IJEPEM

International Journal of Environmental Pollution and Environmental Modelling,
Vol. 6(3): 177-190 (2023)
(Original Paper)

Geographical Analysis of Fire Outbreak in Kano Urban Markets, Nigeria

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Received 23.08.2023; Accepted 26.10.2023

Abstract: Frequent fire disasters in crowded urban business and market structures have become a major concern to Kano urban planners. Urban renewal schemes are being initiated to minimize the occurrence of fire accidents and other associated problems by various levels of government in the State and Country at larger. The study aimed to analysed fire outbreak in urban Kano market. Five markets were purposely selected (Singa, Kurmi, Sabon gari, Farm centre and Bata). Structured questionnaire and interview were administered using multi-stage sampling techniques. The coordinates of the markets were taken and mapped out using Geographic Information System (GIS) Software. The research revealed that there are more concentration of markets in the inner areas of the metropolis and less at the outskirt. The markets in the inner areas of the metropolis are mainly first and second generation markets while those at the outskirt are third generation markets. The study also noted that power fluctuation is the major cause of fire outbreak in the study area. It is found out that the immediate response most of these markets take is rescue their business properties. The study recommends that government should decongest and plan adequately for the markets and Neighbourhood markets should be created and its concept should be integrated in urban development. Standard electricity should be provided by either government or traders' association.
Keyword:*;* Geographical analysis, fire outbreak, Urban Kano

INTRODUCTION

The world has in the past three decades experienced a succession of disasters such as floods, fires, storms, earthquakes, volcanic eruptions and landslides. Such incidents include the worst fire disaster that occurred in 1984 in Mexico (Cavallini*et al*., 2007; International Strategy for Disaster Reduction [ISDR, 2002]), and the 2010 Chilean earthquake (ICRC, 2010). Many lives were claimed by these disasters which occur as a result of natural and artificial phenomena. The increased developments and interactions increase the potentiality of fire occurrences as well. Thus, all stakeholders, especially the users of the buildings need to be well-equipped in terms of knowledge on how to prevent and react to fire outbreaks. While inadequate and deteriorating infrastructure is among the most pressing and difficult issues facing the cities and towns of the developing world (Kyessi, 2002). Fire outbreak does not occur on itself, it can be caused by natural phenomena such as earthquakes, volcanic eruption or human induced like faulty wiring, reckless use of electrical appliances, accidents and carelessness, unattended stoves and gas cookers, and so on (Ogunlere, 2012; Jimoh, 2012; Wahab, 2013). On the other hand, fire outbreak in Nigeria leads to several loss of lives (Kasim, 2012; Punch Editorial Board, 2012); properties (Premium Times, 2012).

The issues related to fire safety have become important in national discourse. A good number of fire incidents have been reported and documented by Nigeria news media, the fire service departments and the National Emergency Management Agency. The News Agency of Nigeria reported that over 50 market stalls were gutted by fire in the early hours of 5th of March 2008 in the Kuto Market of Abeokuta, of Ogun State (NEMA, 2010).

The recent fire incident at the Sabon Gari Market in Kano reportedly was the worst market fire disaster, taking down with it some 3,800 shops and goods estimated at N2 trillion. (*"High Cost of Market Fires"*. Barely a few hours after, another fire incidents also spread panic and darkened the outlook in a neighbouring furniture market in Gwarzo in the same Kano State and another one in Birnin-Kebbi, the Kebbi State capital. In a space of three months, 10 major markets across the country went down with goods and property worth trillions of naira. The National Association of Nigerian Traders (NANTs) is alarmed and pained at the spate of market fires in the country. In the last 17 years,

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the association estimated the cost of goods lost to fire incidents at a hefty N5.3 trillion, barely a trillion less than the most ambitious budget of Africa's largest economy. Among the gutted markets was the famous Balogun Market in Lagos Island. The early morning inferno razed six buildings within the market and some 50 lockup shops in January 2015. Some N30 billion worth of goods was lost to the fire incident.After all this happen traders and shop owners may tend to lose their shops when it comes to land development issues. The shop owners affected by the disaster are unaware of the fate of the goods, shops and their hope is hanging on the balance.

AIM AND OBJECTIVES

The aim of the study is to assess the fire management for market in urban Kano so as to guide policy framework. This will be achieved through the following objectives;

i. To identify and describe the markets affected by fire disaster.
ii. To identify and examine the causes of fire outbreaks in Markets of Urban Kano.
iii. To examine the extent of damage by fire the Markets
iv. To examine the existing Fire Management Strategies in the Markets.

RESEARCH METHODS

Study Area

Location and Extent

Urban Kano lies between Latitude 11°25'N and 12°47'N and Longitude 08°22'E and 08°39'E. The Metropolis has eight LGAs i.e. Dala, Fagge, Nassarawa, Gwale, Tarauni, Kano Municipal, Kumbotso and Ungogo and is bordered by Minjibir LGA on the Northeast and Gezawa and Warawa LGA to the East, Dawakin Kudu LGA to the Southeast and Madobi and Tofa to the Southwest. It covers an area of approximately 500km^2. Urban Kano as one of the leading commercial and industrial Centre is therefore experiencing rapid growth rate. The total land area of metropolitan Kano was estimated at 122.75km^2 in 1966 (Abdulhamid, 2010). This increased to 154.61km^2 in 1981 and 194.72km^2 in 1995 an increase of 23.99% and 27.88% in 1981 and 1995 respectively. However, today the estimated land area of the study area is put at 500 km^2 which represent an increase of 43% (Muhammad *et al,* 2013). The study area comprises of eight local governments. These are Dala, Fagge, Nassarawa, Gwale, Tarauni, Kano municipal, Kumbotso and Ungogo.

