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# Fire Risk Exposure and Preparedness of Peri-Urban Neighbourhoods in Ibadan, Oyo State, Nigeria

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**Abstract.** This study assessed the exposure of urban neighbourhoods to environmental hazards generally and fire risk in particular in Ibadan. Lagelu, a rapidly urbanizing local government area was selected for the study with emphasis on Lagelu West Local Development Council. Relevant literatures were reviewed in this regard while structured questionnaires were administered on adult residents of 320 households in the selected peri-urban communities. Respondents' opinions were obtained as regards the susceptibility of their communities to different environmental hazards. Data was also obtained from the respondents on the causes/sources of fire risk in their respective neighbourhoods as well as adequacy of fire safety apparatus in the communities. Data were measured on a 5-Point Likert scale of strongly agreed (5) to strongly disagree (1). Responses were analysed with basic tools of mean score, relative importance and interpreted based on cut-off point (as devised in Morenikeji, 2006). The causes of fire and adequacy of community fire safety apparatus were analysed in percentages and presented in tables and bar charts. The study showed that there is a general consensus that the communities are highly vulnerable to the environmental risks identified in the study. It was also revealed that fire outbreak is principally caused by human activities, negligence as well as faulty electrical equipment and power surge. Respondents generally are of the opinion that fire safety apparatus available in the communities are grossly inadequate thereby compounding the vulnerability predicament of these communities. The study therefore recommends amongst others, upgrade of the community road network, provision of firefighting system within the neighbourhood and enlightenment of residents on fire safety precautions.

Key words: urbanization, environmental disaster, fire risk, peri-urban, population, Ibadan

## 1. Background

The combined forces of rural-urban migration, interstate migration, industrialization and globalization (via advancement in information and communication technology) have put all nations, including Nigeria on the fast lane of urbanization. Consequently, networks of urban centres have emerged across the world. In Nigeria alone, there are over a million people in at least ten cities and about eight hundred and forty urbanized areas [1]. Furthermore, the number of people living in cities in Nigeria in the last three decades has been increasing by 5.8% per annum with 48.2% of the entire population lives in urban areas. Urban areas present opportunities for socio-economic growth and development. Opportunities for economic growth, research and innovation as well as employment abound in properly managed urban



centres. According to [2] modern productive activities are found more in capital cities. More than any other place in the developing world, significant proportion of paid employments are located in urban centres [2]. However, recent trend of urbanization and increasing population in sub-Saharan Africa have exposed urban populace to daily hazards and disaster risks [3]. Urbanization has led to haphazard development, a phenomenon common in planned and unplanned settlements in developing countries [4]. A number of erstwhile, low density neighbourhoods within urban enclave have undergone rapid transformation and filled with medium/low income residential developments as well as light service/commercial structures. Others have witnessed tremendous increase in the number of poor who could hardly afford three square meals, thereby accelerating the degeneration of the neighbourhood into slum.

The growth of urban centres usually cascade and reverberates in the outer zones of city centres in a phenomenon described as peri-urbanization. The instant effect or indicator of this growth is the increase in the number of residents in the rural belt of urban centres. Urbanization sets in motion the process of peri-urbanization. This according to [5] is a process whereby extensive areas earlier characterized by rural features get absorbed into urban centres or transformed into peri-urban areas. The peri-urban areas are usually expanse of virgin agricultural land featuring pockets of rural settlements. Comparing population growth in the urban centre and the fringes of Ibadan between 1991 and 2006, [6] noted that while the average annual growth in the metropolis was 0.5 percent, average growth rate in the outskirts was 4.8 percent over the same period. Population growth of peri-urban areas requires the provision of more houses and causes pressure on available infrastructure. Being a critical need of man next to food, priority is obviously placed on providing or procuring shelter, thereby encouraging individual investment in housing development. Thus, the peri-urbanization process often culminates into increase in housing units in the affected neighbourhoods while other socio-economic infrastructures are largely neglected. The increasing number of people in the fringe of urban centres as well as the pattern of physical development within those neighborhoods over the years has exposed peri-urban environment to diverse risks, leaving the dwellers more vulnerable than those in the urban centre. Amongst the different disaster ravaging the peri-urban environment is fire disaster and this is of particular interest because of the rising occurrences, devastating impact and the human causal factor. [4] claimed densification of houses in both planned and unplanned settlements limits fire brigade, thereby aggravating fire disaster risks.

