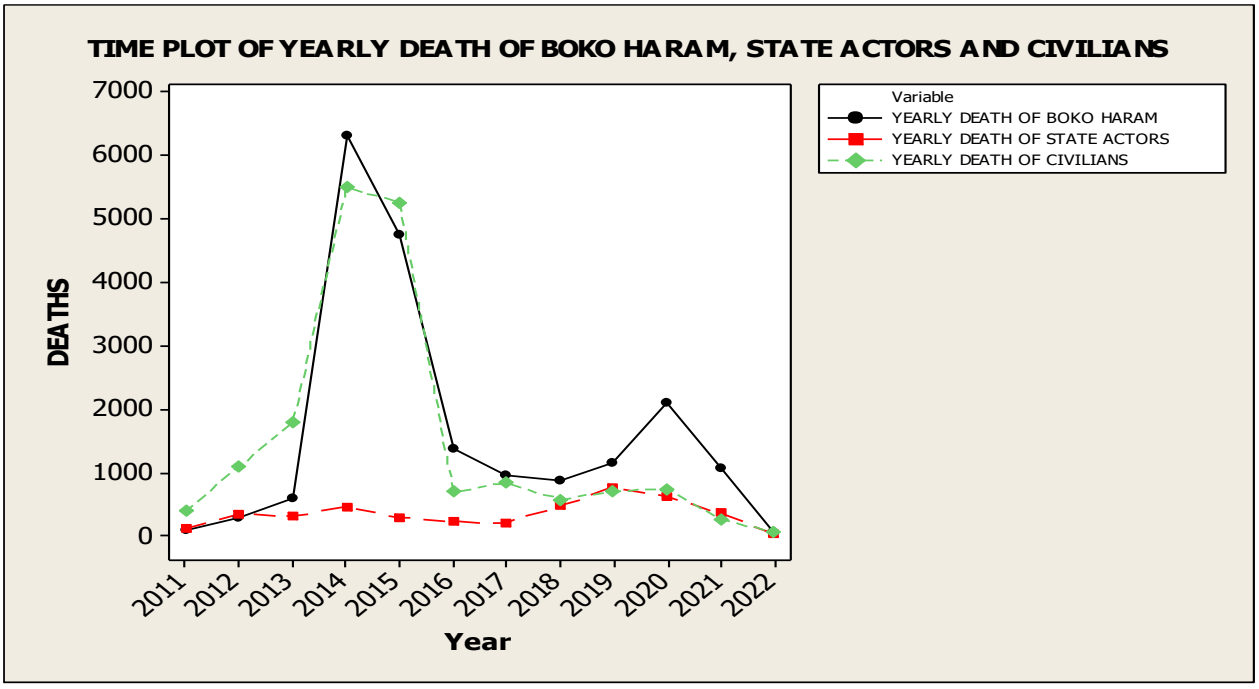


Figure 7: Yearly Deaths of Boko Haram, State Actors and Civilians

The graph above depicts the number of persons killed in the fight by Boko Haram and state actors. Although there has been a significant increase in the number of state actors killed compared to Boko Haram from 2018 to 2019, the impact on each actor has been significantly different. Boko Haram has also killed significantly more people than state actors.

Prioritizing Insurgencies

To focus on the primary drivers of insurgencies in states and zones where the deadliest attacks have occurred repeatedly, it is necessary to identify and prioritize the drivers, create clear objectives, and then focus on these major insecurity drivers in order to restore peace to the nation.

