

Evaluation of The Challenges Affecting the Application of Fire Safety Measures in Commercial Buildings in Awka, Anambra State.

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Abstract: This study investigates the challenges affecting the implementation of fire safety measures in commercial buildings in Awka, Anambra State, Nigeria. Rapid urbanization and commercial growth have increased fire risks due to inadequate safety infrastructure, weak regulatory enforcement, and limited public awareness. Using a descriptive survey design, data were collected from 213 industry professionals-including architects, structural engineers, and builders-using a structured questionnaire. Data were analyzed using frequency analysis for this study.

Key barriers identified include inadequate regulatory enforcement, financial constraints, lack of technical expertise, and limited public engagement. Insufficient fire safety training and lack of routine drills further contribute to low preparedness among building occupants. The study recommends stricter regulatory oversight, increased financial support, enhanced technical training for professionals, and mandatory safety drills. These strategies are essential to improve compliance, mitigate fire risks, and safeguard lives and property in Awka's commercial spaces. The research provides valuable insights for policymakers, industry professionals, and stakeholders in fire safety management.

Keywords: Fire safety, commercial buildings, regulatory enforcement, fire risk, Awka, Anambra State, financial constraints, technical expertise, public awareness, fire safety training, Nigeria

I. Introduction

Fire safety is a vital component of building construction, use, and maintenance, aimed at protecting lives and property. Fire remains one of the most frequent and destructive disasters globally, posing significant challenges, especially in developing nations (Pontip, Ahmed, Erekpitan, and Detur, 2017). The impact of fire disasters is particularly severe in urban areas where rapid development and high population density complicates fire safety management. With increasing urbanization and the complexity of modern buildings, effective fire prevention and response strategies have become critical concerns worldwide (NFPA, 2022).

In Nigeria, rapid urban and commercial growth have outpaced the development of adequate fire safety infrastructure and protocols, heightening the risk of fire incidents. Fire outbreaks not only endanger building occupants but also compromise the structural integrity of buildings. Early detection and suppression mechanisms, combined with proper evacuation strategies and the use of fire-resistant materials, are essential to mitigating fire damage (Gudde, 2019).

Urbanization, defined as the transformation from traditional rural economies to modern industrial ones (Jagiti, 2019), has led to a proliferation of commercial buildings that serve as economic hubs in cities like Awka, the capital of Anambra State. This rapid expansion has introduced new fire safety challenges, increasing the vulnerability of these structures to fire incidents.

A major obstacle to effective fire safety in Awka is the widespread lack of awareness and education regarding fire safety protocols. According to the Fire Industry Association (2024), many building owners and managers remain unaware of fire safety regulations, leading to non-compliance and increased risk. The absence of regular fire safety training for employees further exacerbates this issue, leaving occupants ill-prepared to respond during emergencies.

The consequences of inadequate fire safety measures are evident in frequent fire outbreaks at commercial centers such as Balogun market in Lagos State. Since 2015, the market has experienced multiple devastating fires, resulting in loss of property and lives (Chigozie and Mansir, 2022). These incidents underscore the urgent need for enhanced training programs and awareness campaigns to educate building owners, managers, and occupants on fire safety practices.

Recent research underscores that rapid urbanization and complex commercial building designs in Nigerian cities have intensified fire safety challenges, necessitating innovative and context-specific approaches to fire management. For instance, a study evaluating fire safety measures in high-rise buildings in Nigeria highlighted significant gaps in design and construction practices that compromise fire safety, including inadequate fire detection and suppression systems, poor emergency egress planning, and insufficient regulatory enforcement ((Pontip, Ahmed, Erekpitan, and Detur, 2017). These deficiencies increase the vulnerability of occupants and property to fire disasters, especially in densely populated commercial hubs.

