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**INCLUSIVE
CITY GROWTH
AND THE POOR:**
POLICIES, CHALLENGES AND PROSPECTS

Volume One

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O.F. Adedayo

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*Inclusive City Growth and the Poor: Policies,
Challenges and Prospects*

INCLUSIVE CITY GROWTH AND THE POOR: Policies, Challenges and Prospects

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INCLUSIVE CITY GROWTH AND THE POOR: Policies, Challenges and Prospects

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DECLARATION

Peer Review and Scientific Publishing Policy Statement

2nd April 2018

TO WHOM IT MAY CONCERN

We wish to state that all the papers published in *Inclusive City Growth and the Poor: Policies, Challenges and Prospects* Book have passed through the peer review process which involved an initial review of chapter proposals, blind review of full chapter by minimum of two reviewers, forwarding of reviewers' comments to authors, submission of revised chapter by authors and subsequent evaluation of submitted chapters by the Editors to determine content quality and thematic scope adherence.

All chapters are only published based on the recommendation of the reviewers and the Book editors.

Olatunde Folaranmi ADEDAYO
Book Coordinator
*Inclusive City Growth and the Poor:
Policies, Challenges and Prospects* Book

CHAPTER 17

Fire Outbreak as a Hindrance to Inclusive City Growth and Urban Liveability

Shittu, Abdullateef Adewale

Introduction

Housing is paramount to human existence as it ranks among the top three needs of man. Its provision has always been of great necessity to man (Shittu et al., 2013a). As a unit of the environment, housing has profound influence on the health, efficiency, social behaviour, satisfaction and general welfare of the community. It is a reflection of the cultural, social and economic values of a society and one of the best historical evidences of the civilization of a country (Olotuah, 2000).

In developing nations all over the world as well as Nigeria, the problems of housing are in multiple dimensions and the problems of continuous influx of people from rural to urban centres, lack of basic infrastructure required for good standard of living and the incidence of fire outbreak have compounded housing problems over the years (Shittu et al., 2017). Ogieto (1987) has observed that the disparity between the price and quantity of housing on one hand, and the number of households and the money available to them to pay these prices on the other, constitutes the central problem of housing. According to Okupe & Windapo (2000) the gap between income and shelter cost in Nigeria is very wide. This has almost eliminated the low-income earners from the housing market. A panacea to the problem is the increasing rate of the incidence of fire outbreak, this study focuses on improving inclusive city growth and urban liveability by studying the incidence of fire outbreak as a hindrance to inclusive city growth in Niger State, Nigeria. The choice of Niger State was for the fact that Minna being the closest State capital city to Abuja experiences rapid growth in terms of construction of public buildings especially for commercial and official purposes.

In Nigeria, there have been several forms of serious disaster confronting homes, lives and properties of people and the government. The most common ones are flood, building collapse and fire, of which fire outbreak is the most frequently recorded (Shittu et al., 2017).

Fire safety is defined by Hakkarainen (2002) as the requirements which are related to prevention of ignition and fire spread, limitation of fire growth, evacuation provision and prevention of fire spread between buildings. Fire prevention or fire safety in buildings therefore has one of the top priorities in the design of buildings (Shittu et al., 2017). It is essential that building occupants are trained or enlightened on the issue of fire safety. In view of this, Mallonee et al. (1996) described fire safety training as a way of increasing public fire safety knowledge and improving their response to a fire with the aim of reducing the number of fire-related casualties. This is because residential fires, workplace fires, and environmental fires such as bushfires result in severe and fatal burn injuries (Mallonee et al., 1996).

The studies of fire have shown that most accidental fire starts from three main causes these are Malfunctioning of equipment, Misuse of heat sources and Electrical wiring error in housing projects (Shittu et al., 2017). Housing has been universally acknowledged as the second most indispensable item in human need after food. Housing has a profound impact on the safety of individuals and human beings. This present study considered issues surrounding fire safety management in public buildings in Minna, Niger State.

In Nigeria, there has been serious disaster confronting the homes, lives and properties of people. The most common ones are flood, building collapse and fire. A lot has been written on flood and building collapse, but the incidence of fire is still lax in literature. Fire is still the result of flammable materials being combusted and the essential ingredient for the propagation of fire is air, which is sufficient to start ignition or means of ignition and oxidation (Shittu et al., 2015). When the incidence of fire breaks out, the consequences usually result from loss of lives and properties to great hindrances to inclusive city growth and urban liveability.

