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# Spatio-temporal patterns of air crashes in Nigeria between 1960 and 2012

Adeniyi O. Oluwakoya  · Seun Ogundipe · Ademola Benson Irinyemi

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**Abstract** Air transport is considered the safest among the modal transport options. Over the years the passenger travel by air has double necessitating stricter national and international regulatory framework. In spite of the concerted efforts toward ensuring safety on the global scale, incidents of air crashes are still prevalent especially in the developing countries like Nigeria. The Nigerian aviation sector has suffered series of air mishaps since independence in 1960. This study seeks to examine the spatio-temporal pattern of air crashes in Nigeria. The methodology involves longitudinal research design covering over 30 years, from 1960 to 2012. These cut across many segments such as location, factor responsible for the crash, number of survivor, number of death, number of accident per year and number of carrier involved. The data is analysed with descriptive analytical techniques. The study reveals the classification of causal air crashes in Nigeria as human, mechanical, environmental and mixed themes. The study also reveals that the pattern of air crashes in Nigeria follows a cyclic pattern of occurrence over the years. The implication is that stability of the sector against accident is still far-fetched. Therefore more investment is still needed in

the sector to achieve a healthier and danger free airspace.

## Introduction

Air transport is the safest mode of transportation (Janic 2000). However, this does not preclude this particular mode of transport, from incidents of fatalities. In reality, air crashes linked to many deaths (Cobb and Primo 2003). A change of perception and handlings of issues relating to the movement of passengers and goods in the air is necessary. Losses of invaluable properties worth millions of dollars and precious lives are often the results of all air mishaps (Sobieralski 2013). In this regard, the safety of life and valuable properties ought to hold in high esteem, in all the processes of air transport operations.

More regulations and standards on air safety from the international, regional and local bodies harmonised and shared towards enhancing a secured airway for the Nigerian aviation ecosystem. Consequences relating to air crashes also may be multidimensional and may range from psychological, economic and social dimension. Psychological effect relates to pains and trauma tolerated by the victim and relations of the victim. The economic impact involves all forms of monetary commitment to the incidents. Moreover, the social dimension relates to the social separation that the victim may have to suffer.

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Studies on air crashes have looked at the different perceptive of air crashes (Kaplanski and Levy 2010; Ho et al. 2013; Krieger and Chen 2015). They studied the equity value of airline toward air traffic casualties. Each of these studies suggests a significant effect between the airlines and its equity when accidents occur. For instance, Ho et al. (2013) reveal the impact of aviation disaster on the stock prices of the crash airlines and their competing airlines. It shows that the crashed airlines experienced more profound negative abnormal returns as the level of fatality increases. Krieger and Chen (2015) examine the response to the stocks of commercial airline carriers after their flights are involved in accidents. The study reveals that manufacturer stock prices tend to drift significantly downward in the weeks following accidents resulted from manufacturer fault.

In Nigeria, air mishap has been a recurring incident since the post-colonial period to the modern-day. As a result, many lives and properties lost during the period. (Ademiluyi 2007 and Omotoso and Omotoba 2014). The implication for the Nigeria aviation industry has been appalling, and interest of the flying public waned seriously. The evolvement of the Nigerian aviation sub-sector equalled the development in policy formulation and implementation. The slow policy process explains the state of dilapidating infrastructure across the national aviation substructure and superstructure. However, studies on the incidences of air crashes in Nigeria have not thoroughly examined the geographical dimension of air crashes. Moreso, adopting a descriptive-analytic technique of evaluating the crashes in Nigeria on a spatio-temporal perspective. Especially with particular reference to time, locations, casualties' level and probable cause of the incident. Therefore this study intends to evaluate the crashes in Nigeria from 1960–2012.

### Conceptual framework and literature review

This section discusses the conceptual and theoretical source of air traffic accidents by elucidating on the epidemiology of air traffic accidents and a review of relevant literature on a geographical research approach to air transportation.

### Epidemiology of air traffic accident

Epidemiology describes the roots and causal incidences of diseases. Its applicability to the air transport accidents offers insight into the fundamental provenance of air traffic accidents. This concept provides the conceptual and theoretical framework that helps to understand the basis of casualties relating to air transport accident in Nigeria.