Kano State has the highest population in Northern Nigeria with over 14 million people (Abdulhamid, 2014). Kano metropolis has been the most important commercial and industrial nerve centre of Northern Nigeria attracting millions from all parts of the country and beyond (Nabegu, 2010). The area also has a large migrant worker population, which has been increasing at the rate of 30 to 40 per cent per annum (UNDP 2004).

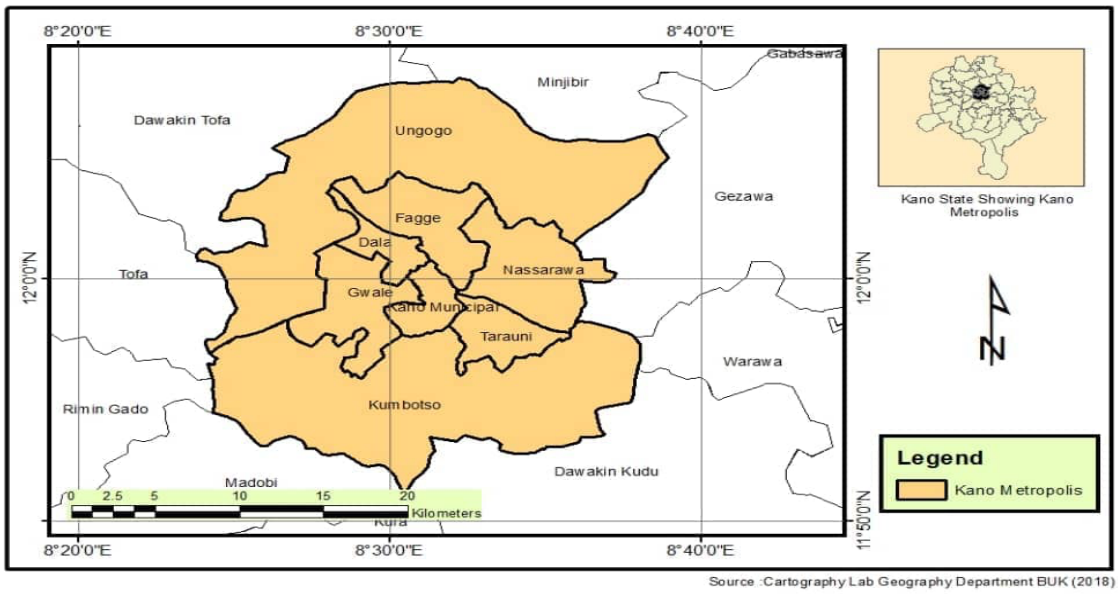


Figure 1. Urban Kano

Types and Sources of Data

This study adopts a field survey research, which is under quantitative research design. Descriptive research statistics used to study large and small population by selecting and studying samples drawn from the population, in order to find meaning about some phenomenon of the population, or obtain an understanding of the present condition of the population. In this study, researcher employs the use of questionnaire, structured interview. The two component of the study were undertaking by sequence; first, SERERA agency survey of series of fire disaster victims and estimated loss, date of occurrences as well process involve in managing the situation. In-depth interview with stakeholders, KNUPDA, Fire brigade service and market association on how the various incidence of fire outbreak happened and vulnerability as well. Second component is the questionnaire survey with businesspersons within the market that are affected with the fire disaster within the time scope.

This research used both primary and secondary data. Primary source of data was derived from questionnaire and in-depth interview surveys while secondary source of data was gotten from SERERA's document, which includes total number of victims and total estimate loss during the fire disaster in each market of occurrences.

Methods of Data Collection

Questionnaires were used to collect data from the users and operators of the commercial land in the study area. Some of the questions contained in the questionnaire include causes of fire, challenges faces market and safety measures and so on. In-depth interview was also administered to take a responses of the ministry of land Kano state, (KNUPDA), Fire brigade service, Commission Association of Market Traders on how the various incidence of fire outbreak happen, their vulnerability, their intervention, participation of outside bodies (NGOs) role, number of staff and qualification, equipment for fire prevention and control management by body concern and so on.

Research Population, Sampling and Sampling Techniques

The number of peoples affected by fire outbreak in different markets based on data collected from Commission Association of Market Traders are 11,623. This constitutes the research population for this study. On the other hand, Multi stage sampling was adopted. The first stage is purposive where markets affected by fire outbreak were selected. The second state was random sampling to select the required sample size for this study since the Association has the list of the traders. The third one was

purposive sampling technique where directors and other high-ranking officers in SERARA, KNUPDA and chairpersons of traders association in Kano State were selected.

To determine sample size of the respondents Krecie and Morgan (1970) formula was adopted as:

$$S = \frac{X^2NP(1-P)}{d^2(N-1)} + X^2P(1-P) \quad \text{(Equation 1)}$$

Where;
S= Required Sampling Size,
X^2= the table value chi-square for 1 degree of freedom at the desire confidence level (0.05= 3.841)
N= Total Number of fire disaster victims,
P= the population proportion(assume to be 0.50)
d= the of the accuracy or level of precision (0.05)

$$S = \frac{3.841(11623)0.50(1-0.50)}{0.50^2(11{,}623-1)+3.841*0.50(1-0.50)} = \frac{11160.9858}{29.055+0.96025} = \frac{1160.9858}{30.01525}$$

$$S = 371.8 \approx 372$$

The sample size of this study was found to be 372 samples based on the Krecie and Morgan sample formula. Therefore, 372 questionnaires was administered to 372 fire disaster affected people in various markets in Kano Metropolis.

