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## A Study of Fire Safety within Kariobangi Light Industries

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### **Abstract:**

*The aim of the research was to study fire safety within Kariobangi Light Industries, Nairobi County, Kenya. This industrial cluster is characterized by poor infrastructure and numerous concrete buildings which house small to medium scale enterprise industries in go downs on the ground floor and low-income residential apartments on the floors above. Specifically, the research sought to assess fire safety awareness among the business community operating within the industrial cluster. Purposive sampling was used to select the industries licensed to operate therein in the year 2014. The Bivariate Pearson correlation analysis shows that there is a significant positive correlation between fire safety awareness among the business community and their implementation of the same ( $p = .000$ ). The linear regression analysis results showed that fire safety awareness impacts significantly on the implementation of fire safety ( $p = .000$ ). It can therefore, be concluded that fire safety awareness among the business community is vital in the improvement of fire safety standards within the industrial cluster. The study recommends that the Nairobi Fire Services and (or) the Directorate of Occupational Safety and Health Services should implement fire safety awareness programs to benefit the business community.*

**Keywords:** Implementation of fire safety, fire safety, fire safety awareness

### **1. Introduction**

Fire disasters are very common in Kenyan slums and informal settlements that are home to the majority of urban residents in the major cities and towns. Informal settlements and slums are usually as a result of the tenacious need for shelter by the urban poor who; due to their social and economic status, cannot get better formal housing (Shaluf, Hamden & Said, 2003). Majority of these fires can be predicted and the required control measures put in place to prevent their occurrence or reduce their adverse impacts on the community. Kariobangi Light Industries is an industrial cluster typical of high population densities, poor settlement and various concrete structures with little to medium commercial ventures in godowns on the ground floors and low-wage private flats on the floors above. This characteristic feature makes Kariobangi Light Industries a cluster of immense concern when it comes to fire hazards and safety. There is a need for active and pre-emptive intervention from all stakeholders in reducing fire risks within Kariobangi Light Industries, which can be very effective in improving the quality of life for its occupants. Strict enforcement of the Occupational Safety and Health Act, 2007 and the Factories and Other Places of Work (Fire Risk Reduction) Rules, 2007 and other relevant rules and legislation within the industrial cluster will ensure gains in fire safety made will benefit current and future generations.

### **2. Materials and Methods**

#### *2.1. Study Design*

The study applied a descriptive research employing cross sectional survey design. It was used to report on the condition of fire safety within Kariobangi Light Industries.

#### *2.2. Study Area and Population*

The study area was Kariobangi Light Industries which lies in the North and Eastern parts of Kariobangi North estate, Nairobi, Kenya. The study population comprised of the enterprises within Kariobangi Light Industries.