Air traffic accidents, like every other accident, do not occur without cause or omission. Reason' (1990) "Swiss cheese" model of human error, provides a sequential theory of accident causation, mainly due to human error. The active and latent failures were fundamental within the context of his "Swiss cheese" model of human error. The model illustrates four levels of human failure, each having a significant relationship on the other. The following are the elements:

1. Organisational influences
2. Unsafe supervision
3. Preconditions for unsafe acts
4. Unsafe acts of operators

The above provides the basis for understanding human errors even in accidents relating to aviation and besides.

In aviation, the importance of the fourth element is very critical in causing an accident—most aviation accidents caused by human error. The human error, defined as mental or physical activities of individuals, deliberate or inaction, is fundamental in causing air fatality. Many unsafe practices, often by commission and omission fingered as the major causes of deaths recorded in air transport.

In addition to Reason's (1990), four elements of human failures, Shappen and Wiegmann () developed the Human Factors Analysis and Classification System (HFACS). The HFACS showed a more comprehensive human error framework and comprised of 19 causal groups within the four elements of human failure. The four factors enunciated in their later works. (Wiegmann and Shappel 2003). The fundamental error types within HFACS enlarged to include decision error, skilled-based and perceptual errors.

However, in evaluating the air crashes in Nigeria, the different human model failures framework identified above, offer an insightful understanding of air mishap causation in Nigeria. Albeit, this study attempt

a classification of the incidences of air crashes in Nigeria, by categorising them into factors based grouping. Moreover, these include human, mechanical, environmental and mixed factors.

Generally, the field of air transportation has significantly benefitted from geographical methodology and approaches. Air transport studies are not complete without understanding the spatial relativity of connectivity and linkages as well as understanding the bedrock for the formation of patterns of such interaction. Moreover, other areas in conjunction with other disciplinary fields that have contributed immensely to air transport studies.

The geographical perspective of air transportation explained in literature covers the physical geography of aviation, the locations of an airport, air route and networks development, prices, competition, regulatory control and policy issues (Vowles 2006; Adey et al. 2007; Derudder and Witlox 2008).

The major incident that had further emphasised the relevance of geographical research in air transportation globally is the deregulation of the US air transport industry. The removal of regulatory bottleneck has sparked increased competition, price war, route and network changes and airport functional role about airline operation. The dimension of influence extends to other regional blocs of the world. Further, it has led to regional development and co-operation through enhanced air transport services among the member states (Graham 1998; Graham and Guyer 2000, Francis et al. 2003; Knowles et al. 2008; Dobruszkes 2009).

Accessible air transport infrastructure influences spatial traffic patterns. Secured airport locations and adequate facilities enhance both safety and operational structure of air transportation services with increased urban and socio-economic development. Geographical spaces, especially those within the immediate precinct of the airport location, should not pose any threat to smooth air traffic services, although its social and economic activities enhance the operation and business environment of the airport. Therefore, safe and secure air transport infrastructure is necessary as part of the essential strategy to induce security, safety and development. (Bowen 2010; Dobruszkes et al. 2011; Papatheodorou and Arvanitis 2009; Stevens et al. 2010).

Despite the growing literature in the field of geography and air transportation studies, all the work

reviewed so far in this study supports safe air travel. However, the spatial dimension of flying over the geographical space and understanding the patterns of air traffic accidents is critical. This knowledge is vital to sustainable air operation. Unfortunately, the research work in this regard and dimension lacks in the literature. Therefore this study intends to examine the spatial dimension of air crashes in Nigeria over time.

### Government policy and air crashes

There are no doubts about the importance of government policy in influencing safety and security concern in aviation. The basis of global air transport operation established on sound technical regulation for safety and security. From the onset, the Chicago Convention of December 1944, agreed by 52 countries, contained annexes that set standards and recommended practices (SARPs) for civil aviation, covering technical, commercial and economic aspects. Signatory countries are to comply fully with the set recommended practices to enhance safety in civil aviation subsector of the states involved.

Nigeria is a member of the International Civil Aviation Organisation (ICAO), therefore should conform to the guidelines earmarked for safe aviation practices. In this light, to what extent has the country implemented relevant regulation to mitigate against fatality in Nigeria Airways? The history of government intervention and policy formulation towards safe flying dated back to 1964. The establishment of Nigerian College of Aviation Technology, Zaira, (formerly known as Nigeria Civil Aviation Training Center) was set up by Act.No.31 of 1964. The Center established as a joint programme between the Federal Government of Nigeria (FGN), the United Nations Development Programme (UNDP), and the International Civil Aviation Organisation (ICAO). This joint programme of assistance from the UNDP and ICAO came to an end on December 31 1974, and the Federal Government of Nigeria assumed full responsibility for the continued management and operation of the College.