The proportional allocation method proposed by Bowley (1990) was used to assign samples to the various market covered by this study. The formula is

$$ni = n * \frac{ni}{n}, nii = n * \frac{ni}{n}, niii = n * \frac{nii}{n}, niv = \frac{nv}{n} \ldots \ldots \quad \text{(Equation 2)}$$

Where:
n= number of samples allocate to market,
nii= number of total victims in each market,
n= is the total number of all victims across all markets

Table 1. Sampling Frame

S/N	MARKETS	TOTAL VICTIMS	SAMPLE ALLOCATION
1.	Singar	246	8
2.	Sabon Gari	5737	183
3.	Farm Centre	1133	36
4.	K/Ruwa Yan Katako	29	1
5.	Kwari	4232	135
6.	Kurmi	143	6
7.	Gandun Albasa	42	1
8.	K/Rogo Small Scale	61	2
Total		**11,623**	**372**

Source: SERARA document, 2018

Method of Data Analysis

Quantitatively, the descriptive statistics, which includes simple frequency counts, percentages and mean were used in the analysis of the result and to answer the research questions one and two. While research question three used Chi-square for testing the relationship between fire management and fire occurrences in market of urban Kano and finally research questions four to present the analyses the result with the aid of statistical package for social science (SPSS).

RESULT DISCUSSION

Three hundred and seventy-two (372) questionnaires were administered to the various respondents within the area of study and only three hundred and sixty-two (362) of the questionnaires were returned which is 97.3 % while ten (10) questionnaires 2.6% were not returned.

Table 2. Markets Affected by Fire in Urban Kano

S/N	MARKETS
1.	Singar
2	Sabon Gari
3	Farm Centre
4	Kofar Ruwa Yan Katako
5	Kasuwar Kurmi
6	Gadun Albasa
7	Kofar Rogo Small Scale
8	Dawanau
9	'Yan lemu
10	Galadima
11	KantinKwari
12	Kofar Wambai
13	Kurmi
14	Rimi
15	'Yankura

Source: SERARA, 2018

Spatial Distribution

Analysis of satellite imageries (2018), shows that only nine existing markets in the urban areas in Kano metropolis were used as the sampling as shown in the figure 4.1. The map in figure 4.1 was produced from the following coordinate points: Farm Centre: 11.97514, 8.54644; Bata Market: 12.00941, 8.5388, Sabon Gari Market: 12.01314, 8.53784, Singer Market: 12.00988, 8.53512, Kwari Market: 12.00404, 8.53087, Kofar Wambai Market: 12.00669, 8.52352, Kurmi Market: 12.00239, 8.51421, Fansamu GSM Market: 11.97528, 8.54702 north and east respectively.

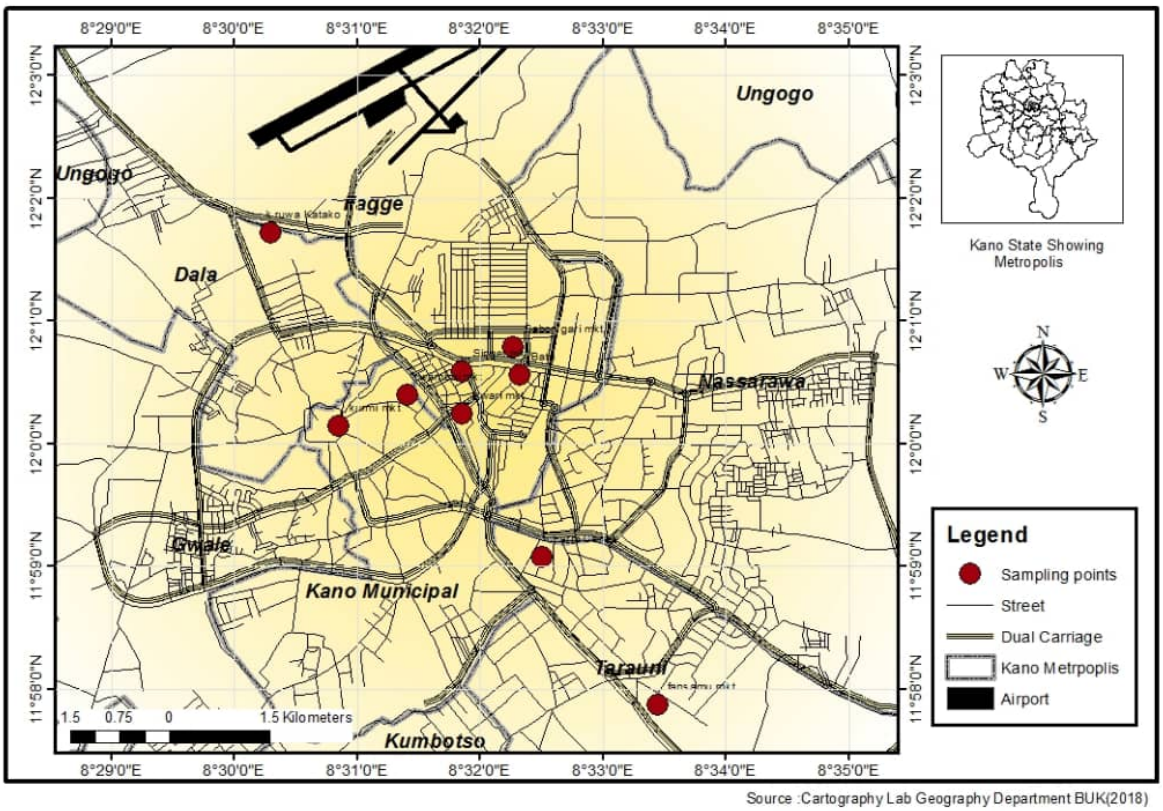


Figure 2. Satellite Imageries of Kano Urban Market (2018)

The distribution pattern as can be seen in Figure 2 is not evenly; there are more concentration of markets in the inner areas of the metropolis and less at the outskirt. The markets in the inner areas of the metropolis are mainly first and second generation markets while those at the outskirt are third generation markets. Because of urban planning ethic, however, the distribution pattern has demonstrated two contrasting images. First, the inner dense concentration of markets has demonstrated poor conception or weak application of urban planning principles along the development trend by the then institution or constituted authorities. Even though these markets have undergone series of transformation which gave them their present features, yet their concentration in almost one place could be very risky (Maigari, 2014).