The issues of environmental risk, disaster, exposure and vulnerability of neighbourhoods have gained prominence in recent discourse among the policy makers, concerned stakeholders and common man. Concerted efforts are geared towards reducing the rate of occurrence of these disasters, providing necessary support to minimize exposure and curtailing the vulnerability of different groups that makes up the society. A disaster occurs from extreme weather event with consequences such as loss of lives, damage to properties and disruption of social, ecological and economic stability without commensurate human or neighbourhood capacity to prevent, respond or contain the outbreak. Several factors have contributed to the increasing vulnerability of urban environment to risk of environmental disaster. According to [7], demographic, economic and political factors are critical factors that lead to urban vulnerability. Other dynamic pressures as noted by [8] arise from public establishments, their activities or inactions that affect adaptive capacity, preparedness and response actions.

Disaster prevention, risk reduction, impact mitigation and sustainability development have been on the front-burner of United Nations Agenda on Environment.

The Hyogo Framework advocated disaster risk reduction and sustainable development globally. The framework demonstrates how disaster risk reduction affects viable growth across board [4]. In addition, the MDGs acknowledged the significance of safety and ability to recover from disaster in all human settlements. [4]. These are further reiterated in goals #1 and #11 of the Sustainable Development Agenda 2030. Target #1.5 of goal #1 specifically aimed at building resilience among the poor and vulnerable and reduces vulnerability to all forms of ecological and environmental calamities. Goal #11 further entrenched objectives of Goal #1 and specifically aimed at creating cities and other settlements all-encompassing, secured, resilient and sustainable (United Nations Development Programme [9]. Disaster risk reduction capacity of a neighbourhood essentially depends on exposure and vulnerability of the community. The capacity reflects the pattern of development as well as the amount of resources available to its residents.

## **2.Literature Review**

[10] investigated fire safety and deterrence approach in office buildings in Nigeria. Extant literatures on this subject were reviewed to explain fire risk in office buildings. Physical inspection was conducted on selected high and low-rise offices to ascertain the fire safety measures incorporated in the building. Interview was also conducted with professionals in the field of Architecture, Building Technology, Building or Estate Manager, Engineers and fire safety directors for their perspectives on fire safety practices in office buildings in Nigeria. Information on the location, spread and number of floors of office buildings in the north-central regions were obtained from the records of urban development control and planning department of each state. A checklist of both active and passive fire safety requirements for high-rise office buildings were compiled from the Nigeria National Building code (NNBC, 2006); National Fire Protection Association (NFPA, 2018) and National Fire Safety Code (NFSC, 2013). The fire safety requirements identified include muster points, exit stairs, fire access, distance to safety, emergency lightening, fire alarm, fire extinguisher, exit signage, fire men access and artificial lightening. Due to the multiplicity of the fire safety systems, a multi-attribute evaluation model was adopted in determining the fire safety performance of each building. Ordinal scales that demonstrate the grade levels X, Y and Z were used to classify the performance of each building. Analysis was basically in frequency and percentage and presented in tables and bar charts. Findings showed amongst others that 67% of buildings surveyed make adequate provisions for fire extinguisher only amongst other safety measures while above 67% are inadequately prepared in the aspect of the remaining fire safety measures. The study also revealed that 67% of the buildings lack place of safety and escape stairs. It further showed that the buildings lack critical fire safety systems. The study suggested that adequate provision of places of safety and firefighting equipment to aide quick intervention in case of emergency.

[11] examined the performance assessment of the firefighting personal protective tunics in Nigeria. The study was prompted by the reports of substandard firefighting kits and dearth of research into materials used for firefighting tunics in developing countries, particularly in Nigeria. The loss of lives and property during fire outbreaks in the country have been attributed on different occasions to the use of inferior gear. Hence the need to examine the

performance assessment for those kits available in Nigeria. This would also ensure the safety of lives of the firefighters and enable them deploy their skill to execute the task to the best of their ability. The study was set in Ota due to the level of industrialization and growing population. Ota has only one fire station where the sample was obtained. The apparatus used for the experiment include thermometer, copper calorimeter, Bunsen burner, 250ml beaker, thread, electric beam balance, wire gauze with ring and ring stand as well as automatic Lee's disc apparatus. The study revealed that the standard of tunic being used in Nigeria fire stations is below the acceptable general standard. It was therefore suggested that fire stations in Nigeria are equipped with standard of PPEs so as to adequately protect against loss of lives of the personnels.