The idea of inclusive growth is that increasing economic prosperity should create opportunity for all segments of the population and that its benefits should be distributed fairly reducing inequalities (Lupton, Raftery and Hughes, 2011). Developing countries are particularly struggling to provide adequate housing, physical infrastructure, economic, social and environmental services to their urban populations. Approaches to planning have failed to address the challenges of rapid urbanisation as well as the poverty, exclusion, informality and vulnerability it produces in its wake. In addition, the rules and regulations adopted for improving the quality of life of urban dwellers have actually led to poor living and working environments for the substantial segment of the

population that remains outside the formal city development process (Lindfield and Sternberg, 2011). This is one of the hindrances to effective inclusive city growth in developing nations.

Slums are the most visible evidence of the exclusion mentioned above and yet for several millions of the population, there is no choice but to live in them. These also affect the urban liveability as a result of fire disaster. This is due to the fact that residents in slums are poor and cannot afford to provide adequate fire safety measures to prevent the incidence of fire outbreak. Buildings in slums are usually constructed not in accordance with Building and Fire Safety Regulations and as a result, access to escape from fire or to fight fire is always impossible in the event of fire outbreak.

It has been established in the works of Shittu et al. (2013c), Shittu et al. (2016) and Shittu et al. (2017) that lack of adherence to Fire Safety Requirements by building owners and occupants is partly and greatly responsible for the increase in the rate of fire outbreak. The overall result of this is loss of lives and properties. This in turn has a multiplying effect on inclusive city growth and urban liveability. This is because the funds required to build more houses in order to reduce inequalities will be diverted by the Government and/or individuals to compensate victims to repair damaged buildings. The poverty level of the victims will increase as the compensations in most cases are usually far from being enough. The likely overall consequence of this may be the quality of the housing of the affected population may be more sub-standard. This necessitates a study of the incidence of fire outbreak as a hindrance to inclusive city growth in Niger State, Nigeria.

The problem identified above gave rise to the following questions which study the provided answers to:

- i. What is the trend in the occurrence of fire incidents in Niger State?
- ii. What is the trend in the rate of housing development in Niger State?
- iii. What is the relationship between the number of recorded fire incidents and the rate of housing development?
- iv. What are the strategies for reducing the effects of the hindrance of fire incidents to inclusive city growth and urban liveability?

Review of Related Literature

Inclusive City Growth

'Inclusive growth' is a relatively new term, gaining traction because of growing evidence that economic growth is leading to growing inequality and not necessarily to reductions in poverty (Lupton et al., 2016). There is

need to find ways to include more people in the benefits of increasing prosperity, at the same time drawing on the talents and energies of a greater proportion of our population to develop economies which are more vibrant, innovative, skilled and productive. Across the world, cities have been identified as having a key role to play in shaping more inclusive models of economic growth, both because they are the engines of growth and because they also tend to contain the largest concentrations of poverty (Lupton et al., 2016).

Developing countries in particular are struggling to provide adequate housing, physical infrastructure, and economic, social, and environmental services to their urban populations (Lindfield and Sterinberg, (2011). Conventional approaches to planning have failed to address the challenges of rapid urbanization, as well as the poverty, exclusion, informality, and vulnerability it produces in its wake. In addition, the rules and regulations adopted for improving the quality of life of urban dwellers have actually led to poor living and working environments for the substantial segment of the population that remains outside formal city development processes in most developing nations including Nigeria.

The overall goal of urban revitalization is to make cities more livable. In this regard, infrastructure may be correctly viewed as both the driver of city transformation and inclusive and equitable development. However, inclusive and equitable development require that slum rehabilitation be (i) viewed as an essential requirement for urban renewal in Asia and the Pacific, and (ii) pursued as part of a multi-sector urban development approach to poverty reduction (Lindfield and Sterinberg, (2011). This is implementable and workable in Nigeria where the problem of fire outbreak has impacted negatively on urban liveability.

Urban Liveability

Giap et al. (2014), liveability is the concept which encompasses those elements of home, neighbourhood, and metropolitan area that contribute to safety, economic opportunities and welfare, health, convenience, mobility, and recreation. This implies that the concept of liveability is clearly more a qualitative construct representing a set of characteristics that relate to the attractiveness of an area as a 'desirable' place to live, work, invest, and conduct business.

According to Centre for Liveable Cities and Urban Land Institute (2013), nearly 70% of the world's population is expected to live in urban areas by

2050. According to UN-HABITAT, cities are already home to half of humankind. More than 400 cities worldwide now have a population exceeding 1 million. The number of megacities—those with a population of more than 10 million—is on the rise (Australian Bureau of Statistics Database, 2011).