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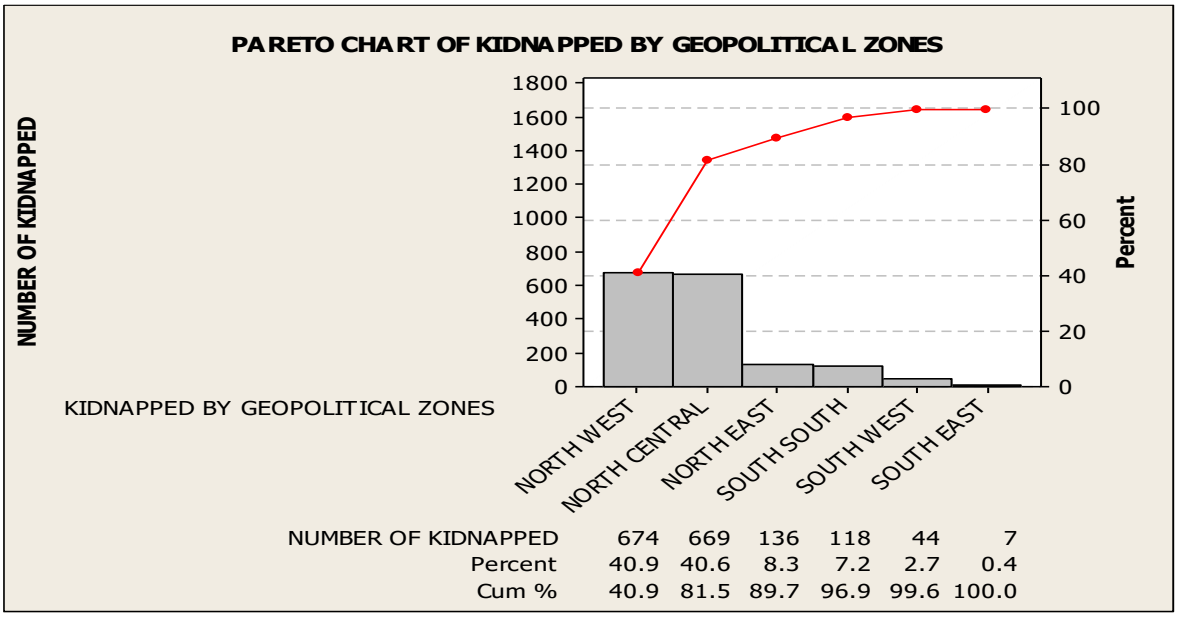


Figure 8: Pareto chart of kidnapped by Geopolitical Zones

The North–West and North–Central are the key zones in Nigeria where 80 percent of all kidnappings occur, and if these two zones can be free of kidnappings, the threat will be much reduced.

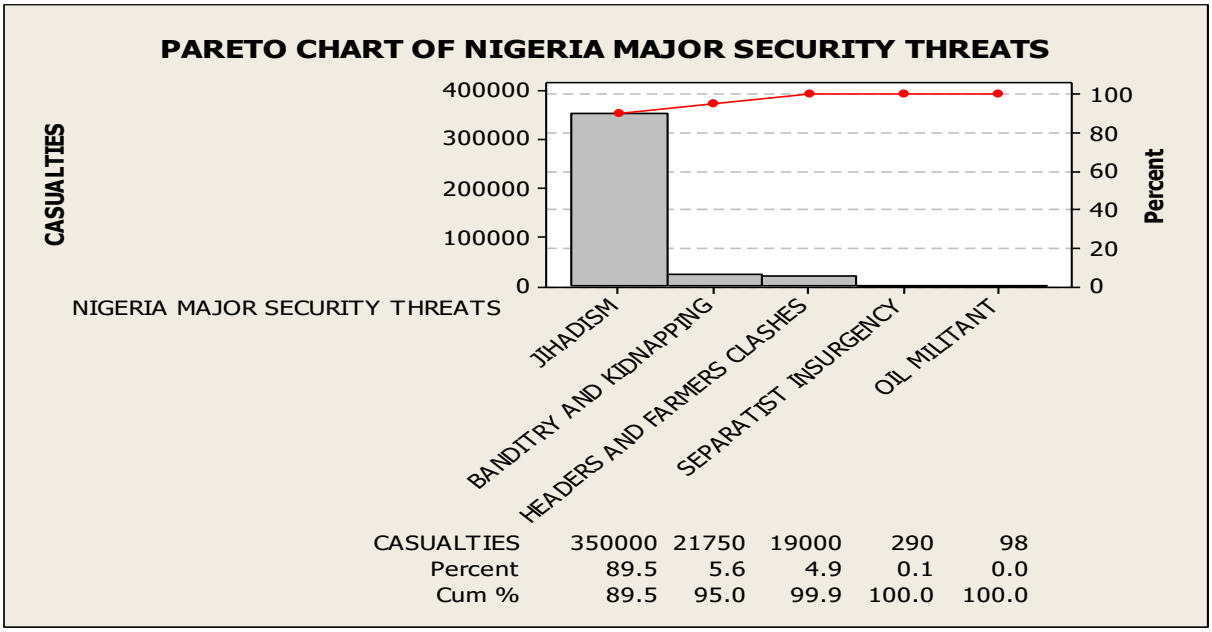


Figure 9: Pareto chart of Nigeria Major Security Threats

Nigeria's major security challenges include Jihadism, clashes between herders and farmers, banditry and kidnapping, separatist insurgency and oil militants. In terms of importance, jihadism is Nigeria's only significant security challenge. Figure 9 above revealed that Jihadism contributes to over 80

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percent of the major security challenges in Nigeria.