[12] analysed fire outbreaks in residences and municipal buildings in Lagos State, Nigeria. Data on fatal fire outbreaks in Lagos metropolis between 2009 and 2014 were obtained from the Lagos State Fire and Safety Services, National Emergency Management Agency, Nigeria Security and Civil Defense Corps and Ministry of the Environment, Health Monitoring Unit. Structure questionnaires were administered to 2000 residents of Lagos State between the ages of 18 and 79years. Interviews were also conducted alongside the structured questionnaires. Basic descriptive tools engaged in the analysis of data for the research include frequency, percentages and mean while results of data analysis were presented in bar chart, tables and pie chart. Findings revealed amongst others that most fatal fires in homes often start in a bed, sofa, other loose fittings or clothing in rooms that are rarely protected by smoke detectors. Also, fatalities are higher among males and elderly than females and younger people. The study further revealed that negligence and arson are the commonest causes of fire outbreak in homes and public buildings. The study recommended amongst others, enlightenment of users and occupiers of building on fire safety precautions, installation of automatic fire prevention gadgets at high risk areas in the building, preparedness and prompt response of fire brigade to incidence of fire outbreaks. This study was carried out in Lagos and focused properties in the metropolitan areas of the city.

[13] examined the incidence of fire outbreak in urban areas and the control approach in Gombe metropolis. Factors hindering fire management efforts were identified. Primary data was obtained with the aids of questionnaires administered on 250 residents of the study area. More information was further obtained via interviews, focus group discussions, direct observation and review of documents of the state fire service. A five-point likert scale was used to determine the least and most significant causal factor. Findings shows that negligence constitutes the most significant causal factor of fire incidence in the study area while electrical fault was the least. It was further revealed that majority of residential buildings in the study area lack functional fire extinguisher while those that have could not operate it. Inadequate firefighting gadgets, personnel and lack of access in highly inhabited areas of the metropolis during fire outbreak were highlighted. The study suggested amongst others, the effective and credible monitoring and surveillance system for the distribution of fuel in the country, public enlightenment on fire safety and precaution through print and electronic media, provision of community based fire-fighting gadgets as well as development of plans and strategies to prevent fire outbreaks.

[14] examined the impact of urban lounge on residential environment quality in Ibadan, Oyo State Nigeria. Primary data obtained with questionnaires, inspection and discussions were

used for the analysis. The study revealed the effect of demographic attributes of occupants on the surroundings. Furthermore, various problems such as congestion, poor roads, poor infrastructure, poor public services arising from poor maintenance culture were observed. The study recommended timely and effective planning that properly decongest the densely populated areas and promote enduring quality environment. It further recommended comprehensive regeneration agenda by providing basic amenities supported with enhanced hygiene approaches.

### 3. Study Area

This study location was Ibadan, with mean growth rate of 4.6% per annum between 2010 and 2020 [15]. Ibadan is divided into eleven local government areas (LGAs), five of which are in the metropolis and the remaining six are either urban proxy or rural habitations [5]. Lagelu, one of the urbanizing LGAs in Ibadan metropolis is the focus of this study. The local government which occupies approximately 416km<sup>2</sup> of land came into existence in 1976 with administrative headquarter located at Iyana Offa [16]. It is bounded by Egbeda, Iwo, Ibadan North, Akinyele and Ibadan North-east to the East, West, North and South respectively. Based on the national population census of 2006, Lagelu LGA has 148,133 inhabitants and projected to 208,100 in 2016. The population density was approximately 438.3 per km<sup>2</sup> and population growth rate of +5.49% per annum [18;19]. Lagelu LGA is subdivided into 14 wards with over 1076 towns and villages distributed among the administrative subunits of the local government area. In 2017, Lagelu West LCDA with headquarters and Lagelu North LCDA were carved out of Lagelu LGA. The land area of Lagelu West Local Council Development Area is about 260 sqkm. It consists four (4) political wards of with over thirty towns and 278 small and bigger villages [17]. Apparently, Lagelu West LCDA represents the rapidly urbanizing and developing part of Lagelu local government area and is the most populated [17]. Major towns in the LCDA includes: Olorunda, Elewuro, Idi Ape, Ajara, Onikokoro, Eniosa, Yawiri, Elegu, Papa, Tela, Olukotun, Idi Orogbo, Ayeye, Olode, Kute, etc.