Cities are becoming denser—a trend particularly evident in Asia. Not only are people moving to cities from the countryside and outlying areas seeking economic opportunity, but they are also moving to other countries in order to live in the global cities of the world. Many of the key cities in Asia have population densities of 2,000 to 12,000 persons per square kilometre—such as Tokyo, Shanghai, Mumbai, and Singapore (Avent, 2011).

A general sentiment exists that high density spells the end for liveability in a city. Density is often blamed for accentuating problems like overcrowding, crime, disease, pollution, poverty, and high living costs. The often-reported negative impacts of high-density living, such as a congested cityscape, low quality urban services, increasing competition among people for use of facilities, and associated social conflicts, create a pessimistic view of life in a compact, highly built-up city (Centre for Liveable Cities and Urban Land Institute, 2013).

The results of some international surveys for example, the Global Liveability Survey by the Economist Intelligence Unit (EIU), Mercer's Quality of Living Survey, and Siemens's Asian Green City Index—have added to the perception that liveability tends to be higher for cities that have a larger geographic space, low-rise developments, and a low-density population (Centre for Liveable Cities and Housing Development Board, 2012; Centre for Liveable Cities and Land Transport Authority, 2012). Unfortunately, most Nigerian cities do not have a larger geographic space, low-rise developments, and a low-density population. With the incidents of fire outbreak added to this, urban liveability is put at serious threat and risk.

Concept of Housing

Housing according to Jinadu (2004) can be classified under five categories: Housing types based on location or setting; Housing types based on ownership structure; Housing types based on structure, design or layout; Housing types based on internal composition/height, and Housing types based on building materials.

subsidized housing. Social housing is government supported accommodation for people with low to moderate incomes. Social housing could also be rental housing owned and managed either by the state or non-profit organisations, or a combination of the two. It also includes affordable housing, community housing or cooperative housing. Most social housing providers are non-profit oriented.

Shittu et al. (2013a) reported that the official estimate shows a shortage of 16 million housing units in Nigeria with 80% of the population living in informal housing. These are structures of varying degrees of degeneration on land which they have no ownership or title rights.

Ibimilua (2013) reported that the challenges of housing in terms of quality and quantity appear to be the same all over the world. The needy have less access to housing while the less needy have greater chances of accessing housing. In Nigeria, housing is generally inadequate in the rural areas in terms of quality, while the major problem in urban areas is more of quantity, although quality is also an issue. The shortage of housing is one of the factors responsible for the poor environmental quality across Nigeria. In 1991, the national housing policy was promulgated in order to propose possible solutions to the housing problems in Nigeria. Twenty years on, millions of Nigerians are still homeless while many others are living in indecent houses. Ibimilua (2013) therefore identified the major challenges to be due to poor implementation, corruption, bureaucracy and political instability. It was then recommended that housing finance, cooperatives, use of local building materials, development of infrastructure, policy implementation and review of the housing policy are the possible solutions to the housing problem in Nigeria.

The Incidence of Fire Outbreak

Fire is referred to as the rapid oxidation of combustible material and gases producing heat and light (oxygen, heat and fuel) in the absence of one of these elements there cannot be fire (Aqua Group, 1984). Fire is one of the most destructive hazards which threaten buildings. It has the potential to affect the occupant, the building and its components. Areas not directly damaged by the flame or heat may be smoked, dirty and falling debris, which could have been caused by the huge volumes of water used in fire fighting.

The problem of fire in human settlements can be disaggregated into cause of the fire, spread of the fire, escape from the fire and fire-fighting

According to Shittu (2007), majority of fire outbreaks in domestic buildings were caused by electrical fault rather than gas faults. Fire in buildings can be credited to various factors. According to Hassan (1999) the causes of fire can be grouped under Accidents, Carelessness and Willful acts.

Shittu et al. (2015) pointed out that the following private and public buildings had faced the trauma of fire outbreak examples in Niger State Nigeria include:

- (a) The incidence in part of the Kure Ultra-modern, Minna, Niger State burning down about 50 shops.
- (b) Federal Polytechnic at Bida in Niger State respectively.
- (c) A fire broke out opposite NANA'S PLACE were residential buildings were razed to the ground.
- (d) There were also other cases where a fire broke out in Jatau community in Minna, Niger State where lives and properties were lost.

