



How Enforcement of Fire Safety Protocols by the Regulatory Agencies Can Help Reduce Incessant Fire Outbreaks in Nigeria

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Abstract

The frequency of market fires and residential building fires in Lagos, Nigeria is quite alarming leading to significant loss of lives and property destruction. This situation is mostly blamed on the late response by emergency managers in the state rather than the negligence on the part of developers, owner or occupier of a building. This research work focused on investigation of 50 high rise and non high rise buildings comprising both residential and commercial structures in Lagos through questionnaire and checking fire station diaries for fire calls records and subsequent causes of fires determine

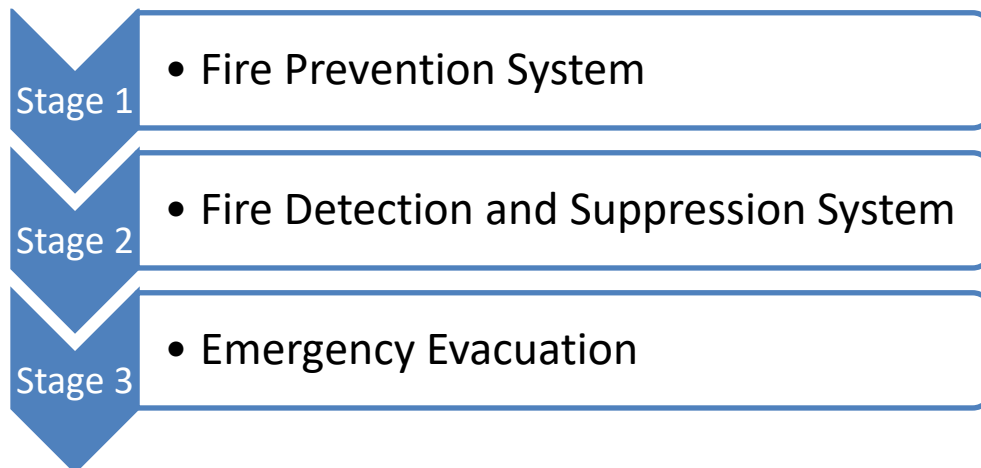
d by fire investigators. We adopted statistical Pearson correlation analysis of the data obtained to determine the relationship between operational conditions of firefighters and the outcome variables (quick response, life safety and property protection) and also determine the relationship between building owner's or occupier's level of preparedness with respect to implementing fire safety measures and outcome variables (fire outbreak, life safety and property protection). Our results showed that promptness and response times of firefighters are dependents on several factors such as presence of emergency lane, response distance, emergency alert time, training and motivation of firefighters, presence of emergency medical service etc. Finally the study access the impact of enforcement procedures to ensure safety compliance by the regulatory agencies is actually making any difference.

Keywords: *Fire safety awareness, emergencies, disaster, fire call, and safety compliance*

I. INTRODUCTION

In emergency management two specific terms must be clarified, which is the difference between emergency and disaster. Emergency is a critical situation that requires an urgent attention which can be managed with existing resources and infrastructure and if not properly managed can easily deteriorate into a disaster. Emergency is a sudden event which could be imminent or sudden which threaten lives, properties and the environment. However, disaster usually results into loss of lives, destruction of properties with a negative impact on the environment. It is usually catastrophic event that causes significant damage, loss or disruption which overwhelms the capacity of local resources and infrastructures, requiring external assistance. Therefore, a fire emergency is a serious situation that requires immediate attention to prevent harm to people and property because fire is fast, and within zero to thirty seconds a small fire can grow up to a dangerous level. This situation requires adequate preparedness and coordinated response from both the building owners and emergency managers. Fire safety could be defined as a set of activities put together to prevent the ignition of a fire, its spread and damage it might cause.

If we analyze the safety components of these set of activities, we would be talking about, how to prevent fire, how to fight fire and how to survive fire. The response capacity of any organization or society can group into 3 categories.