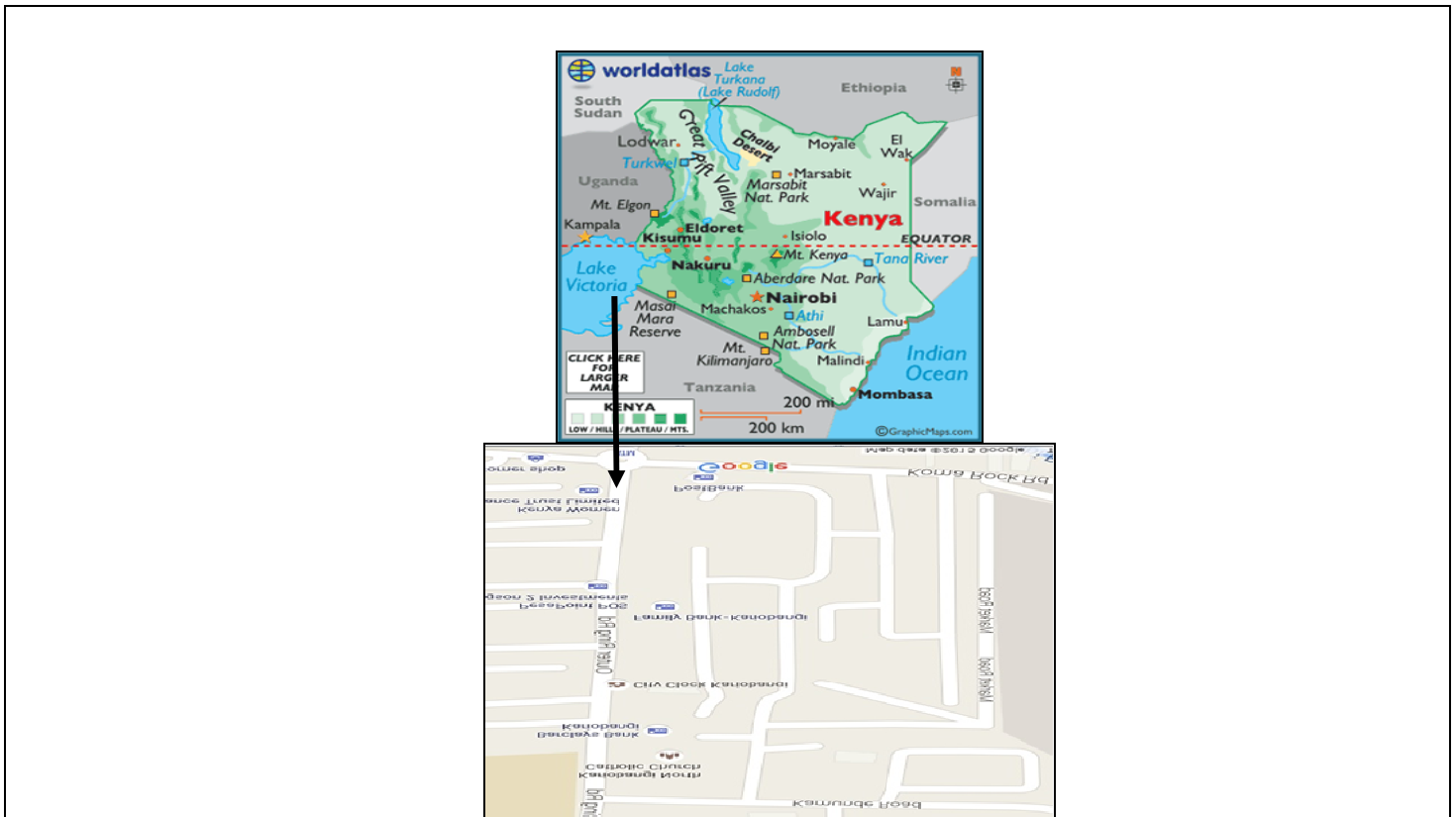


Figure 1: Map of study area Enclosed: map of Kenya displaying location of study area. Source: Google maps

### 2.3. Sampling Method

Purposive sampling was used to select Kariobangi Light Industries as the sample area. For the purpose of this study, only licensed industries were considered.

### 2.4. Sample Size Determination

In determining the sample size, the researcher purposively narrowed down to the licensed enterprises as per the Nairobi City County Licensing Department records of 2014. All the licensed enterprises formed 100% of the sample. The researcher also restricted the interviewees to comprise of the business owners or their appointed representatives in the 30 licensed enterprises.

### 2.5. Research Instruments

#### 2.5.1. Questionnaires

Quantitative data was collected using a structured questionnaire. They offered the researcher with data on the socio-demographic characteristics of the respondents and fire safety awareness data of the respondents.

#### 2.5.2. Interviews

The researcher conducted unstructured interviews with the respondents. The interviews provided valuable qualitative data on the respondents' point of view on certain aspects pertaining to fire safety awareness.

### 2.6. Data Processing and Analysis

The finished questionnaires were improved for comprehensiveness and uniformity, checked for mistakes and oversights and then coded and evaluated qualitatively and quantitatively. Qualitatively the data was summarized into topics in line with the researchers' specific objectives. This allowed the researcher to make overall declarations in terms of the witnessed characteristics hence conceptualization. Quantitative data from the questionnaires was summarized, coded, tabulated and analyzed. Editing was done to improve the validity of data for coding. Coded data was fed into the statistical package for social sciences (SPSS) version 20. Descriptive statistics such as cumulative percentages, mean and standard deviation were generated for the independent study variable. Bivariate Pearson's Correlation analysis of the study variables was used to determine the relationship between the variables while a linear regression analysis was used to determine the significance of the independent variable; fire safety awareness, and how it influences implementation of fire safety; the dependent variable.