It was also reported in the work of Shittu et al. (2017) a fire incident that gutted about eight rooms of the G-block of a male hostel at Usman Danfodio University, Sokoto. Christianity Today Magazine, March 12, 2004, again reported the case of a building fire that destroyed twenty six lives in Nigeria, because there was only one entrance and exit to the building. In addition, in 2005, fire incident occurred in the female hostel of the Federal University of Technology, Minna, Niger State which destroyed property and another incidence also occurred in 2009 and at the Bosso campus (temporary site) of the same institution. A recent incidence of fire outbreak was reported by Voice of the Nigerian Tertiary Institutions in 2013 that the Community Campus Radio Station of the Federal University of Technology, Minna, popularly referred to as Search FM 92.3 was gutted by a mid-night inferno on Wednesday 16, January, 2013 destroying properties worth over ₦50 million Naira. The fire outbreak which occurred around 12:00 a.m. as a result of electric spark gutted the whole studio and other offices of the station. This is in line with the discoveries of Shittu (2001), Shittu (2007) and Shittu (2009) that the major cause of fire outbreak in Nigeria is electrical faults.

Mogbo (1998) researched on the environment and fire incidences in Nigeria and the implications on public policies and politics. Shittu (2001) studied the incidence of fire outbreak in public and residential buildings of Kwara State from 1990 -1999; Shittu (2007) researched on a comparative analysis of fire outbreak between the military and civilian era in Niger State in domestic and public buildings and Shittu (2009) studied the incidence of fire outbreak in North-Central Nigeria; and Shittu et al. (2013b and c), Shittu et al. (2016) studied the appraisal of fire safety provisions in tertiary

institutions buildings in Minna, Niger State and Katsina, Katsina State respectively, and Shittu et al. (2017) researched on the appraisal of fire safety provisions in public buildings in Minna, Niger State. These previous researches have shown that the incidence of fire outbreak is a national issue affecting all building types and requires urgent attention in form of prevention against ignition and fire spread and compliance to fire safety regulations.

Impact of Fire Incidents on the Rate of Housing Development

Building cost has been on the increase in our contemporary society and this attracts a great deal of concern to both private and public bodies. The rapid increase in cost of construction is observed to be influenced by different variables. Omole (1988) is of the view that essential materials like cement, finishing materials are sometimes scarce to come by in Nigeria. A large house will cost more than a small one and equally finished large windows costs more than smaller one. Jackson (1988) added that about 50% of building cost goes in to materials and the remaining 50% is used up as labour and profit cost in buildings. Therefore, market force that is interplay of demand and supply, are one of the major factors affecting cost of building materials. Oladapo (1993) in the same vein agreed that most building materials with the exception of wood could be said to be imported. Jackson (1988) reported that the basic cost of a building is determined by the design. Shittu et al. (2013a) observed that although Nigeria is potentially endowed with natural resources to produce most materials required for their construction industry vast of the resource still lies fallow and local production of building materials had never matched demand at any time. It was noted further that 20% paint and a reasonable percentage of the cement consumed in 1974 were imported.

Osoba (1992) observed with dismay the upward trend in the cost of basic building materials, which according to him began after the civil war and other increases in cost of building materials coincide with Udoji award and the mismanagement of the economy. Other causes of upward trend in building material cost according to Osoba (1992) are:

- i. High demand of building materials arising from post-civil war.
- ii. Massive importation of building materials.
- iii. Inefficient distribution system aggravated by middlemen and high transportation cost.
- iv. Insufficient building materials.
- v. Massive intervention of government in direct housing construction.

In addition to the above, Olusola-Obasa (2012) reported that Key players in the cement industry say there will soon be an end to the annual increase in the price of cement in Nigeria, going by recent activities in the sector. They believe that with improved production capacity from cement plants across the country, supply may soon exceed demand. If compared with the nation's overall demand for cement which is put at 17 million metric tons per annum, it was obvious that the supply of the product would outweigh the demand. This should lead to a crash in the product's price and also ending the era of importation of the product.

Finally, Shittu et al. (2013a) discovered that the cost of sharp sand and paints have the most significant impact on the rate of housing development. Generally the study discovered a positive correlation between the cost of building materials and rate of housing development. This implied that there is a great tendency that an increase the price of building materials would result in a decrease in the rate of housing development in Nigeria. This impact is more likely to be higher in this present time of economic recession in Nigeria. The multiplying effect will be felt on effective inclusive city growth and urban liveability.