The apex institution for the formulation of aviation policy in Nigeria is the Federal Ministry of Aviation. The need to institute effective policy towards a safe sky, six statutory agencies under the Federal Ministry

of Aviation established to secure the Nigerian airspace safely. However, effective delivery of oversight functions by the Ministry and supporting agencies have not been critically active to mitigate incidences of air mishap in the country. The problems are weak monitoring regimes, corruption, deviation from standards, infrastructural inadequacy and dilapidation and appointment of quacks as head of the ministry and its agencies.

The national aviation decision-makers have not imbibed the present global realities in private sector management of critical public utilities. This policy gap has hindered innovations and ingenuity which aviation as an essential sub-sector of the nation requires accelerating growth and investment. For instance, in 1979, the biggest airport terminal in Nigeria was inaugurated; no new significant facilities added afterwards. It modelled after the Schipol Airport in Amsterdam then, today, the current state is far below the benchmarked airport.

Therefore privatisation of the primary airport terminal may be considered as a panacea to upturn the vicissitudes prevailing on these terminals. Allied nations which have been successful in this regards may be an understudy. Examples in literature are the United Kingdom, France, Spain and South African (Graham 2008). There is no doubt about the impact of adequate infrastructure and risk mitigation in the aviation industry (Stewart and Muller 2008).

In Nigeria, many of the crashes since 1960 substantially relate to weak control and policy implementation. Though technical regulation and standards initiated through international convention and protocol in the global meeting, however, enforcement is carried out by the local agencies regulating national airspace. Assumption of international regulated aviation framework does not connote automatic safety for the respective government, which are part of the global body.

To fully secure the Nigeria airspace, the government has to do more to exercise total control over the nation's airspace. Securing the sky with stringent policy framework is inevitable. Also, all the stakeholders in the Nigerian aviation environment need to work together towards achieving high-level safety standards.

## Nigeria Air crashes since 1960–2012

This section discusses the brief history of plane crashes and the analysis of Nigeria air crashes from 1960–2012. It has five subsections to analyse the air crashes in Nigeria on a decade basis of a spatio-temporal evaluation of the air mishap since 1960.

### Data sources and data collection

Primarily the data for this research is secondary data. The data culled from aviation crashes report and documentary sources. These sources include the documented reports from the Federal Ministry of Aviation, Federal Airport Authority of Nigeria (FAAN), Nigerian Civil Aviation Authority and the National Bureau of Statistics. The timeline ranges from the post-colonial to 2012.

### A brief history of air crashes in Nigeria

Fundamentally, air transport development in Nigeria has two dimensions, which are colonial and post-colonial. However, the post-colonial era virtually holds for all the occurrences of accident till date. The earliest of this period can be described as the beginning for the Nigeria aviation industry as aviation activities began to develop in the country. The first incident of air traffic accident occurred in 1969, and since then the Nigerian aviation industry has continued to witness cases aircraft crash. The next of the following discusses the incidences of the air crash in the post-colonial era.

### Air crashes in Nigeria between 1960–1970

This period can be described as the inchoate era for the Nigeria aviation industry as aviation activities began to develop in the country. This era coincides with the period of Nigeria independence. In terms of policy formulation and implementation, it describes the beginning of aviation activities in a new state known as Nigeria. This phase marks the epoch that gives birth to a national carrier known as Nigerian Airways.

Aviation policy inherited was from the colonial period. Emphasis was more concentrated on harnessing the aviation potential towards national development and international linkages. The traffic level was

relatively low, and safety concern not prioritised as at present.

Figure 1 shows the analysis with regards to location and other factors relating to the accidents that occur for ten years between 1960 and 1970. The year 1960; 1962–1966 can be described as disaster-free, as no form of an accident happened during these periods. Significant to these statistics, the period 1967 to 1969, recorded the highest number of losses. This period coincides with the time of civil war in Nigeria when many military aircraft hull and lives were lost. However, the first major civil aviation accidents in the country occurred in 1969 and involved the loss of eighty-seven lives. The cause of the accident is both human and mechanical. The implication suggests conforming to the best practices for safety and security of lives and properties.