### 3. Results and Discussions

The researcher visited 29 industries which constituted 96.66% of the sample population. All respondents returned their questionnaires. Table 1 and Figure 2 below shows the distribution of the enterprises visited based on their description of business activity. The highest percentage of enterprises are involved in the manufacture and sale of paints, thinners and adhesives 44.8%.

Business Activity Description					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Assembling of mattresses	2	6.9	6.9	6.9
	Cartons manufacturing	1	3.4	3.4	10.3
	General engineering repair	1	3.4	3.4	13.8
	Manufacture of paints, thinners and adhesives	13	44.8	44.8	58.6
	Manufacture of plastic products	3	10.3	10.3	69.0
	Manufacture of steel structures	1	3.4	3.4	72.4
	Bakery	1	3.4	3.4	75.9
	Manufacture of shoe polishes, creams and leather dyes	2	6.9	6.9	82.8
	Manufacture of cosmetics	4	13.8	13.8	96.6
	Manufacture of popcorn, crisps and peanut butter	1	3.4	3.4	100.0
	Total	29	100.0	100.0	

Table 1: Distribution of Enterprises based on Their Business Activity

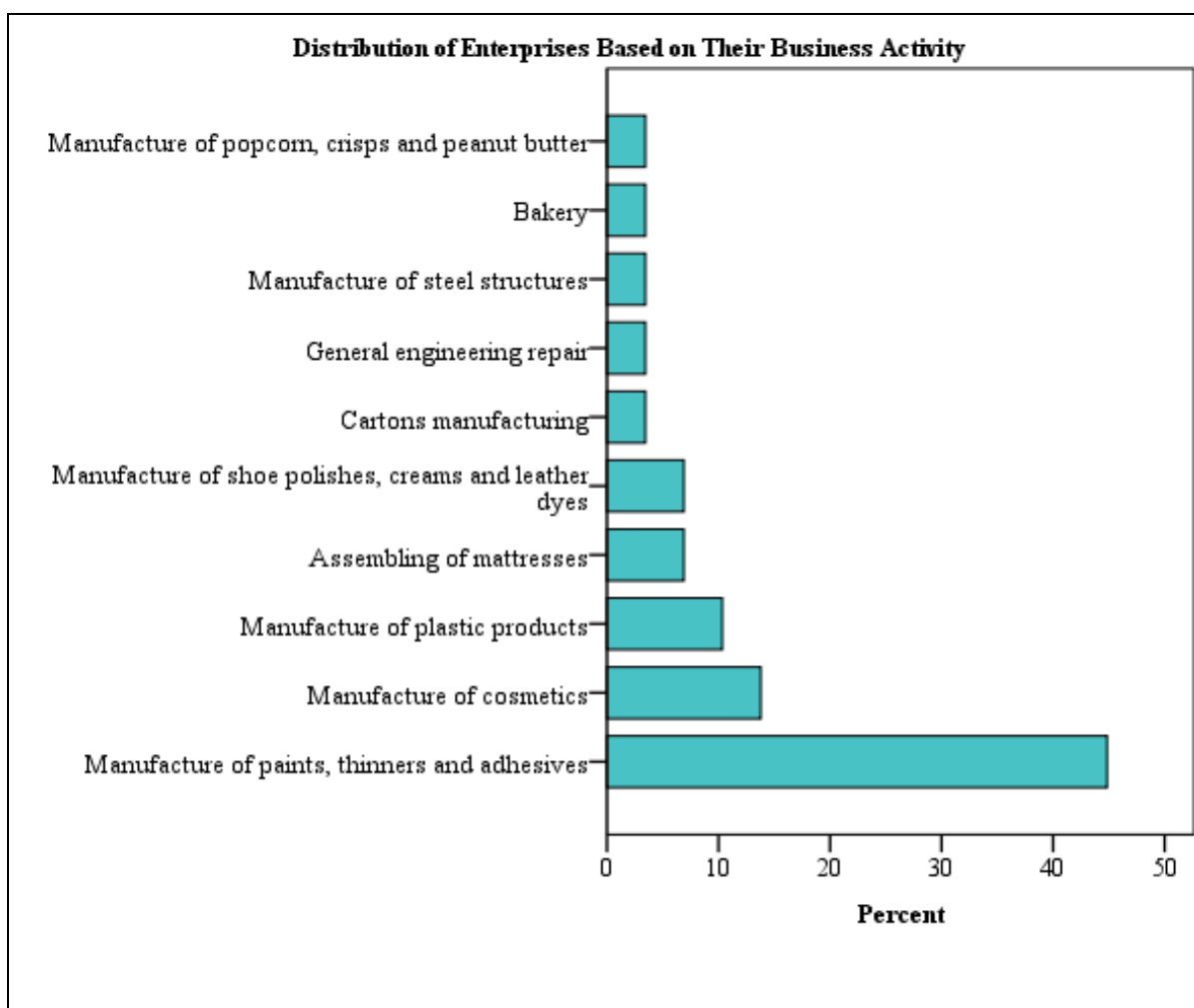


Figure 2: Distribution of sampled enterprises by their business activity