Strategies for Mitigating the Effects of Hindrances of Fire Incidents to Inclusive City Growth and Urban Liveability

Centre for Liveable Cities and Urban Land Institute (2013) suggested a ten-stage strategy for mitigating the effects of hindrances of fire incidents to inclusive city growth and urban liveability. These are:

- Stage One: Plan for Long-Term Growth and Renewal
- Stage Two: Embrace Diversity, Foster Inclusiveness
- Stage Three: Draw Nature Closer to People
- Stage Four: Develop Affordable Mixed-Use Neighbourhoods
- Stage Five: Make Public Spaces Work Harder
- Stage Six: Prioritise Green Transport and Building Options
- Stage Seven: Relieve Density with Variety and Add Green Boundaries
- Stage Eight: Activate Spaces for Greater Safety
- Stage Nine: Promote Innovative and Nonconventional Solutions
- Stage Ten: Forge 3P Partnerships

The ten-stage strategies, according to Centre for Liveable Cities and Urban Land Institute (2013), provide an insight into Singapore's integrated model of planning and development, which weaves together the physical, economic, social, and environmental aspects of urban living. Many of the impacts of high-density city living can be mitigated or managed better

through such an approach. For Nigeria, this is an important factor as the country continues to grow and high-rise buildings increasingly dominate most of the urban landscape. The approach can therefore be adapted to solve Nigerian inclusive city growth urban liveability problems.

Taipale (2013) also gave the following strategies for mitigating the effects of hindrances of fire incidents to inclusive city growth and urban liveability.

- i.** Implementing Inclusive and locally rooted visions of 21st century cities for all
- ii.** Tending Towards a culture of sustainability
- iii.** Integrated planning of sustainable urban Infrastructures
- iv.** Valuing local skills and non-market based Solutions
- v.** Measuring success and sharing data and knowledge
- vi.** Appropriate mandates and financing at all levels of government
- vii.** Cities proactive in a globalized world
- viii.** Decent urban mobility for everyone
- ix.** Provision of Sustainable construction processes, buildings and maintenance
- x.** Energy security and empowerment through distributed renewable energy systems

Taipale (2013) added that the process towards sustainable cities starts with profound analyses of the past and present culture of the city. It builds on an inclusive and holistic vision, applies integrated planning and transparent governance, and monitors implementation rigorously. Even a huge amount of excellent but disconnected pieces does not make a well-functioning whole. Because money is not going to stop talking, its language will have to become sustainability. A locally rooted, democratized culture of sustainability has to be the foundation of urban development.

Research Gap Identified

Efforts have been made by many researchers to address the problem of fire outbreak. In the foreign scene, Huseyin and Satyen (2006) researched on the level of fire safety knowledge among people of different age groups and investigate its relationship to the level of fire safety training, and the manner in which people from different age groups would respond to a fire based on their fire safety training in Melbourne, Australia. The study revealed that middle-aged individuals would respond more accurately to a fire than younger and older adults. The findings demonstrate the importance of fire safety training in enhancing people's fire safety knowledge and their response in the event of a fire which could lead to a

reduction in the rate of fire casualties. The study therefore suggested an incorporation of fire safety training as part of health improvement programs to reduce the number of fire-related injuries and fatalities.

In addition, Marsha and Williams (2012) carried out a qualitative study on Fire Safety Education & Outreach Programs at Memphis, Tennessee. The study revealed that for a variety of reasons, fire danger is not as salient or as pressing a concern for most Memphis residents as is crime. However, the statistics regarding the frequency of residential fires in high-risk Memphis neighbourhoods shocked most of these participants into a much more proactive and preventative mind-set. Addressing the problem will require a long-term, coordinated effort and the great majority of respondents believe that responsibility lies with the Fire Department, elected officials, community leaders, property owners, and residents themselves. The study of Marsha and Williams (2012) also showed that there are four key strategies to effective fire prevention and safety. These are:

1. Raise awareness of the risk of fire danger and educate the public regarding ways to protect themselves, their families, and their property.
2. Provide financial assistance (in the form of grants) to low income and elderly homeowners who are in need of electrical wiring upgrades.
3. Tear down vacant buildings.
4. Strictly enforce building codes in rental properties.

In the field of fire safety education and awareness, Clare, Garis, Plecas and Jennings (2012) researched on reduced frequency and severity of residential fires following delivery of fire prevention education by on-duty fire fighters using a cluster randomized controlled study in Surrey, British Columbia. The study specifically examined the frequency and severity of fires pre and post - the home visit intervention in comparison to randomized high-risk cluster controls. The study discovered that the frequency of fires have reduced in the city overall, however, the reduction in the intervention cohorts was significantly larger than for controls. In addition, it was found that when fires did occur within the intervention cohorts, smoke detectors were activated more frequently and the fires were confined to the object of origin more often post-home visits. No equivalent pattern was therefore observed for the cluster control. It was concluded that on-duty fire-fighters can reduce the frequency and severity of residential fires through targeted, door-to-door distribution of fire prevention education in high-risk areas.