Interestingly, the decade started well with no particular locations and aircraft involved in the accidents. It is regarded as the period of renaissance in the annals of aviation in Nigeria for two reasons. First, the nation has just gained independence and second the birth and nationalisation of the Nigeria airways from West African airways in 1963.

Air crashes in Nigeria between 1971–1980

Figure 2 shows the air crashes in Nigeria between 1971 and 1980. This decade marks the translation of policy framework into reality. Massive infrastructure

provision in terms of modern airport amenity inaugurated. Notable was the commissioning of the Murtala Mohammed International Airport in 1979. This airport modelled after the Amsterdam Schipol Airport.

Remarkable was also the carving out of the Civil Aviation Department (CAD) of the Federal Ministry of Aviation to become the Nigerian Airport Authority (NAA). The year 1971 recorded just one accident, and luckily, there was no form of human loss. The total number of the survivor for the year was 41. Moreover, the factor responsible for the crash after the investigation was environmental.

In 1972 there was a single crash, although there was not a record for the number of the survivors. Sadly, however, in 1973 on January 22, a gory event smeared the Nigerian airspace, returning pilgrims from Hajj in Saudi Arabia, crashed on landing at the Kano International Airport, killing 176 passengers. Fortunately, 26 passengers survived the incident. The mechanical factor was responsible for this crash.

After this incident, the period 1974–1976, witnessed a rest of fatality in the nation's sky. This development was shortened with a disaster involving the Nigerian Airways in 1977, at the Sokoto airport, though 23 passengers survived the crash. In 1978, at the Kano International Airport, 16 passengers died while a Nigeria Airways crashed. Other two (2) crashes reported for the same year, but the factor responsible and the number of passengers that died not recorded. There was no accident recorded for 1979.

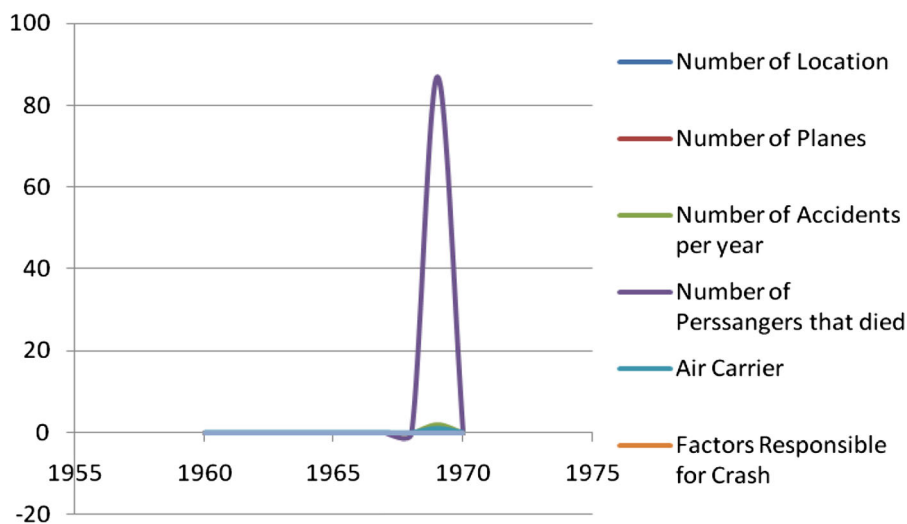
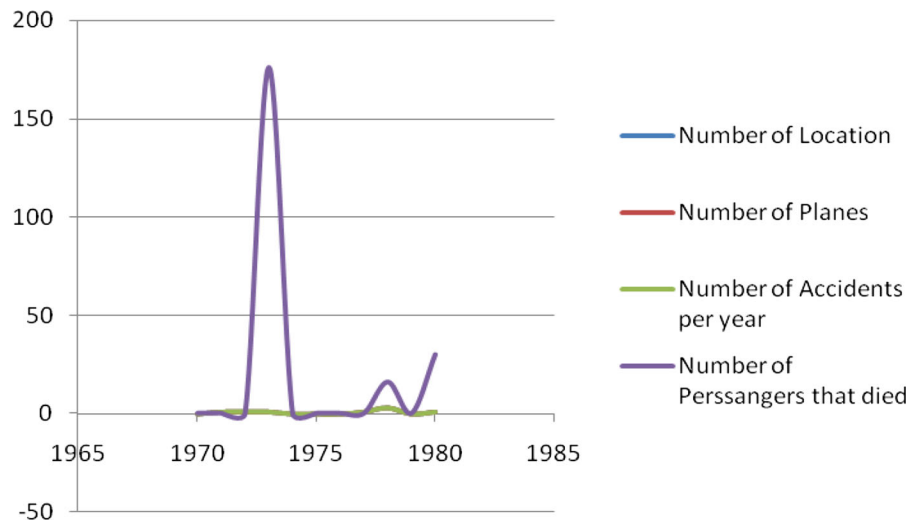