### 3.2. Social-demographic characteristics

#### 3.2.1 Distribution of Respondents by Gender

68.97% of the respondents were males while 31.03% were females. This study findings agree with the outcomes of a study by Olabisi, Olagbemi&Atere (N.D) on a gender based analysis of factors affecting small-scale commercial performance in informal economy in Lagos-State Nigeria. The study sought to determine if there is difference between factors prompting small scale business performance among the female- owned enterprise and male-owned enterprises in informal economy in Lagos state, Nigeria. Male respondents (business owners) were 54% and female respondents (business owners) were 46% (Olabisi, Olagbemi&Atere, N.D).

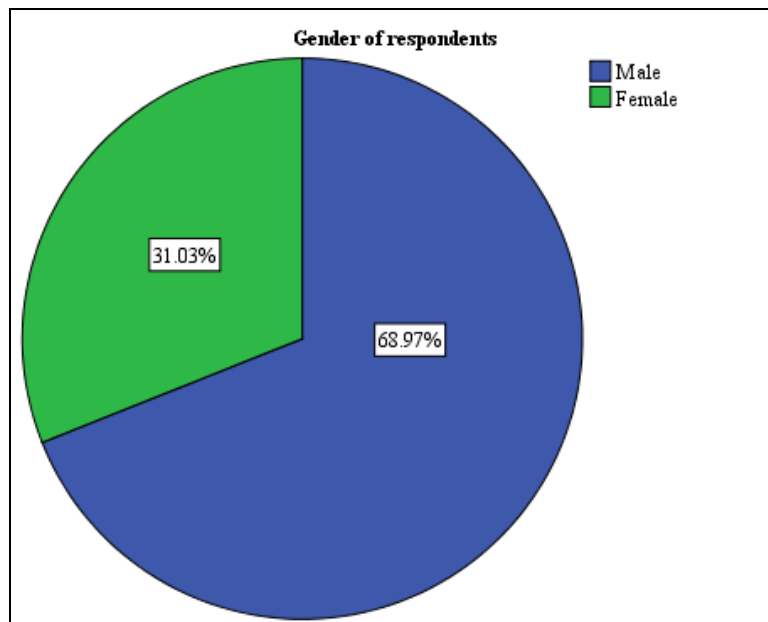


Figure 3: Distribution of respondents by their gender

#### 3.2.2 Distribution by Duration of Operation

The respondents were asked to specify the number of years they have been operating at Kariobangi Light Industries and the findings are presented in Figure 4 below. Greater than 50% of the sampled enterprises had been in operation for greater than 10 years. The findings of this research are in line with the outcomes of a study by Fatoki (2013) on the determinants of longevity of micro enterprises in South Africa in which majority of the sampled enterprises (43.80%) were 10 – 15 years in operation (Fatoki, 2013).