It can be observed from Figure 2 that the pattern of the distribution of the markets in the study area is mostly nucleated most significantly in Nassarawa, Kumbotso, Kano Municipal, Fagge and Dala Local Governments area. This is as a result of the presence of markets. Almost all the Markets are located near or inside the Metropolitan.

Nearest Neighbour Analysis

The distribution of Urban Markets in Kano Metropolis is not even which is influenced by differences in land uses. As for the study area, the distribution of Urban Market is influenced by commercial and transport activities. The pattern of the distribution of Urban Market is dispersed as discussed below

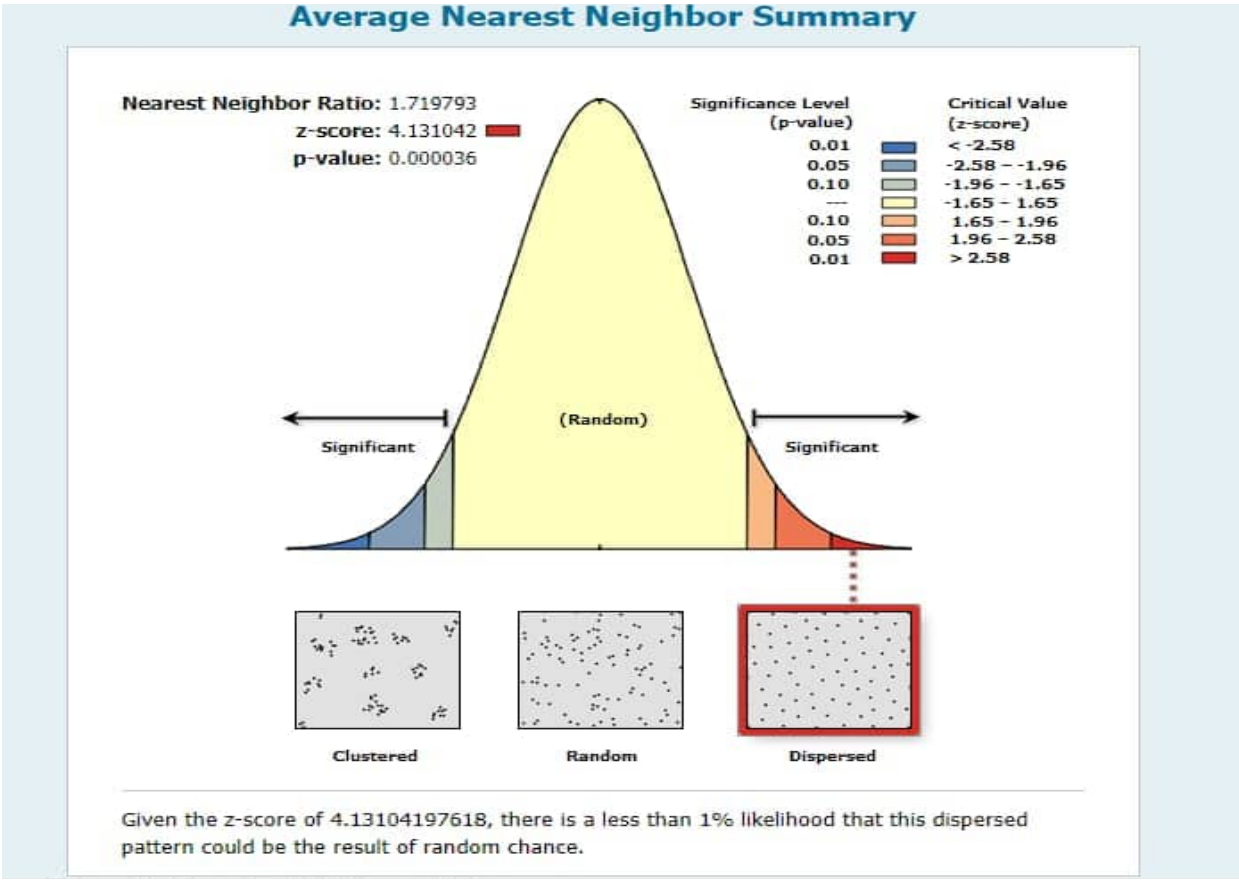


Figure 3. Nearest Neighbour analysis of the study area

From the above, it can be observed that in Nearest Neighbour Index (NNI) is greater than 1 which is 1.719 and Z score is 4.131 which is greater than 2.58. In addition, the pattern is differs significantly from random at both 95 and 99% level of significance (P=0.00001). This means that the distribution pattern of the urban market is disperse with high concentration of the urban market in some specific areas. This is because most of the urban markets are concentrated within Kano Metropolitan.

This study was conducted to investigate the trend of fire incidents in Urban Market in Kano during an 8-year periods (2010 to 2018). The study covered eight markets in Kano, with emphasis on areas where fire incidents have occurred frequently. The total numbers of incidents as well the number of deaths for each region was also considered. It must be noted that only reported fire incidents were considered in this study. There might have been several unreported fire incidents throughout the country for which estimates are not available, and hence are not considered in this study.

Table 3 and Figure 4 illustrate the number of fire incidents that have occurred in Kano from 2010 to 2018. It can be seen from the figure that in 2010 to 2014, the rate of fire incidence was almost the same, but there was a sharp increase from 2011 to 2018. The reason for this constant rate of fire incidents could be a result of the constant supply of electricity in the country throughout those years. As explained in the Introduction section, electrical related problems are the leading cause of domestic fires, resulting from old wiring, poor wiring, overloading of electrical circuits, heating appliances, etc. From 2011 to 2014, the country has grappled with a series of energy crises that led to an unstable supply of electricity. This unstable electricity supply generates a constant ignition source that can ignite flammable gases because most gases have minimum ignition energy of less than 1 mJ. For example, LPG (Liquefied Petroleum Gas), which is one of the main sources of cooking fuel in the country, can cause fire if there is any accidental leakage, from which a combustible atmosphere is created and with electrical spark as the ignition source.