In the context of the Nigerian research domain, Shittu (2001) observed the number of fire outbreak in residential and public building of Kwara State and discovered that the amount of financial loss due to fire incidences on the average was about 4% of capital expenditure from 1990-1999. Shittu

(2007) studied the incidence of fire outbreak in Niger State from 1993-2004 between the military (1993 - 1998) and civilian (1999 - 2004) political dispensations and found out that the incidence of fire outbreak in both domestic and public buildings were significantly more frequent during the civilian era than the military era in Nigeria. Shittu *et al.* (2013b) researched on the appraisal of fire safety provisions in tertiary institutions buildings in Minna, Niger State of Nigeria and revealed that building clients and users do not comply with fire safety regulations with respect to the provisions of fire fighting equipment's and number of escape routes in buildings. Shittu *et al.* (2015), on the other hand, studied the relationship between cost of fire incidences and capital expenditure in Kwara State and discovered that there is no improvement in the trend of fire incidence in Kwara State over the last two decades.

Aliyu and Abdulrahman (2016) researched on the assessment of fire safety provisions in tertiary institution hostel buildings in Niger State. The study used a well-structured questionnaire and observation schedule to acquire data in some selected tertiary institutions in Niger State. The study found that the fire safety equipment is not available or not functional in the hostels also; most of the students in the hostels are not conversant with the usage of such equipment. It was recommended that proper scrutiny of hostel buildings be made by the school management from time to time to ensure that all fire safety precautions are in functional condition, and orientation of students in the hostels about what to do in occurrence of fire outbreak.

Finally, Shittu *et al.* (2017) assessed fire safety provisions in selected public buildings in Minna, Niger State, Nigeria. The study employed the use of interview, questionnaire and checklist to collect data and the use of both inferential and descriptive statistics for data analyses. The study revealed that fire safety requirements are not adequately provided or complied with in public buildings in Minna.

These studies have however failed to study the incidence of fire outbreak in relation to its effects on inclusive city growth and urban liveability.

Methodology

The source of data collection for this research work was the secondary source of data collection, that is, from the archives of the Niger State Fire Service on the recorded cases of fire incidents and Niger State Urban Development Board on the rate of housing development. The study

employed the use of both descriptive and inferential methods of analysis to analyse the collected data.

The use of tables were employed to present data collected for the study while bar charts and line graph were employed to present trend analysis on incidents of fire outbreak and rate of housing development. The statistical technique used for inferential analysis of data is the simple and linear regression analysis in order to determine the statistical relationship existing between the incidents of fire outbreak and the rate of housing development, with the aid of the computer software package called the Statistical Package for Social Sciences (IBM 20.0 SPSS).

This research assumes 5% significance test as test of statistical significance. Hence for any value of Probability (P) from 0.00 to 0.05 there is significance in the test but for values greater than 0.05 there is no significance in the test.

Results and Discussion of Findings

Data Presentation

Table 1: Research Data

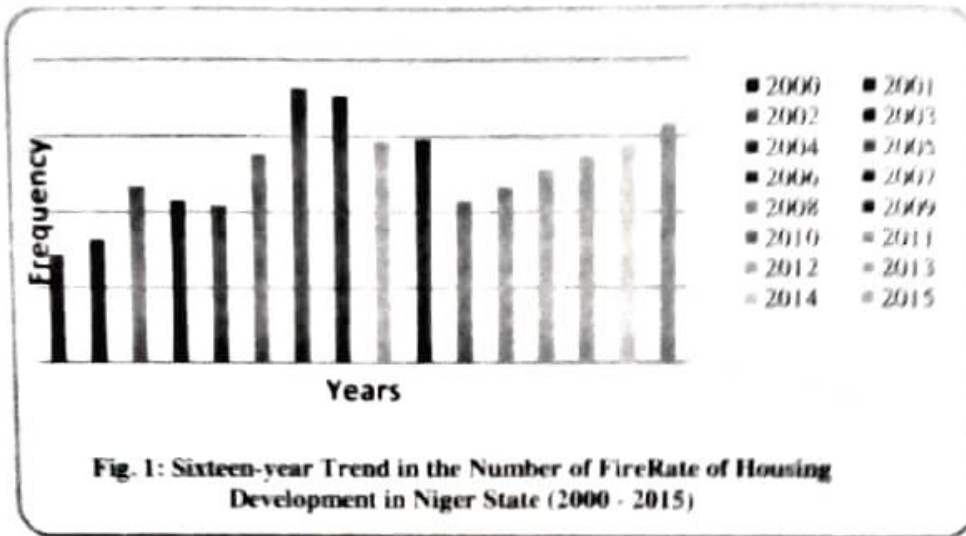
Year	Number of Fire Cases	Increase in Housing Stock
2000	72	578
2001	82	543
2002	117	506
2003	108	497
2004	105	401
2005	138	394
2006	182	311
2007	177	277
2008	147	495
2009	148	365
2010	108	317
2011	117	363
2012	129	197
2013	137	219
2014	145	210
2015	158	176