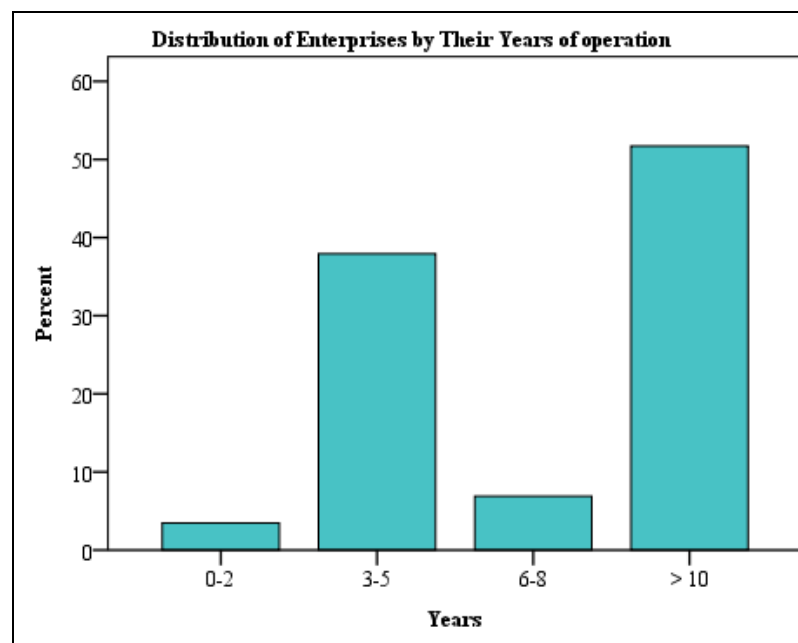


Figure 4: Distribution of enterprises by duration of operation within Kariobangi Light Industries

3.2.3. Distribution by Level of Education

The respondents were asked to indicate their level of education. The findings are presented in Figure 5 below. Majority of the respondents (41.38%) had attained a secondary education. These findings are in line with those of a study by Nathan Associates and TNS (2014) for Financial Sector Deepening Uganda (FSDU) which found that owners of micro, small and medium enterprises (MSMEs) in Uganda are fairly well-learned. Above half have secondary education or higher (Nathan Associates & TNS, 2014).

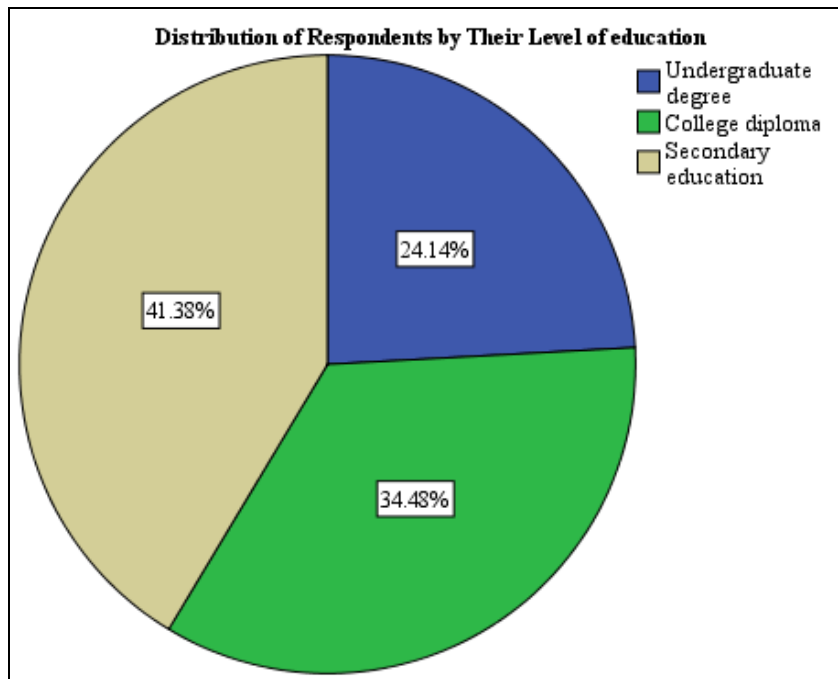


Figure 5: Distribution of respondents by their level of education

3.3. Implementation of Fire Safety

In this section the study sought to find out to what extent the respondents perceived they implement fire safety at their respective enterprises. The researcher used a five point Likert scale and the findings are presented in Figure 6 below. The majority of respondents implied that they rarely implement fire safety (34.48%) in their respective enterprises. The respondents perceived that provision of firefighting equipment was vital in the implementation of fire safety.