Table 3. Fire Incident that have occurred in Kano from 2010 to 2018

S/N	Markets	Years									Frequency	Percentage
		2010	2011	2012	2013	2014	2015	2016	2017	2018		
1.	Singar					2		1	1		4	10.3
2.	S/Gari	1	2		1		1				5	12.8
3.	F/Centre						1	1			2	5.1
4.	K/Ruwa Yan Katako					1					1	2.6
5.	Kwari	2				1			1		4	10.3
6.	Kurmi	2	4		1		2	2	3	3	17	43.6
7.	K/Wambai		1			1			1	2	5	12.8
8.	Bata Market			1							1	2.6
Total		**5**	**5**	**3**	**2**	**5**	**3**	**5**	**6**	**5**	**39**	**100**

Source: Field Work (2018)

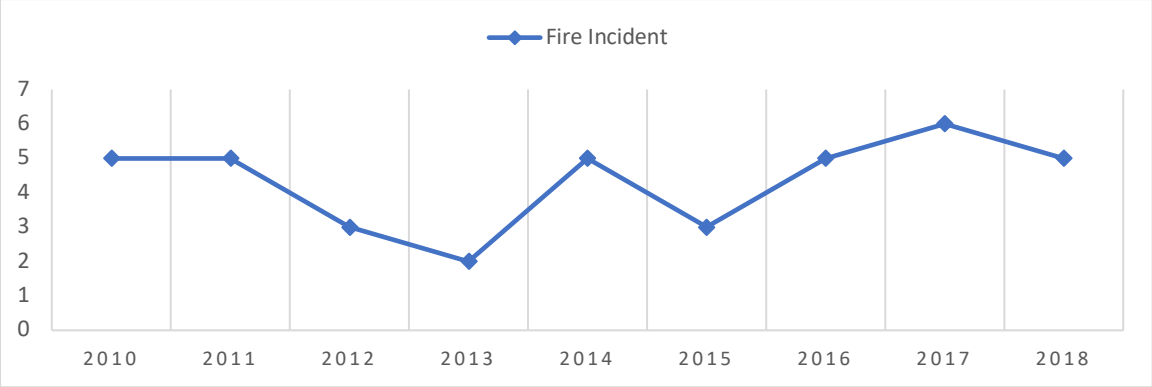


Figure 4. Fire Incident of Urban Market in Kano

Moreover, the causes of fire in Kano Central Market, noted that power fluctuations accounted for 26% of the total fire incidents in markets. However, the following causes are underscored (with percentage): cooking with naked fire in the market, 19%; overloading of electrical appliances, 16%; improper and old electrical wiring system, 13%; illegal tapping of electrical power from the national grid, 11%; use of substandard electrical materials, 8%; and use of defective generators, 7%. Highlighted the extent of severity of fire disaster due to congested situations in this market, as shown in Figure 7. As markets do not have proper layouts, accessibility by fire tenders is always difficult when there is a fire outbreak because every major market in Kano faces the problem of congestion. For this reason, fire hydrants have been obscured by stalls, and lanes that fire trucks need to use to access the markets are converted into stalls, etc. All of these factors come together to cause the kind of destruction that occurs during such outbreaks of fire. The typical result of these outbreaks is the destruction of goods and structures whose costs run into thousands of Kano. These losses always become a burden for the traders because they do not have fire insurance to compensate for their losses.

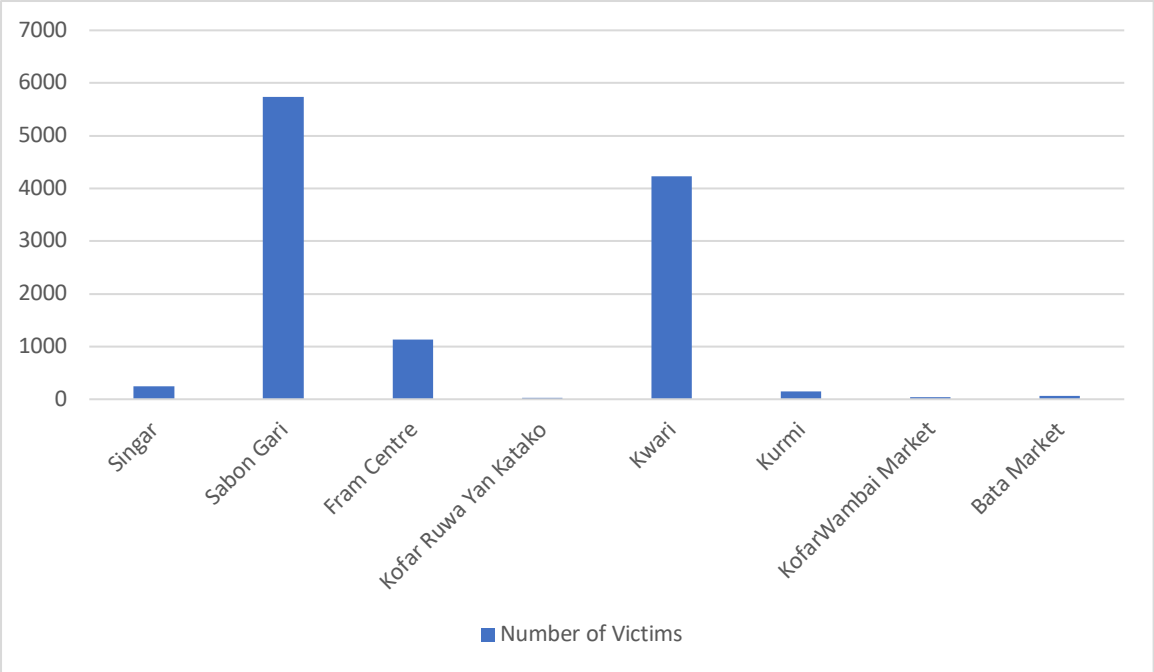


Figure 5. Bar Chart of Number of Victims

The Causes of Fire Outbreaks in Markets of Urban Kano

Socioeconomic Characteristics of the Respondents

Table 4 presents the socioeconomic characteristics of the market owners. These include Gender, age, marital status, educational status, nationality, state of origin and LGA.