The graphic below depicts the estimated major threats posed by the Boko Haram insurgency to human lives in Nigeria.

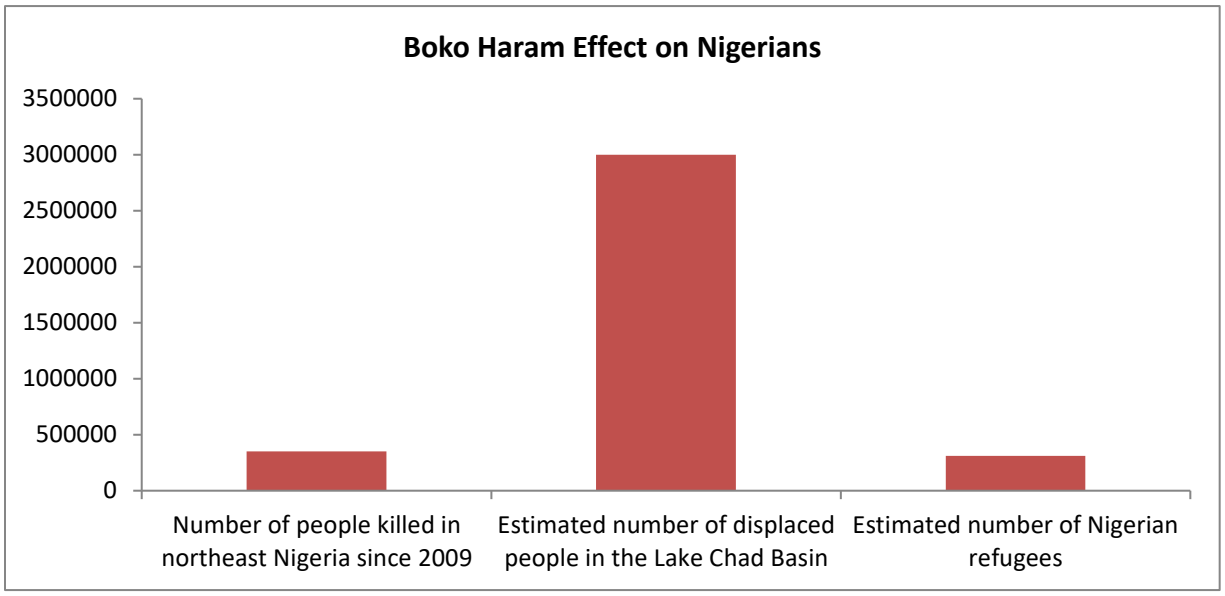


Figure 10: Effect of Boko Haram on Nigerians

The Boko Haram insurgency's actions have had a significant negative impact on human security and lives, as shown in the graph above.

Monitoring Insecurity Activities

The cumulative sum (CUSUM) control chart was used to monitor the government's performance and security impact in reducing insecurity, particularly insurgencies, because of its capacity to detect out-of-control in any process. When the CUSUM chart is utilized with Fast Initial Response, the scheme is quite adaptable.