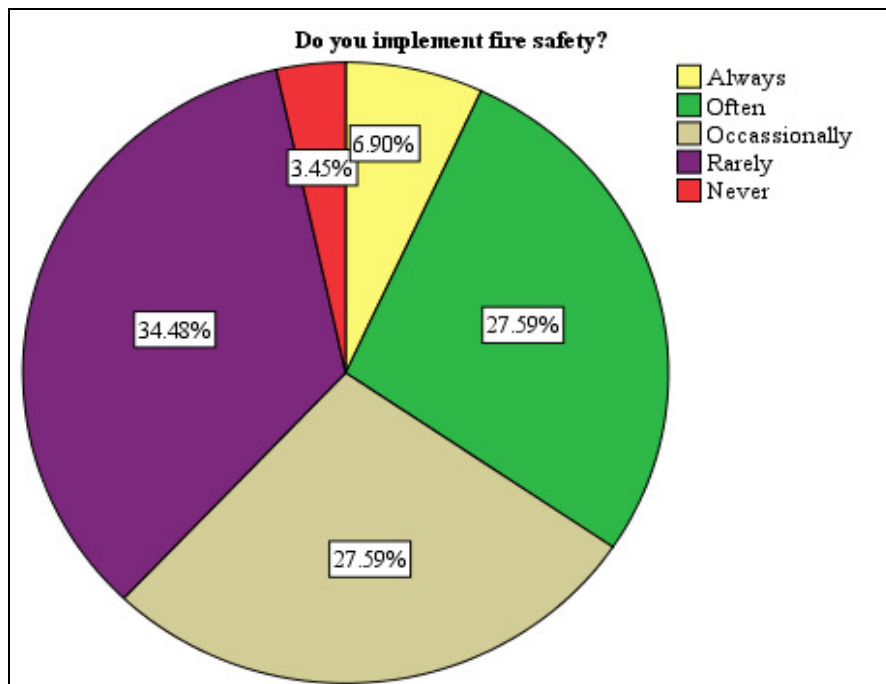


Figure 6: Respondents perception on their implementation of fire safety

### 3.4. Fire safety Awareness among the Business Community Operating within Kariobangi Light Industries

In this section the study sought to assess fire safety awareness among the business community operating within Kariobangi Light Industries. Fire safety awareness was assessed by filling of a well-structured questionnaire.

#### 3.4.1. Fire Safety Policy

The researcher sought to find out if the enterprises had a fire safety policy in line with the requirements of Section 34 of the Factories and Other Places of Work (Fire Risk Reduction) Rules, 2007. 31.0% of the respondents indicated they had a fire safety policy but the policy was not availed to the researcher on request nor was it posted within the workplace. Some respondents also had the perception that having fire extinguishers at the workplace is the fire safety policy. 51.7% of the respondents were not aware of what a fire safety policy is nor its contents.

Fire safety policy available at the workplace?					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	9	31.0	31.0	31.0
	No	5	17.2	17.2	48.3
	Not aware	15	51.7	51.7	100.0
	Total	29	100.0	100.0	

Table 2: Availability of fire safety policies in the sampled enterprises

#### 3.4.2. Fire Safety Audits

The respondents were asked if they undertake annual fire safety audits in line with the requirements of Section 36 of the Factories and Other Places of Work (Fire Risk Reduction) Rules, 2007. 31.0% of the respondents indicated they undertake annual fire safety audits but fire safety audit reports were not availed to the researcher on request; except in one enterprise. 41.4% of the respondents were not aware of the requirement to carry out annual fire safety audits by a registered fire safety auditor.

Fire safety audits undertaken at the workplace?					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	9	31.0	31.0	31.0
	No	8	27.6	27.6	58.6
	Not aware	12	41.4	41.4	100.0
	Total	29	100.0	100.0	

Table 3: Respondents undertaking annual fire safety audits

#### 3.4.3. Fire Safety Awareness General Findings

In the subsequent section on assessing fire safety awareness, the researcher used a five point Likert scale and the responses ranged from 5 = very great extent, 4 = great extent, 3 = moderate extent, 2 = little extent to 1 = no extent. The study findings are presented in table 4 below.