Table 4. Socioeconomic Characteristics of the Respondents

Sex of Respondents	**Frequency**	**Percent**
Male	328	90.6
Female	34	9.4
Total	**362**	**100**

Age of Respondents	**Frequency**	**Percent**
10-20	32	8.8
21-30	170	47
31-40	97	26.8
41-50	46	12.7
51 to above	11	3.0
Total	**360**	**99.4**
No Response	6	1.7
	362	**100.0**

Marital Status	**Frequency**	**Percent**
Married	228	63
Unmarried	123	34
Divorced	11	3.04

Total	**362**	**100.0**
Educational Status	**Frequency**	**Percent**
Primary education	7	1.9
Secondary education	48	13.3
Tertiary education	227	62.7
Qur'anic education	80	22.1
Total	**362**	**100.0**

Source: Questionnaire Survey, 2018

In table 4.1, out of the 362 marketers that responded to the questionnaire, 90.6% are male headed while 9.4% are female, and the rest 1.8% did not respond to the question. In relation to the ages of the respondents, 8.8% were between 10 and 20 years, 47% were between 21 and 30 years and 26.8% were between 21 and 40 years. Also, 12.7% were between 41 and 50 years while 3.0% were between 51 years and above. The study also indicated that 1.7 % did not respond to the questions. The marital status indicated that 63% of the respondents were married while 34% were single. Also, 3.04% were devoiced. With regards to educational qualification, majority of the sampled population were educated as 62.7% of the respondents had attended Tertiary education and 13.3% had obtained Secondary education while 1.9% had attained Primary education and 22.1% had attend Qur'anic education.

The causes of fire outbreaks

Because of congestion in these areas, most marketers have resorted to illegal electrical connections, which have been identified as one of the major causes of shack fires, thus contributing to the marketer's vulnerability to fires. This is because the electricity provided to marketer in such localities comes from unapproved sources.

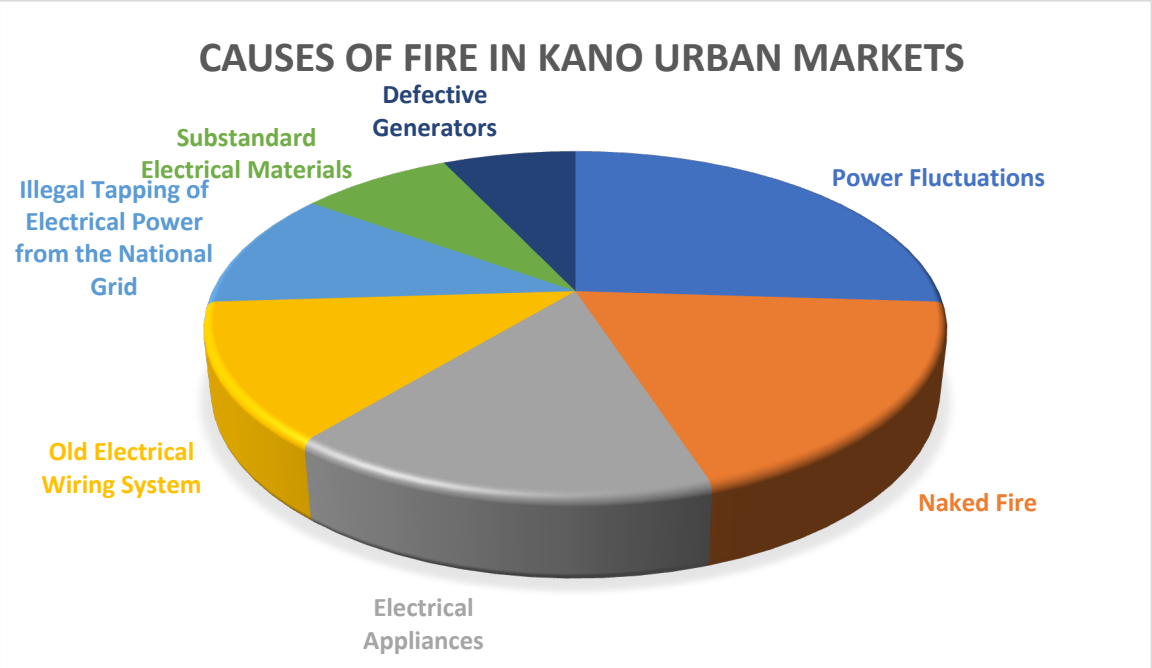


Figure 6. Causes of Fire in Kano Urban Markets

Extent of Damage by Fire out Breaks in the Markets

The property lost or damaged in urban market fire outbreak

Table 5. Properties Damages

Properties	Frequency	Percent
Money	146	39.4
Stock	53	14.6
Shop	58	16.0
Stall	50	13.8
Other	55	15.2
Total	362	100.0

Table 5 Show the extent of damage items ranging from Money, Shop, Stock and Stall in Urban Markets of Kano metropolis are 58 (16%) Shops were damage, Money were also damaged with 146 (39.4%), Stock of 53 (14.6%) and Stall of 50 (13.8%) were all damaged and other items damaged covered 55 (15.2%).