#### 3.1 Research Methods

The study population was head of households and house owners resident in Lagelu Local Government. Based on [18] population projection of 208,100 in 2016 for Lagelu LGA, the sample size was arrived at by linear interpolation of appropriate population size and corresponding sample size on Cochran's Table at 95.0% confidence level and 0.05 margin of error. This yielded the sample size of 320. The four political wards in Lagelu West LCDA constituted the sample frame. Four towns were selected in each of the wards, i.e. Alegongo, Olorunda, Monatan and Sagbe/Pabiekun. Eighty questionnaires were subsequently administered to adult male residents in each town, making a total of 320 questionnaires distributed across the four wards. The distribution and retrieval was achieved within two weeks with the help of research assistants. A total of 296 valid questionnaires were retrieved, yielding 92.50% response rate. Data were measured on 5-Point likert scale of strongly agreed (5) to strongly disagree (1). Response were analysed with basic tools of mean score, relative importance and interpreted based on cut-off point (as devised in [20]). The causes of fire and adequacy of community fire safety apparatus were analysed in percentages and presented in

tables and bar charts. The descriptive analysis revealed basic characteristics of respondents and houses in the neighbourhoods as well as adequacy of fire safety apparatus.

#### 4.0 Data Analysis and Discussion

##### 4.1 Socio-economic characteristics of respondents

Table 1: Socio-economic characteristics of respondents

Category	Attributes	Respondents	Percentage
Age	21 – 30	33	11%
	31 – 40	74	25%
	41 – 50	143	48%
	Above 51	46	16%
Gender	Male	257	87%
	Female	39	13%
Resident status	Homeowner	209	71%
	Tenant	87	29%
Level of education	Primary school	31	11%
	Junior School	17	6%
	Senior School	67	23%
	Diploma	101	34%
	First/Second Degree	90	30%
Occupation	Self-employment	97	33%
	Private sector	86	29%
	Public sector	113	38%
Accommodation	Tenement	119	40%
	Bungalow	77	26%
	Flats	54	18%
	Duplex	27	9%
	Semi-Detached	19	6%

Table 1 showed the basic demographic attributes of respondents. The Table revealed that 64% of respondents are 41 years old and above while 36% are between the ages of 21 and 40 years. Meanwhile, 87% of the respondents are male with 71% are home owners. The high percentage of homeowners resident in the communities attests to the fact that respondents have adequate knowledge of the communities and are able to provide informed opinion about the issues raised in the questionnaire. Furthermore, all respondents possess certificates that indicate the various level of educational attainment, thus giving them the opportunity to understand the issue at stake. Moreover, 62% of respondents are either self-employed or work with private sector while 38% work with public sector. The kind of accommodation in the neighbourhood shows that tenement buildings which are either storey tenement or bungalow tenement are prevalent the study area more than other accommodation types. The relatively fewer numbers of other accommodation suggested the neighbourhood is gradually opening up to new developments.

##### 4.2 Susceptibility of study area to environmental hazards

Respondents were requested to assess the susceptibility of the study areas to different environmental hazards including fire disaster. The relative importance index were calculated for each risk factor and

ranked. The result is presented in Table 2. In order not to impair the result of the analysis, cut-off points as devised in Morenikeji (2006) were used to interpret the mean scores.

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Table 2: Opinion on susceptibility of neighbourhoods to environmental hazards

Environmental hazard	Total	Mean score	RII	Ranking
Air/water pollution	1049	3.544	0.709	7 <sup>th</sup>
Road accidents	1267	4.280	0.856	2 <sup>nd</sup>
Flooding	1223	4.133	0.826	3 <sup>rd</sup>
Building collapse	1114	3.762	0.753	6 <sup>th</sup>
Fire incidence	1325	4.478	0.895	1 <sup>st</sup>
Urban/economic violence	1167	3.941	0.786	4 <sup>th</sup>
Health risk	1129	3.814	0.763	5 <sup>th</sup>

Arising from the Table, it was observed that fire hazards, road accidents and flooding ranked 1<sup>st</sup>, 2<sup>nd</sup> and 3<sup>rd</sup> respectively while urban/economic violence, health risk, building collapse and air/water pollution ranked 4<sup>th</sup>, 5<sup>th</sup>, 6<sup>th</sup> and 7<sup>th</sup>. However, based on the cut-off points, it is inferred that respondents are of the opinion that their neighbourhoods are susceptible to the environmental hazards and are considered serious extant threats to the sustainability of their settlements. This is shown in the range of the mean scores with the minimum being 3.544 and maximum value being 4.478. This fall within the cut-off points of 3.50 – 4.49, indicating that the respondents agreed that the study area is vulnerable to the hazards regardless of the rank.