Source: i. Niger State Fire Service, Minna (2016)

ii. Niger State Urban Development Board, Minna (2016)

Results of Trend Comparison

The results of the trend analysis were presented in the graphs depicted as Figures 1 -2. Each of these figures is presented and discussed below



It is shown in Figure 1 that the rate of fire incidents fluctuated from 2000 - 2015. The rate of housing development therefore followed an inconsistent pattern over the period under review.

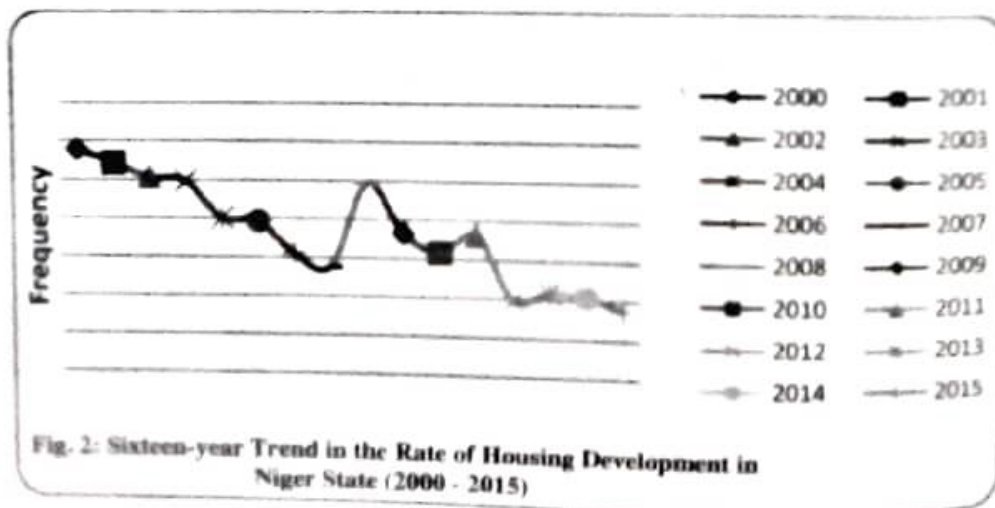


Figure2 also shows that the number of recorded fire incidents followed a fluctuating pattern. The trend here is also inconsistent. This implies that the rate of change in the number of fire incidents is not uniform.

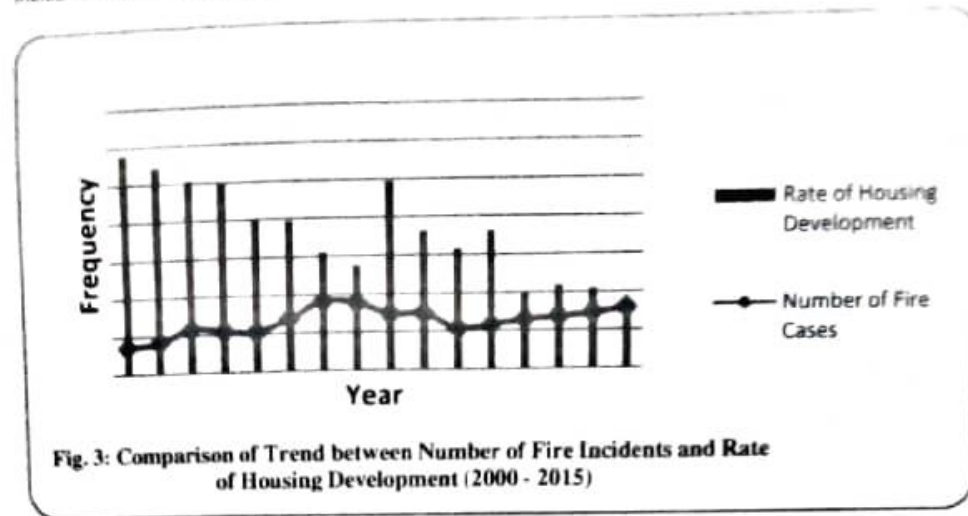


Figure 3 shows the trend comparison between the rate of housing development and number of fire incidents from 2000 – 2015 in Niger State. It was found that the number of fire incidents and the rate of housing development both fluctuated over the period of study in almost an opposite direction. This implies that increase in the number of fire incidents leads to decrease in the rate of housing development and vice versa.