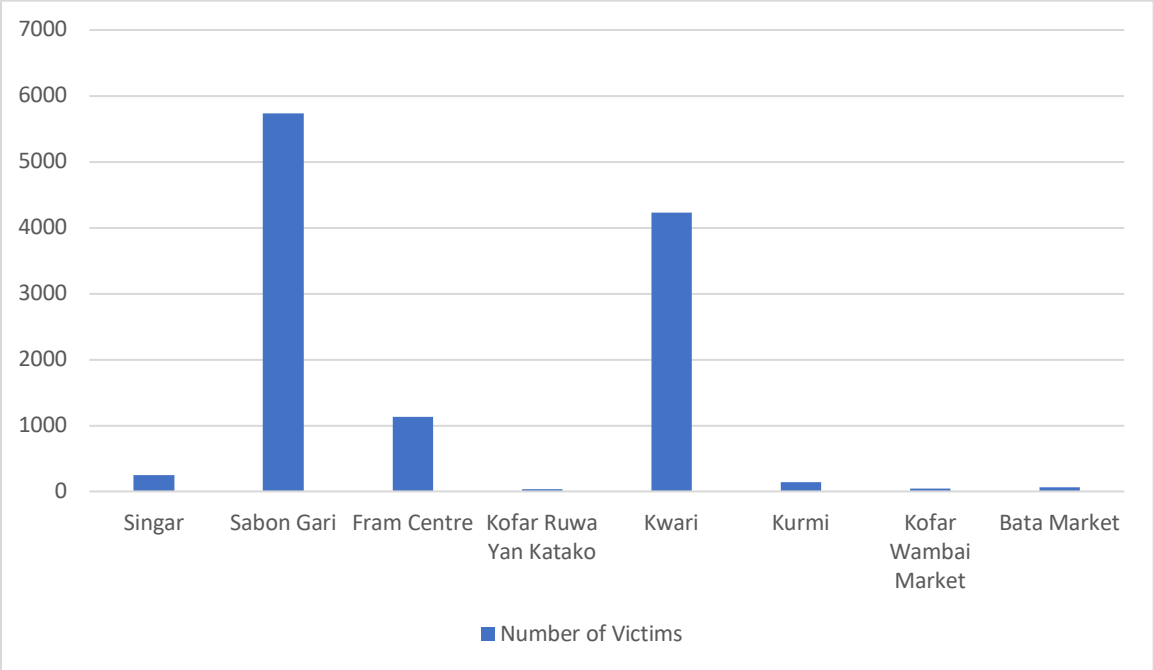
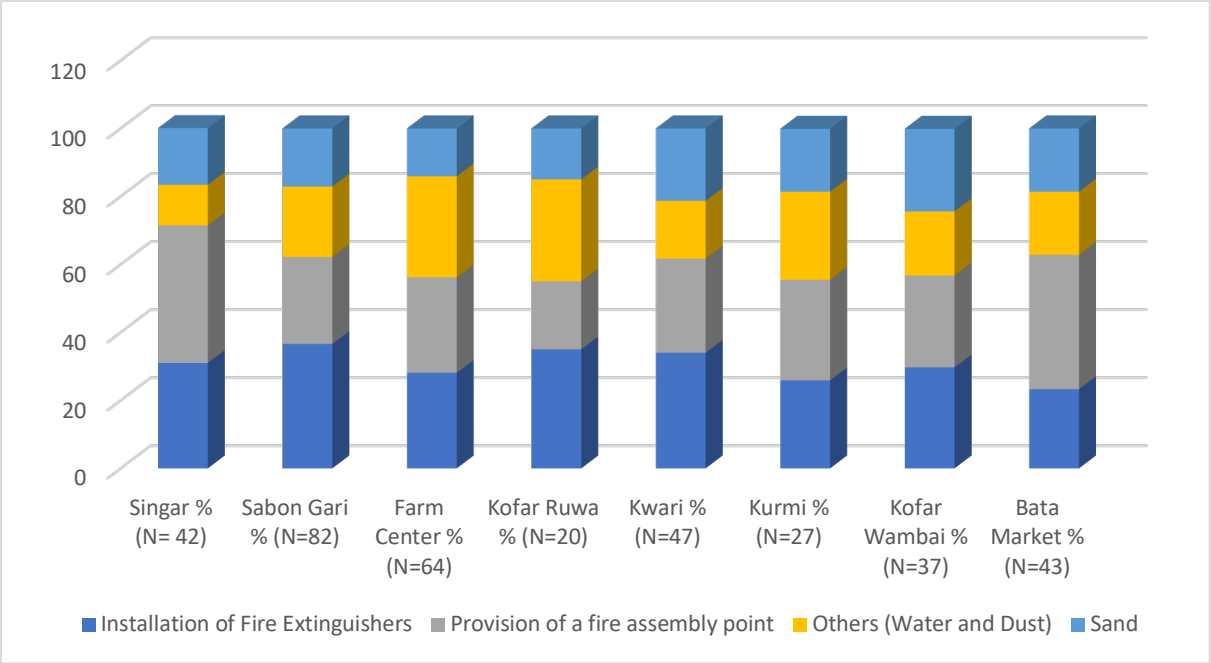


Figure 7. Bar Chart of Number of Victims

Based on markets, Sabon gari recorded the highest victims of fire outbreaks, followed by Kantin kwari, Farm center; with Kofar Wambai and Kofar ruwa yan katako have the lowest victims.