#### 4.3 Causes of fire hazards

Table 3: Causes of fire hazards

Causes of fire hazards	No. of respondents	Percentage
Unsafe cooking practices	178	60%
Faulty cooking equipment	203	69%
Faulty electric equipment	164	56%
Electric surge	149	50%
Inappropriate fuel storage	231	78%
Bush/waste burning	113	38%
Careless attitude	153	52%
Arson (willful damage)	99	33%
Accidents (vehicle/road)	136	46%

Respondents were asked to identify the causes of fire hazards in the neighbourhoods. Table 3 showed result of analysis of response. It was revealed that inappropriate fuel storage, faulty cooking equipment and unsafe cooking practices top the table with 78%, 69% and 60% of total respondents identifying them as the major causes of fire disaster. It was also observed that causes like accidents, arson and waste burning are considered less significant factors



compared to others as the percentage responses fall below average. This therefore implies that the majority of factors that cause fire hazard result from anthropogenic activities.

#### 4.4 Community fire safety apparatus

Respondents were requested to indicate the level of preparedness of the neighbourhoods against fire hazard. Opinions were obtained as regards the adequacy of fire safety measures in the communities. The adequacy or otherwise were expressed in percentage and presented with bar chart. Figure 1 shows the chart.

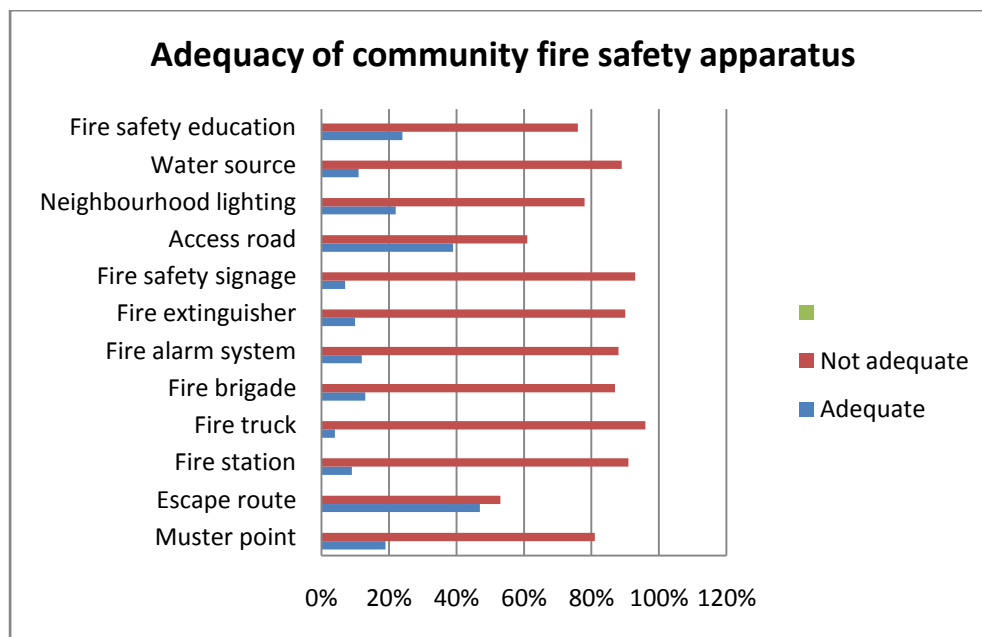


Figure 1: Adequacy of community fire safety apparatus

The opinion presented in the bar chart above reveal that respondents are generally discontented with the adequacy of community fire safety apparatus available in the neighbourhoods. The percentage that indicated inadequate fire safety measures is very high across majority of the measures and slightly above average for escape route. This thus implies that the level of preparedness of these communities is rather low, with the resultant effect of inability to prevent or curtail fire outbreak.

#### **5. Conclusion and recommendations**

This study examined the level of fire risk exposure of the study area and the adequacy of community fire safety measures. The study have shown that the study area is highly vulnerable to all kind of environmental hazards prominent among which is fire hazards, yet, the communities are ill prepared to prevent or curtail the incidence in case it occurs. The various causes of fire disaster were also identify, with general consensus pointing to the fact that most fire incidence that have occurred in the communities were caused by human actions, inaction or activities. The study therefore concludes by recommending that the state and local governments need to improve the level of community preparedness against fire outbreak by

providing adequate community fire safety apparatus. Moreover, there is need to enlighten the residents on fire safety, prevention and management strategies which is believed to go a long way to assisting the communities build a strong and permanent firefighting mechanism in the study area. Efforts geared towards implementing the recommendations of the study go a long way to achieving laudable milestones in the areas of goals #11, i.e. making cities and human settlements inclusive, safe, resilient and sustainable.

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