Results of Regression Analysis

Presentation and Discussion of Results of Regression Analysis

It was observed from Table 2 the regression analysis that there exists a slightly strong, negative and significant relationship between the number of fire incidents and rate of housing development. The coefficient of determination (R^2) value observed was 41% which was improved to 48% in the quadratic and cubic models, implying a fairly strong relationship and the correlation coefficient (R) observed was 86% indicating strong degree of association between the variables. The negative correlation observed between the variables indicates that an increase in the number of fire incidents will lead to a decrease in the rate of housing development and vice versa. The value of the R^2 implies that 48% variation in the value of the rate of housing development is accounted for by changes in the number of fire incidents recorded over the study period while 52% is as a result of other factors not in the scope of this study. The value of F calculated of 9.547 observed was greater than the value of F tabulated of 4.60 while the probability (P) value of 0.008 observed was less than 0.05. This led to the rejection of the null hypothesis which states that there is no significant relationship between the number of fire incidents and rate of housing development. The result of this study is in line with that of Shittu et al. (2010) where it was discovered that there exists a significant relationship

between the number of fire incidents and number of fire outbreaks in domestic and public buildings of selected States in North Central Nigeria including Niger State from 1990 – 999. Similar result was also discovered in the works of Shittu (2007) that there exists a significant relationship between number of fire incidents and number of fire outbreaks in Niger State between 1993 and 2004.

The results of the regression analysis is summarised in Table 4.2.

Table 2: Summary of Results for Regression Analysis

Analysis No.	Variables		Observations				Inferences				
	X	Y	Type of Model	Regression Equation	R/R ² (n)	F _{cal}	F _{tab}	P _{value}	Strength of Relationship	Remark	Action On Hypothesis
1	Fire	Housing	Linear (Simple)	$Y = 714.581 - 2.698x$	86/41	9.547	4.60	0.008	Slightly Strong	SS	Reject H ₀
2	Fire	Housing	Logarithmic	$Y = 2015.179 - 341.270\ln(x)$	67/45	11.220	4.60	0.005	Fairly Strong	SS	Reject H ₀
3	Fire	Housing	Quadratic	$Y = 1206.081 - 10.819x + 0.032x^2$	69/48	5.882	3.81	0.015	Fairly Strong	SS	Reject H ₀
4	Fire	Housing	Cubic	$Y = 910.888 - 3.183x - 0.031x^2 + 0.000x^3$	69/48	3.643	3.49	0.045	Slightly Strong	SS	Reject H ₀

Source: Researcher's Analysis of Data (2017)

Key:

SS = Statistically Significant

Fire = Number of Fire Incidents

Housing = Rate of Housing Development

Conclusions and Recommendations

It was revealed from the analysis of this research that the number of fire incidents and the rate of housing development fluctuated over the period of study in almost an opposite direction. Thus; increase in the number of fire incidents leads to decrease in the rate of housing development and vice versa. The relationship between the number of fire incidents and rate of housing development is therefore significant. It can therefore be concluded that the incidents of fire outbreak poses significant hindrances to inclusive city growth and urban liveability.

In the light of the findings of the study, the following recommendations were made:

- i. Government should enlighten residents of a neighbourhood on the importance fire safety requirements viz a viz fire prevention, fire fighting equipment and fire escape routes.
- ii. Government should provide financial assistance (in the form of grants) to low income and elderly homeowners who are in need of electrical wiring upgrades.
- iii. Relevant Government agencies should tear down vacant buildings for easy access in case of *fire fighting and fire escape*.
- iv. Activating spaces for greater safety.
- v. Developing affordable mixed-use neighbourhoods.
- vi. Government should plan for long-term growth and renewal.
- vii. Promoting innovative and nonconventional solutions.
- viii. Provision of integrated planning of sustainable urban infrastructures.
- ix. Measuring success and sharing data and knowledge.
- x. Provision of sustainable construction processes, buildings and maintenance.
- xi. Implementing inclusive and locally rooted visions of 21st century cities for all *neighbourhoods*.

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