Fig. 1 Air passenger death between 1960 to 1970



**Fig. 2** Air crashes casualties between 1971–1980

However, in 1980, near Warri, the Nigerian Airforce plane crashed, due to a boisterous thunderstorm, killing 30 passengers.

Remarkably, this era was a period when government heightened its intervention in terms of investment in airport infrastructure. The aviation agencies witnessed a structural transformation of national aviation institutions for effective service delivery. The Civil Aviation Department (CAD) carved out of the Federal Ministry of Aviation. This new department was transformed into Nigeria Airport Authority (NAA) to manage the newly constructed terminal then in 1979 as well as other airports in the country.

A period of transformation in the history of the Nigerian aviation sub-sector and nation's transport in general, but accidents during this period was minimal except for the incident in 1973 when a massive number of lives lost in Kano.

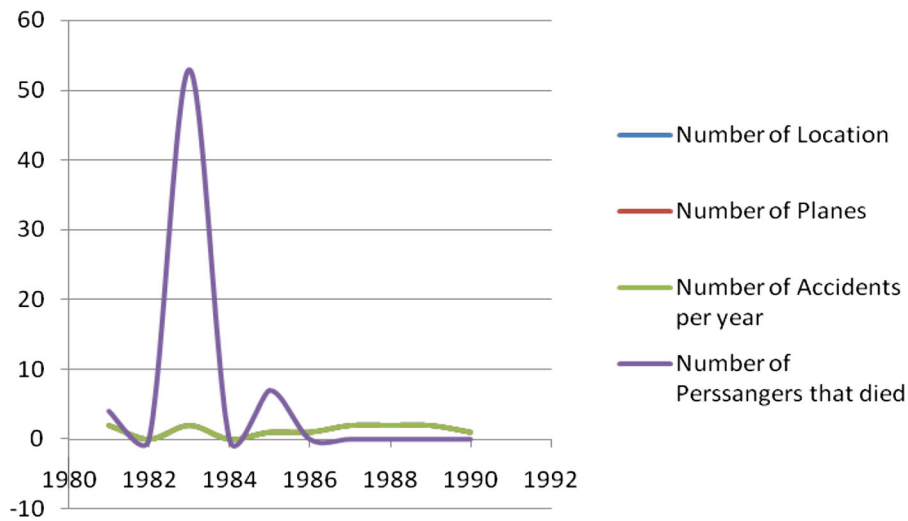
#### Air crashes in Nigeria and the factor responsible for the crash

Figure 3 shows the number of passenger death in Nigeria between 1981 and 1990. Alone in 1981, two crashes happened at a different location in the country. In the first crash which occurred near Murtala Mohammed International Airport, involving an airline belonging to the government of Benin, Nigeria's neighbour. The second in the year on Arax Airline, but there was no data on the number of casualties.

Between 1982 and 1983, there was no crash recorded; however, in 1983, an aircraft belonging to a private company crashed near Lagos International Airport. This particular crash recorded a total of just three casualties. Also in 1983, an airline belonging to the Nigerian Airways, crashed at the Enugu Airport, killing 53 passengers. The cause of the crash was related to fuel problems. The number of a survivor for this crash was 19. In 1984 no air mishap was recorded in Nigeria.

In 1985, a plane belonging to the Nigeria government, crashed in Kaduna killing the seven passengers on board. On August 6, 1986, an aircraft belonging to Kabo Airline overran the runway at Calabar Airport, though all the crew members and passenger survived the incident. The human factor attributed to the cause of this crash. In 1987, both at Ilorin and Port Harcourt respectively, involving Nigerian Airways aircraft, the numbers of survivors at both were 9 and 109 respectively. The fire outbreak caused the second incident.