	No extent	Little extent	Moderate extent	Great extent	Very great extent
There is an established firefighting team?	55.2%	17.2%	6.9%	10.3%	10.3%
The firefighting team is trained?	62.1%	10.3%	13.8%	3.4%	10.3%
All workers have been instructed on the safe use of fire extinguishers?	31.0%	31.0%	13.8%	10.3%	13.8%
There are fire action signs?	55.2%	31.0%	0.0%	3.4%	10.3%
You undertake annual fire drills?	86.2%	3.4%	3.4%	6.9%	0.0%
You have arrangements to call for emergency services in case of fire?	3.4%	17.2%	20.7%	44.8%	13.8%
Smoking is prohibited at the workplace?	3.4%	3.4%	3.4%	13.8%	75.9%
'No Smoking' signs have been put up?	44.8%	17.2%	0.0%	20.7%	17.2%
A smoking zone with an appropriate ashtray has been provided?	89.7%	0.0%	3.4%	6.9%	0.0%
First aid facilities are available?	0.0%	24.1%	27.6%	41.4%	6.9%
Transport for injured persons is available?	10.3%	0.0%	10.3%	48.3%	31.0%
Fire assembly point identified and marked?	86.2%	6.9%	0.0%	6.9%	0.0%

Table 4: Fire safety awareness of respondents within the sampled enterprises

Most outstanding findings on fire safety awareness were that a substantial percentage of respondents indicated they had instructed/trained all workers on the safe use of fire fighting equipment while a significant number indicated that there was a trained fire fighting team available at the workplace. However, the researcher's observations on the handling and condition of fire fighting equipment and deficiency in the selection and distribution of fire fighting equipment in some of the enterprises are a clear indication that the respondents were not conversant with the basics of fire safety and fire fighting equipment. Most evident inadequacies were the provision of foam fire extinguisher at a generator room, provision of dry powder fire extinguisher at a deep fat fryer, provision of water hose reels as the only fire fighting appliance in an enterprise handling paints and provision of fire fighting equipment at a distance from the hazard areas.

Fire action signs to inform workers and other building occupants of what to do in case of a fire were basically not available. The respondents indicated that they do not undertake fire drills and majority of them were not conversant with the term 'fire drill' or what it entails. Fire assembly points were also not available in the sampled enterprises. The respondents cited lack of a suitable space where workers can assemble while other respondents cited having few employees as the reason why they do not comprehend the need for an emergency assembly point. These findings all relate significantly as fire action signs serve to advise the building occupants on what to do in case of a fire. The fire drills seek to practice the fire action instructions and a key feature in the fire action signs is the fire assembly point where the building occupants will assemble.

Smoking is a leading cause of workplace fires, the respondents indicated that smoking is greatly prohibited. However, 'No Smoking' signs have considerably not been provided within the sampled enterprises and smoking employees or visitors to the sampled enterprises have not been provided with a smoking zone equipped with an appropriate ash tray. Lack of suitable space to put up the smoking zones was cited by majority of the respondents while some respondents emphasized that it was the duty of the Nairobi City County to provide and maintain the smoking zones.

The respondents indicated they had provided first aid facilities at their workplaces. However, the researcher observed that in some enterprises, first aid kits were not provided while in some the first aid kits were empty or had either expired provisions. Certificates of trained first aiders were also not availed to the researcher on request in the sampled enterprises. The respondent indicated that they had made arrangements to call for emergency services in case of a fire; however, none of the respondents had contacts of the Nairobi Fire Services or a contracted fire company. The respondents also explicated they were not aware of where to obtain the contacts.

#### 3.4.4. Pearson Correlation Analysis between Implementation of Fire Safety and Fire Safety Awareness of the Respondents

A Pearson correlation analysis between fire safety awareness of the business respondents and their implementation of fire safety was determined. A significant positive correlation interprets that as the respondents' awareness of fire safety increases, implementation of fire safety will equally increase. P value < 0.05.  $r(27) = .718^{**}$ ,  $p = .000$ . It also infers that the findings of the sample apply to the population.

Correlations			
		Do you implement fire safety?	Fire safety awareness of respondents
Do you implement fire safety?	Pearson Correlation	1	.718 <sup>**</sup>
	Sig. (2-tailed)		.000
	N	29	29
Fire safety awareness of respondents	Pearson Correlation	.718 <sup>**</sup>	1
	Sig. (2-tailed)	.000	
	N	29	29

\*\*. Correlation is significant at the 0.01 level (2-tailed).