Fire Prevention encompasses the following

- **Fire Safety awareness education:** It is crucial for fire prevention such as properly using electrical appliances, storing flammable materials, and maintaining heating systems.
- **Fire Risk Assessment:** is a systematic process to identify and evaluate potential fire hazards in a building or area.

Fire Detection and Suppression and System

- Sprinkler System
- Fire Extinguisher
- Hose Reels
- Drenchers
- Fire Alarm System

Emergency Evacuation

Means of Escape: It refers to the routes and exits that people can use to safely leave a building or area in case of an emergency such as fire. A well designated means of escape should be clearly marked, easily identifiable, provide safe route that must lead to a place of safety.

Emergency Lightning: It is important to ensure safety during power outages or emergencies. It helps people navigate through buildings, exit safely and reduce the risk of accidents and injuries. It requires backup power, exit signage, illumination and compliance with local codes.

Practice Evacuation Drills: They are essential for ensuring that people can safely exit a building or area during an emergency. These drills help to discover potential issues, improve response time, and increase overall safety. The important aspects include regular scheduling, clear communication, realistic scenarios, debriefing and evaluation.

Assembly Area: These are the gathering areas or muster points, are designated safe locations where people assemble during an emergency evacuation. It

serves several purposes such as accountability, safe zone, and communication and coordination point.

Occupancy Load: It is the maximum number of people that a building or space can safely hold. It's a critical factor in emergency planning and evacuation procedures.

Response Distance: According to NFPA 1710, it recommends that fire department should strive to respond to fires within 4 minutes of receiving an emergency call.

Causes of Fire

They are grouped into four categories namely.

- Accident
- Incendiary
- Natural
- Undetermined

II. LITERATURE REVIEW

Fire safety in high rise building is so different from other building categories due to its architectural peculiarity, as it creates danger for a large number of people there, reducing the possibility of their evacuation and rescue. These buildings due to its complex nature and multi-functionality considering the originality of the designs in terms of external and internal views, leads to the challenges of selecting a constructive system, a large number of utilities and technical systems.

To address the issues related to safety of lives, operations, and evacuation of people is what led to the development of a fire protection system for high-rise buildings, which include; measures to ensure the durability of buildings or parts thereof against progressive collapse by ensuring the fire resistance of structures and buildings; measures to limit the spread of fire in high-rise buildings through



the installation of fire barriers inside the building and the device of fire breaks between buildings; measures for ensuring timely and unimpeded evacuation of people and their rescue at emergency in high-rise buildings; systems of active protection of buildings from fire, namely: fire detection and suppression system etc. [1]

High rise buildings all over the world are becoming popular due to their capacity in ensuring optimum use of land, increasing urban density and designed for large number of households. In spite of these numerous benefits, occupants of high-rise buildings are exposed to fire safety hazards. In view of the aforementioned, a study was conducted by a team of researchers to examine the perception of high-rise building occupants in Lagos State with a view to ensuring fire safety consciousness. The study showed that fire policy regarding the development of high rise building focuses more on active policies, involving the provision of equipment to combat fire outbreaks rather than policies that facilitate easy means of escape. Also, there is a positive relationship between fire safety measures provided by the facility managers and prescribed fire safety standards. This implies that if facility managers ensure that occupants are aware of fire safety measures. Their level of compliance with the prescribed fire safety standards in the building increases and in return will enhance occupants' safety. The study recommends that investors should incorporate more ways and means of escape in the high rise buildings development plan. Also, facility managers should educate the occupants on fire safety measures and ensure their participation in a fire drill or other training related to life safety. Furthermore, the government should set up a regulatory body to monitor and assess fire safety facilities and measures put in place for in high rise buildings.[2]

III. RESEARCH METHODOLOGY

The cross-sectional research design was used and the population of the study comprises of occupants of residential and commercial buildings in Lagos, Nigeria. The state was chosen because it has a large number of high-rise and non high rise developments bedeviled with incessant fire outbreaks. A sample of 100 respondents was selected from the population of occupants of the high-rise and non-high-rise buildings using the simple random selection method.