1988 was not free from an incident of casualty, two incidents at Lagos International Airport and Port Harcourt Airport, belonging to Angola charter and Nigerian Airways. The mixed factor was also responsible for this crash. The numbers of survivors were 6 and 132, respectively. Also, in 1989 at Port Harcourt Airport and Murtala Mohammed Airport, the number of survivors were at 92 and 132 respectively. The mixed factor was the result of this crash. Capping the



**Fig. 3** Air crashes casualties between 1981–1990

decade was the crash at the Murtala Mohammed International Airport, in Lagos, belonging to the Concord Airlines, the number of survivors was just 45.

**Air crashes in Nigeria between 1991–2000**

Table 1 shows the accident figure from 1991 to 2000, and in 1991, it was just two accidents, three passengers died in all, these occurred at the Sokoto and Port Harcourt Airport. It involved both the Okada Air and Kabo air, the cause of the accident, mixed in nature, and the total number of the survivor was 145. Sadly in 1992, more aircraft accident was recorded for the year,

five accidents and 138 people survived the incident. The factor is mixed. However, the year 1993 was good for the Nigerian airspace as no accident recorded at all. In 1994, only one accident recorded, and three lives lost for the whole year and three survivors. The factor responsible for the crash is mixed. However, the year 1993 was good for the Nigerian airspace as no accident recorded at all. In 1994, only one accident recorded, and three lives lost for the whole year and three survivors. The mixed factor identified as responsible for the crash. In 1995, the Nigerian airspace witnessed four accidents that claimed 28 lives, though a total of 211 survived the accident. Indeed, 1996 was the most

**Table 1** Air Crashes in Nigeria between 1991–2000

Year	Number of locations	Number of planes	Number of accidents per year	Number of passengers that died	Air carriers	Factors responsible for crash	Number of survivors
1991	2	2	2	3	2	Mixed	145
1992	5	5	5	–	5	Mixed	138
1993	–	–	–	–	–	–	–
1994	1	1	1	3	1	–	2
1995	4	4	4	28	4	Mixed	211
1996	5	5	5	170	5	Mixed	184
1997	3	3	3	6	3	Mixed	75
1998	3	3	3	–	3	Mechanical	26
1999	1	1	1	–	1	–	19
2000	2	2	2	1	2	Human	18

Source: Author’s data compilation from FMA, FAAN, NBS and NCAA

horrible for the decade in the annals of the history of Nigerian air transport for the period, as a total of 5 accidents for the year alone and claimed 170 lives. The accidents occurred at four different locations in the country and one hundred and eighty survivors recorded for the year. Nearly like the previous year, 1997 was also not too good as a total number of 3 accidents recorded; claiming six lives, though 75 survived the year. For 1996 and 1997, the factor responsible for the crash was both mixed. In 1997 alone, 75 passengers survived the crash. The year 1998 recorded a total number of 3 accidents, though no life was lost. A total number of 26 passengers survived the accident for the year. The mechanical factor attributed as responsible for it. In 1999, a single accident occurred for the year. The survivor was just 19. Moreover, for the close of the decade, the year 2000 recorded a total of 2 accidents and a single death and 18 survivors.

#### Air crashes in Nigeria between 2001–2012

Table 2 shows the air crashes in Nigeria between 2001 and 2012. This period witnessed an abysmal incident in the annals of the Nigerian aviation safety record. Despite the restructuring and supposed compliance with the international regulation and safety requirements, the decade witnessed the highest death so far among other decades since the formal inception of

aviation activities in the country. This incident calls for concern and promulgation of sustainable aviation policy engendered towards lasting safety impacts and livability.

The year 2001 alone recorded three incidents of air mishaps at Maiduguri, Lagos and Port-Harcourt, just a single death for the year. The mechanical factor was attributed as the possible cause of the accident, though 35 survivors identified for the year. However, in the year 2002, three airlines operating the domestic route: Savannah Airline, EAS airline and Sky Executive Airline, killing a total of 76 passengers for the year. EAS Airline alone on May 4 in Kano, suffered 71 deaths of passengers, while the airline developed an engine problem and crashed with 11 survivors. The factor identified for the crash during this period mixed in nature.

In the year 2003 and 2004, it was a brief relief for aviation fatalities, not without any incidents, but very minimal. For both years, a total of 3 accidents recorded involving airlines, and 19 survivors in both disasters. However, an unpalatable twist soon enveloped the Nigeria aviation airspace in the year 2005 and 2006.