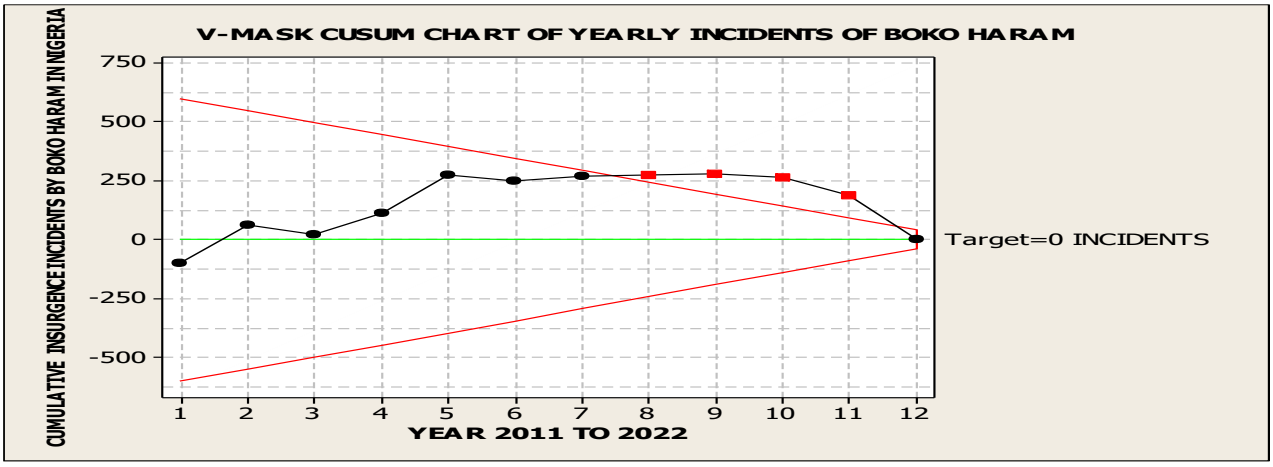


Figure 11: CUSUM Chart of Yearly Boko Haram Incidents

It is clear that the Nigerian government and security agencies have been unable to contain Boko Haram's attacks since 2018, indicating that the Nigerian government would have sought foreign assistance in combating the insurgency long before it reached its current level.

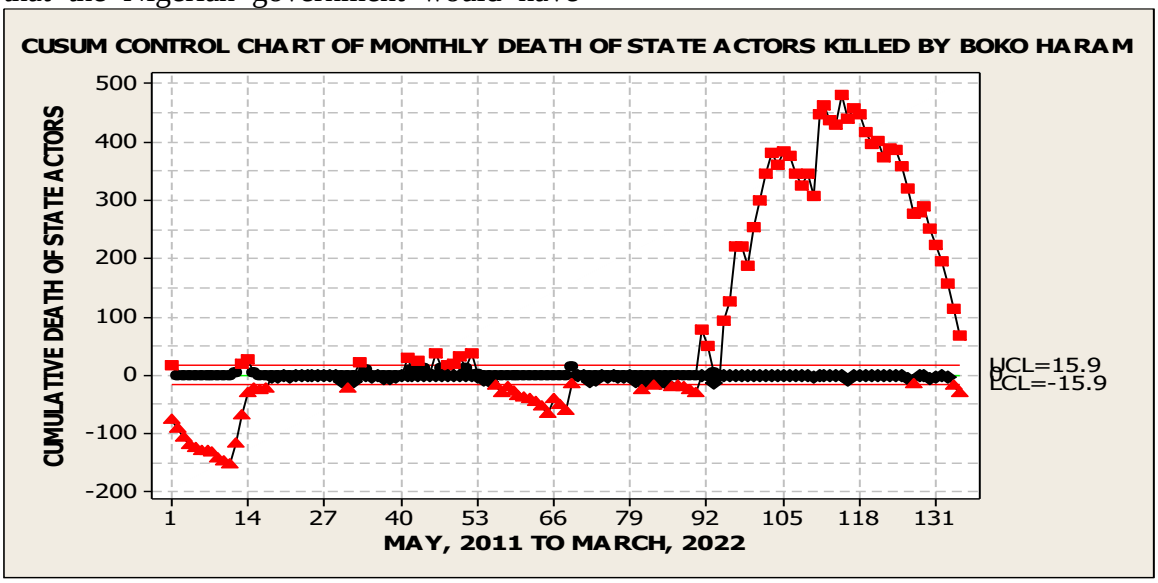


Figure 12: CUSUM Chart of Monthly Death of State Actors Killed by Boko Haram

It is also obvious that the number of State Actors killed by Boko Haram has spun out of control since November 2016, because no more than 16 State Actors are supposed to die in any combat with Boko Haram, and this can be attributed to the lack of weapons handed to them to fight Boko Haram. The control chart also shows that the number of monthly deaths of State Actors has risen to around 500.

Figure 13: CUSUM Chart of Monthly Death of Civilians Killed by Boko Haram

It is also clear that the number of civilians killed by Boko Haram has gone out of control since November 2013, which may be ascribed to the government's inability to protect citizens' lives and properties, which is the primary obligation of every government in the world.

4. CONCLUSION

According to the findings in this study, insecurity is most prevalent in Borno, Zamfara, and Kaduna states, while abduction is most prevalent in the North-Central and North-West. From 2018 till date, the number of state actors and civilians killed by Boko Haram increased significantly, according to the analysis.

Monitoring the devastation caused by insurgencies and the claims made by the Nigerian government to have dealt with these issues using CUSUM control charts, it is clear that the Nigerian government and security agencies have failed to stop Boko Haram's attacks since 2018. It is also clear that the number of State Actors killed by Boko Haram has increased significantly since November 2016, and the number of civilians killed by Boko Haram has gone out of control since November 2013.

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It is recommended that the adopted and proposed method: the DMAC method (Define, Measure, Analyze and Control) be capable of monitoring the underlying causes of insecurity situations in Nigeria for efficient addressing and taking drastic measures before getting out of hand.

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