The sample size was determined using Cochran's sample size formula for continuous data (Cochran, 1977) taking an acceptable margin of error (e) of 0.05, confidence level of 1.96, population proportion (P) taken to be 0.5, and a total number of population (N) is 100. Data for the study were obtained through field survey using a structured questionnaire on Google forms. A total of 300 structured questionnaires were administered out of which 100 were returned and used in the analysis. Microsoft Excel was used to analyze the data gathered. Descriptive statistics - frequency and mean score were used for data presentation.

Cochran Formula

n = sample size

e = margin of error

p = estimated population of an attribute in the population

q = 1-p

z = confidence level

IV. RESULTS AND DISCUSSION

The respondents were asked to rate their level of awareness with fire safety measures incorporated into their building using five Likert and their response is presented in Table 1. The table showed installation passive fire protection was ranked (mean =1.71) as fire safety measure they are least conversant with. This was followed by seeking fire service approval before, during and after construction. The respondents were also not aware of legal implication of non compliance with safety regulation (mean =1.75). They equally non conversant with having a sectioned area for smokers at the workplace (Mean=1.79). They not familiar with having a trained fire marshal to coordinate fire emergencies (Mean =). Most of the respondents don't know the emergency number to call during a fire or even location of the nearest fire station.

However, the installation of active fire protection such as fire extinguisher, storage of flammable substance in a safe area, conduct of fire safety awareness, conduct of practice evacuation drill, installation of fire alarm system, conduct of risk assessment are fire safety measure they are most conversant with.

Many people are of the opinion that if fire safety protocols were enforced, it would lead to better compliance among the building occupants



Table 1: Fire safety education awareness level and occupant's preparedness

Items	Mean	Rank
Conduct fire risk assessment of your premises	4.42	15
Installation of active fire protection	4.14	14
Conduct of fire safety awareness training	4.01	13
Conduct of practice evacuation drill at your workplace	3.33	12
Storage of flammable substance in a safe area	3.2	
Existing means of escape adequate for safe evacuation with respect to occupancy load during a fire	3.11	11
Installation of functional Fire Alarm System for early warning during a fire	3.11	10
Regular Maintenance of Fire Protection Equipment	2.13	9
Knowledge of emergency numbers to reach during emergency situations	1.92	8
Conduct regular inspection of all electrical installations	1.85	7
Documentation of fire safety plan	1.84	6
Knowledge of the location of fire stations		5
Building having trained fire marshals to coordinate fire emergencies	1.82	4
Designation of a sectioned area for smokers	1.79	3
Obtaining an approval from fire authority before building construction	1.76	2
Penalty for non compliance with safety regulations	1.75	1
Installation of passive fire protection during building construction	1.71	0

Firefighters were asked to rate their performance with respect to operational condition using Likert 5 and their response were presented in the table II below. The table showed the travel distance to fire grounds with a (mean = 4.91) and timely emergency alert (mean = 4.90) ranked the highest in respect to effective performance and prompt response. It was followed by presence of

emergency lane (mean=4.89) and maintenance culture of fire engine (mean=4.75), motivation of the firemen (4.55), Training and development of firefighters (4.33), presence and location of fire hydrant for refilling, and available of emergency medical service (paramedics)(mean=4.1) usually determine the effectiveness of their operations and the capacity to save lives and properties.