Specifically, the year 2005 was the sad year for national air transport. Ten air mishaps recorded for the year. For hardly was any month incidents relating to flying in the Nigeria airspace was accident-free. Horridly, in October of the same year, at the Lisa Village in Ogun.

**Table 2** Air crashes in Nigeria between 2001–2012

Year	Number of locations	Number of planes	Number of accidents per year	Number of passengers that died	Air carriers	Factors responsible for crash	Number of survivors
2001	3	3	3	1	3	Mechanical	35
2002	3	3	3	76	3	Mixed	11
2003	2	2	2	–	2	Human	9
2004	1	1	1	–	1	–	10
2005	10	10	10	225	10	Mixed	4
2006	2	2	2	120	2	Mechanical	3
2007	–	–	–	–	–	–	–
2008	1	1	1	4	1	Environmental	–
2009	–	–	–	–	–	–	–
2010	1	1	1	97	1	Mixed	–
2011	1	1	1	–	1	Environmental	4
2012	2	2	2	153	2	Mixed	4

Source: Author's data compilation from FMA, FAAN, NBS and NCAA

State, not too distant to the Lagos Metropolis, a domestic operator with a livery Bellview Airline, nosedived after few minutes of take-off and buried the entire occupant alive at the Lisa Village.

This particular accident alone claimed 117 lives. The remains yet recovered to date. After this incident in December, at Port Harcourt, a Sosoliso Airline, with 108 passengers comprising majorly students travelling home after vacation, perished on the approach of Port Harcourt runway. The figure of deaths for the whole year was 225 and ten survivors. The factor responsible for this particular accident was environmental as there were a boisterous rainstorm minutes before take-off and the time of flight. The pilot refuses to heed instructions given at the tower. However, for the ten air mishaps for the year, it was mixed.

Moreover, the year 2006 was no better, albeit fewer accidents in comparison with 2005 recorded. The two accidents recorded, worse of the two happened on October 29, 105 passengers died in this accident, involving an ADC airline. The cause of the accident was mechanical as deplorable plane conditions and bad tires were responsible for the crash. The total number of casualties for the year was 120 who lost their lives, and two people survived. Responsibly, there were no accidents recorded for 2007. Contrary, in 2008, only a single accident occurred, and four lives were lost when a plane crashed into a mountainous forest in Calabar, Cross River State.

However, the year 2009 was accident-free, as no accidents recorded for this period. However, from 2010 to 2012, the resurgence of horror and trepidation seems to envelop the Nigeria aviation industry. In 2010, an aircraft belonging to Dana Air was involved in an accident killing the 97 passengers on board. The engine of the plane lost due to a bird strike. Overall, the cause of the crash mixed in nature. In 2011, in Port-Harcourt, a plane belonging to Pan African Airline slid off the runway during a period of persistent rainfall. Though the four occupants inside survived the incident. Lastly, in the year 2012, 2 cases of air transport mishap were recorded. Particularly more horrifying of these 2, an aircraft belonging to Dana Airline from Abuja to Lagos, on approaching the Lagos runway crashed few kilometres to landing. All the 97 passengers on board killed in the crash. Only four-passenger survived for the whole year and the cause of the accident mixed in nature, all the locations of the air crash in Nigeria shown in Fig. 4.