Responses to Fire

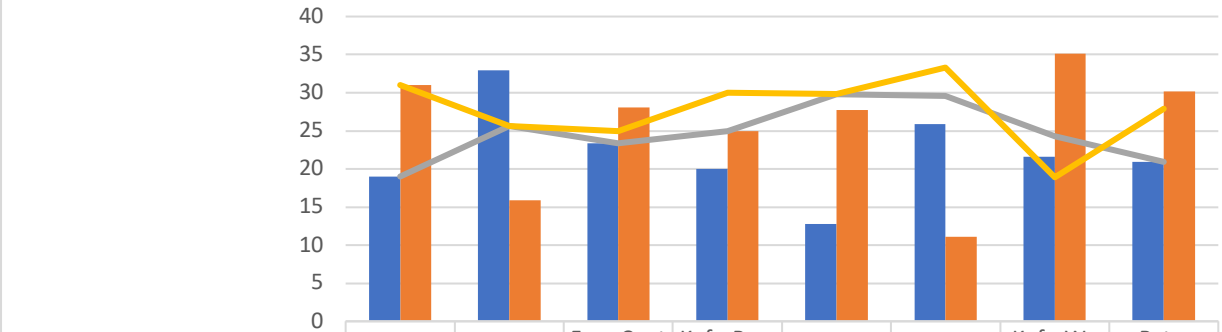


Source: Field Survey, 2018

Figure 8. Responses to Fire by the respondents

Based on the fig. 8 above, it is found out that 39.5% believed that furnishing fire assembly point will reduce and minimize the damage that might occur when conflagration happened, followed by installation of fire extinguishers in the markets especially in Singar market. While using sand carries 18.6% with Kofar wambai and Kwari market believed mostly with this. On the other hand, Kwari and Kurmi markets responded that keeping water and sand will minimize the effects of fire outbreak in the markets. But all the respondents, did not bring prevention measures but rather measures during the event.

Table 6. Immediate Response to Fire Outbreak

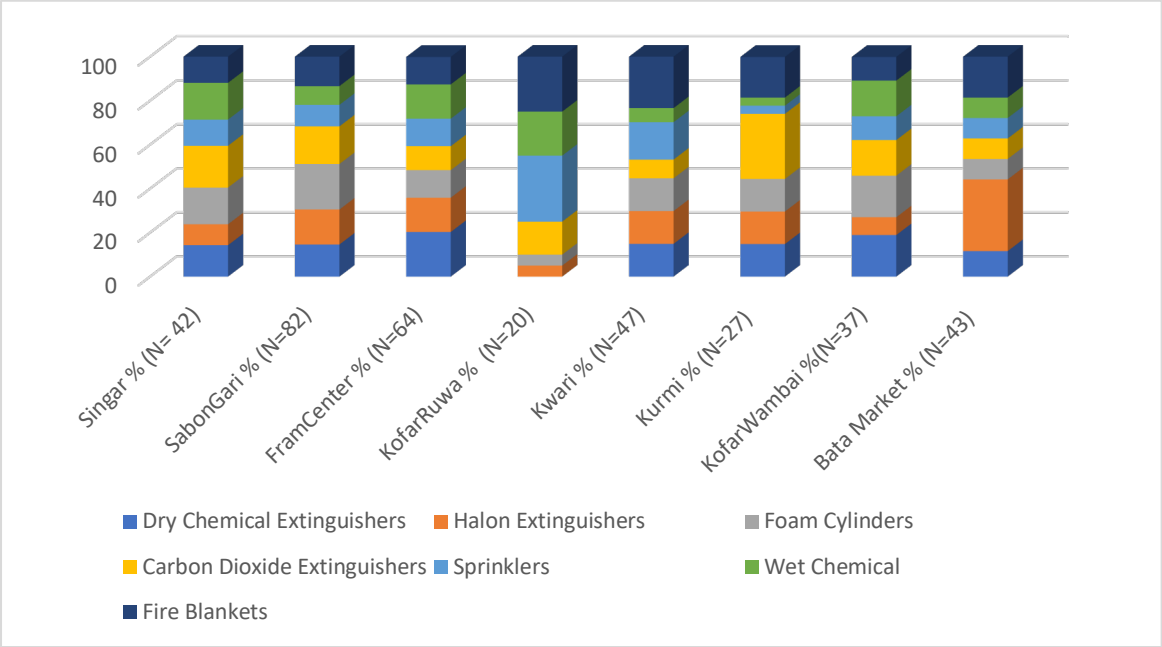


	Singar % (N= 42)	SabonGari % (N=82)	FramCenter % (N=64)	KofarRuwa % (N=20)	Kwari % (N=47)	Kurmi % (N=27)	KofarWambai %(N=37)	Bata Market % (N=43)
Call the fire brigade	19	32.9	23.4	20	12.8	25.9	21.6	20.9
Rescue business items	31	15.9	28.1	25	27.7	11.1	35.1	30.2
Try and put out the fire	19	25.6	23.4	25	29.8	29.6	24.3	20.9
Others	31	25.6	25	30	29.8	33.3	18.9	27.9

Source: Field Survey, 2018

Based on the above table, it is indicated that the immediate response in Sabon gari market was calling fire brigade, rescue items was the immediate response in Singar, Kofar Wambai, Farm center, and Bata markets. The lowest response to the immediate response was try and put out the fire.

Table: 7. Fire Fighting Equipment



Source: Field Questionnaire, 2018

The most common equipment of fighting fire outbreak was: dry chemical extinguisher, form cylinder, wet chemical, sprinklers, fire blanket, carbon dioxide extinguisher, foam cylinders and halon extinguisher in Singar, Sabon gari, Farm center, Kofar ruwa, kwari, Kurmi, and Kofar Wambai respectively.

CONCLUSION

This study examined the analysing fire outbreak in urban Kano market. The markets were distributed based on population concentration in an area; that is why there are markets within the metropolitan and few outskirts. It was concluded that the most common causes of fire outbreaks in these markets was electricity, which claimed lives and properties of affected people. The immediate action taken by traders when fire outbreak is evacuation of their properties before start calling fire brigade. However, there is more equipment for fire outbreaks in these markets, but in small quantity.

RECOMMENDATIONS

Based on the findings of this research, the following recommendations are given:

1- The congested markets, especially the inner zone markets the Governments should decongested and plan adequately for the markets;

2. Utilities such as water supply; electric power; sanitary facilities; and fire and safety facilities should be put in place;

3. Markets generally, should be included in the economic development plan of Kano State;

4. Environmental management system should be put in place in order to mitigate the current detrimental activities (fire outbreak).

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