Table II: Operational Condition of Firefighters

Items	Mean	Rank
Nearness and location of fire station to a building	4.91	11
Promptness and timeliness of emergency alert	4.90	10
Presence of emergency Lane	4.89	9
Maintenance culture of fire engine	4.75	8
Motivation of firefighters	4.55	7
Level of Training and development of Fire Fighters	4.33	6
Presence, Location and Functionality of Fire Hydrants	4.05	5
Presence of Emergency Medical Service	4.01	4
How well equipped a fire station is ?	3.99	3
Adoption of modern technology in automatic fire detection system linked with fire service control room	3.97	2
	3.60	1
Crowd Control and Security of the fire ground.	3.5	0



Table III: Objectives of fire safety management

Items	Mean	Rank
Quick Response	5.00	7
Life Safety	4.99	6
Property Protection	4.98	5
Economic Growth	4.88	4
Preserved Environment	4.52	3
Social Order	4.31	2
Human Settlement	3.99	1

Table IV: Pearson Correlation Analysis between occupant's fire safety measures and objectives of Fire Safety Management

Correlation coefficient	0.9429
N	100

Relationship between level of preparedness and emergency management culture of building occupant and out outcome variables (death tolls, property destruction)

In investigating the relationship between fire safety measures examined in Table I and negative impact of fire disaster, Pearson correlation analysis was employed and the outcome is presented in table IV. For an easy interpretation of the result, the factors that account for fire safety measures was computed into a dummy variable and the same was done for negative objectives of fire safety management. There is positive correlation between the values in Table I and Table IV.

The above result implies that with increased level of awareness, there would be better adherence to fire safety measures by building occupants; it could avert the negative impact of fire disaster such as death, property destruction.

Table V: Pearson correlation between operational condition of fire fighters and objectives of fire safety management

Correlation coefficient	0.54321
N	100

Relationship between operational condition of fire fighters at the fire ground, and the objectives of fire safety management.

In investigating the relationship between operational condition of fire fighters examined and objectives of

fire safety management, Pearson correlation analysis was employed and the outcome is presented in table V. There is positive correlation between the values in Table II and Table III.

The above result implies that from the firefighter's perspective, improved operation condition could produce better performance such as life safety, property protection, economic growth and social order.

Existing Safety Laws and Regulations in Nigeria

The following safety regulations and were studied to understand what law says

- National Fire Safety Code, 2013
- Fire Service Regulation, 2019
- Lagos State Safety Commission Law 2011 Cap No.6

V. CONCLUSION

Lagos is a cosmopolitan city, with nucleated settlement in which majority are high rise buildings commonly found in the commercial nerve centre of Lagos Island. They are built for optimal use of land that is limited. It becomes imperative to consider the fire safety management due to the inherent hazards, rate of fire spread and means of escape during a fire. Many people are of the opinion that the devastating effects of fire disaster such as death tolls and property destruction was due to the late arrival of firefighter to the fire grounds and discounting the possibility of building occupiers taking responsibility by building the capacity to prevent and respond to incipient fires through compliance with fire safety regulations as it relates to provision of both active and passive fire protection and adequate means of escape. Our research sampled user's perspectives and firefighters perspectives through sampled questionnaires to juxtapose it with the existing fire safety regulations.

It was discovered that during a fire, most buildings do not have ordinary portable fire extinguisher to put out incipient fires that can easily grow into a fully developed fires in seconds. These level of negligence on the part of the building occupants as a result of low awareness coupled with



utter disregard of stipulated fire safety regulations and late arrival of fire fighters to the fire grounds due to challenging operational conditions highlighted above were responsible for the incessant destructive fires leading to death and property destruction.

VI. RECOMMENDATION

This study recommends that since inadequate means of escape is what makes fire outbreak in high rise building disastrous, developers should incorporate adequate means of escape in the high-rise buildings development plan as stipulation in the National Fire Safety Code, 2013 and also incorporate fire-fighting equipment that enhance combating fire outbreak at the incipient stage and passive fire protection that would slow down the spread. Secondly, the government must ensure regulatory bodies are set up to monitor and control fire safety guidelines in facilities and measures put in place for upcoming high rise buildings. They must also ensure there should tougher sanctions for violators of fire safety regulations. The fire department should partner with facility managers in educating the occupants on fire safety measures and ensure their participation in a fire drills or other training related to life safety.

Finally, Government must commit serious investment into the fire service by setting up a special emergency fund to better equip, motivate and train firefighters to ease and smoothen their operational capabilities.

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