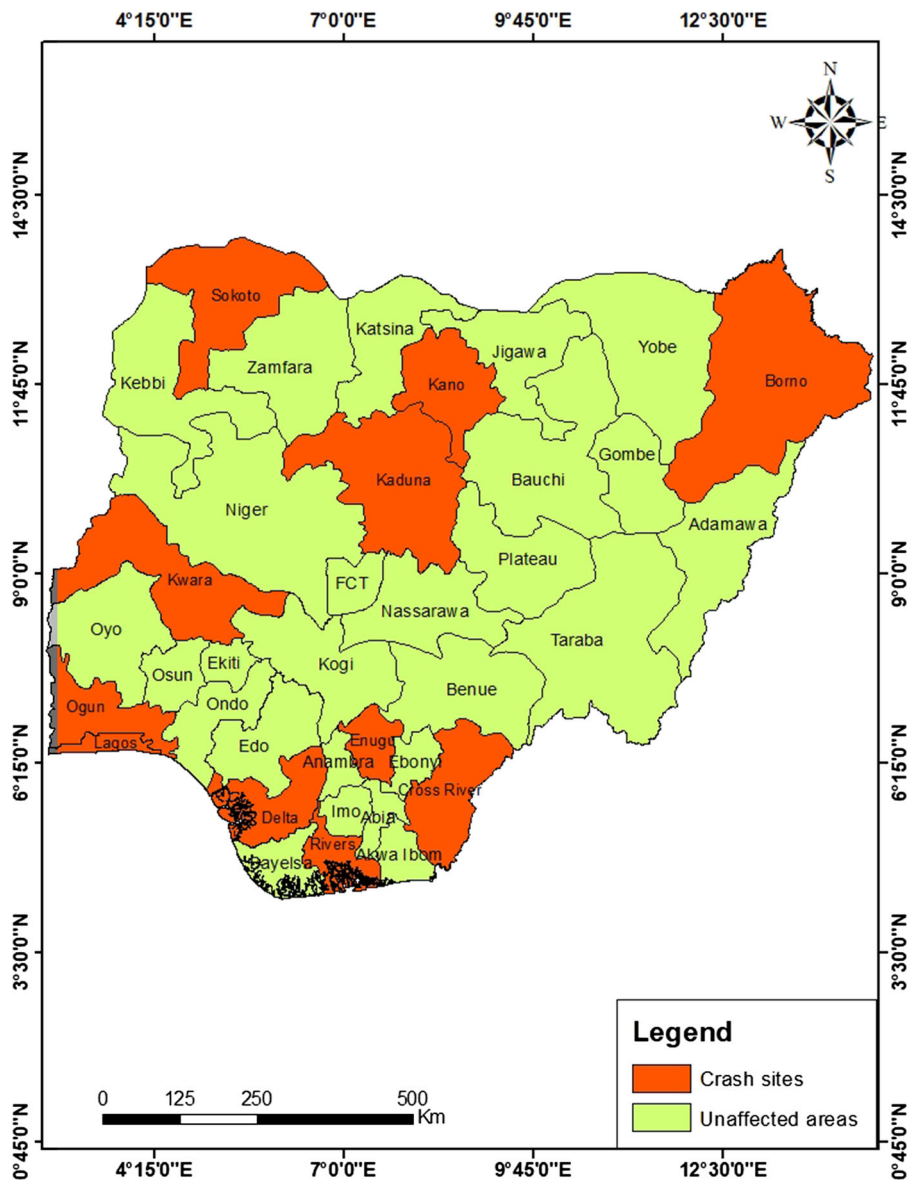
## Conclusion

The study examines the spatiotemporal patterns of air crashes in Nigeria from 1960 to 2012. It presents varying patterns of air crashes in a periodic unit of analysis from 1960–2012. It classifies the provenances of air crashes into the human, mechanical, environmental and mixed. The changing fortunes affected the growth and the sustainable development of the aviation sub-sector as the cyclic pattern of stability and crash in the sub-sector is prevalent. Coupled with the weak regulatory framework and effective control, all these in a way hindered the subsector from achieving its full safety potentials. Remarkably, the subsector witnessed slow progress due to the recurrent crashes occasioned during this period.

The investments in the sector have been minimal due to the weak structural arrangement, which allows public sector control and management of this critical subsector. The bane of the sub-sector, among others, includes inadequate regulatory oversight, lack of institutional capacity development initiative, infrastructural decay and meagre foreign direct investment.

Conclusively, the sub-sector needs a critical overhaul in policy direction and investment for effective operation and accidents mitigation. However, the following policy recommendation could help boost the subsector and mitigate against crashes in the future:

- i. All the major airports in each of the six geopolitical zones upgraded to the international standard with world-class infrastructure and amenities
- ii. Regulations, issuance of the crew operating licence follow a more stringent and tie to safe airline operation
- ii. The government should set a ceiling on the minimum age of aircraft that should be allowed to fly in the country
- iv. The air traffic controller equipment in the entire major airport upgrade.
- v. Enhanced aviation personnel training should be initiated regularly across the board, even in conjunction with the aircraft manufacturer to understand the technicalities of their brand better.



**Fig. 4** Map of crash locations in Nigeria

- vi. The government should initiate a policy that would attract huge investment in all the facet of the Nigerian aviation sector.

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