Table 5: Pearson correlation between implementation of fire safety and fire safety awareness

This study findings agree with the inference made by Makachia (2013) who sought to establish the standing of fire safety in particular public and private universities in Kenya with reference to the Factories and Other Places of Work (Fire Risk Reduction) Rules, 2007. The study established that the lack of awareness on the legal requirements of the Factories and Other Places of Work (Fire Risk Reduction) Rules, 2007 has contributed meaningfully to the low fire safety standards in Kenya's universities. These Rules provide for awareness creation on fire safety at the workplace through; among other ways, constituting and training of firefighting teams, training all workers on the safe use of fire extinguishers, undertaking fire drills, mounting of notices within the workplace to warn occupants of imminent fire risks, establishing of written fire safety policies and undertaking of annual fire safety audits.

#### 3.4.5. Linear Regression Analysis between the Dependent and Independent Variable

Table 6 below shows the variables utilized in this study. The independent variable in the study is fire safety awareness of the respondents and the dependent variable is implementation of fire safety.

Variables Entered/Removed <sup>a</sup>			
Model	Variables Entered	Variables Removed	Method
	Fire safety awareness of respondents <sup>b</sup>	.	Enter
a. Dependent Variable: Do you implement fire safety?			
b. All requested variables entered.			

Table 6: Variables used in the linear regression

Model Summary				
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
	.718 <sup>a</sup>	.515	.497	.73412
a. Predictors: (Constant), Fire safety awareness of respondents				

Table 7: Model summary in the linear regression analysis

Table 7 above shows the variation in the dependent variable due to changes in the independent variable. R square = .515 therefore, fire safety awareness of the respondent's accounts for 51.5 % of the variations in the implementation of fire safety within Kariobangi Light Industries.

Coefficients <sup>a</sup>					
Model		Unstandardized Coefficients		Standardized Coefficients	Sig.
		B	Std. Error	Beta	
	(Constant)	-2.432	1.024		
	Fire safety awareness of respondents	2.272	.424	.718	.000
a. Dependent Variable: Do you implement fire safety?					

Table 8: Linear regression coefficients

The linear regression analysis was used to determine the relationship between the dependent variable (implementation of fire safety) and the independent variable (fire safety awareness). The equation arrived at was implementation of fire safety (y) = (2.272 x fire safety awareness of the respondents) -2.432. An interpretation of the B value of the unstandardized coefficients interprets that a unit increase in fire safety awareness among the business community will result in a 2.272 increase in their implementation of fire safety. P-value for the t-test statistics was used to decide the significance of the independent variable in the regression model. Fire safety awareness (p = 0.000) was found to impact significantly on implementation of fire safety at the sampled enterprises.

#### 4. Conclusion and Recommendations

The main objective of this thesis was to study fire safety within Kariobangi Light Industries within Nairobi County, Kenya with the Occupational Safety and Health Act, 2007 and its subsidiary legislation the Factories and Other Places of Work (Fire Risk Reduction) Rules, 2007 as a standard guiding the researcher on the fire safety requirements at all workplaces in Kenya.

The specific objective sought to assess fire safety awareness among the business community operating at Kariobangi Light Industries. It can be concluded that there is need to improve fire safety awareness among the business community operating within the industrial cluster as it impacts significantly on the implementation of fire safety. It is apparent that if a small fire was to start at the sampled workplaces, there would be barely any employees ready to do first-aid firefighting and that if a worker did use a fire extinguisher, there are high chances they would not do so safely given that there are different classes of fire and different types fire extinguishers.

##### 4.1. Recommendations

The study recommends the following:

- The business owners operating within the industrial cluster should develop comprehensive fire safety policies to offer guidelines on how gaps observed in this study shall be corrected as well as ensure compliance to the Occupational Safety and Health Act, 2007 and the Factories and Other Places of Work (Fire Risk Reduction) Rules, 2007.
- Baseline fire safety audits; by Directorate of Occupational Safety and Health Services approved fire safety auditors, of the industrial cluster would form a good basis when advising the business owners.
- It is recommended that the Nairobi Fire Services and the Directorate of Occupational Safety and Health Services undertake fire safety awareness programs within the industrial cluster.

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