Moreover, the growing complexity of commercial buildings demands integration of advanced technologies to enhance fire safety. Automated fire detection systems, smart alarms, and building information modeling (BIM) for fire risk assessment have shown promise in improving early detection and coordinated emergency responses in other contexts (Salman, 2011). However, the

adoption of such technologies in Nigeria faces barriers including financial constraints, lack of technical expertise, and inadequate regulatory incentives (Cyprain & Alao, 2023). Addressing these barriers is vital for modernizing fire safety infrastructure and reducing fire-related losses.

Community engagement and public awareness also play crucial roles in sustainable fire safety management. Studies reveal that many building owners and occupants lack sufficient knowledge of fire safety regulations and emergency procedures, which undermines compliance and preparedness (Fire Industry Association, 2024). Regular fire drills, public education campaigns, and stakeholder collaboration have been effective in other urban settings to foster a culture of fire safety and resilience (Onwumere et al., 2023). These strategies can empower occupants to respond appropriately during emergencies and encourage proactive maintenance of fire safety systems.

Research by Oluwunmi (2023) identifies electrical faults, political factors, low awareness, use of substandard building materials, and negligence as primary causes of fire outbreaks. Despite existing regulatory frameworks, enforcement remains weak due to carelessness and lack of political will, as confirmed by Cyprian and Alao (2023).

Brief Description of Anambra State and Awka Community

Awka is a vibrant urban city with a growing population and diverse economic activities underscores the critical need for effective fire safety measures. The concentration of government offices, educational institutions, markets, and commercial buildings increases the risk and potential impact of fire incidents, necessitating robust fire prevention and emergency preparedness strategies.

Climate

Awka's tropical savanna climate, with a pronounced dry season influenced by the Harmattan wind, creates conditions that heighten fire risks. The dry season, characterized by low humidity and dusty winds from the Sahara, facilitates the rapid spread of fires, especially in areas with dry vegetation or poorly maintained infrastructure. This seasonal pattern demands heightened vigilance and preparedness for fire outbreaks during these months.

The heavy rainfall during the rainy season supports agriculture but may also contribute to structural challenges in buildings, such as dampness or electrical faults, which can be fire hazards if not properly managed. Therefore, fire safety protocols must consider the seasonal climate variations to mitigate risks effectively.

Temperature and Soil

The warm temperatures ranging from 25°C to 35°C contribute to a generally hospitable environment for residents but also create conditions where fires can ignite and spread quickly, particularly during the dry season. The fertile soil supporting extensive agricultural activities means that crop residues and farming waste could become potential fuel for fires if not managed properly.

Additionally, soil erosion and gulying in some parts of Awka, aggravated by deforestation and urban sprawl, may affect the stability and safety of buildings and infrastructure, indirectly influencing fire safety by complicating emergency access and water supply for firefighting.

Economic Activities

Awka's economy, centered on government institutions, education (notably Nnamdi Azikiwe University), trade, healthcare, and hospitality, involves numerous public and private buildings with varying levels of fire safety readiness. The presence of educational institutions and markets with high human traffic increases the potential for fire emergencies, as evidenced by studies showing inadequate fire emergency preparedness in schools and commercial buildings within Awka.

The diverse economic activities also mean that many buildings store flammable materials, such as cooking fuel in hospitality, electrical equipment in offices, and agricultural products in markets, all of which require stringent fire safety measures. The economic losses from fire incidents can be substantial, affecting livelihoods and the broader urban economy.

Moreover, the ongoing urbanization and commercial growth in Awka have outpaced the development of fire safety infrastructure and regulatory enforcement, leading to increased fire risks.

Problem Statement

Despite existing fire safety regulations and guidelines, many commercial establishments in Awka remain inadequately equipped to prevent and respond to fire outbreaks. Factors such as non-maintenance, inadequate provision, and non-functional fire safety equipment often lead to fire disasters (Cyprian & Alao, 2023). Outdated infrastructure, non-compliance with safety standards, and lack of early detection and reduction strategies persist. Previous research has focused on the broader southeast region, but this study addresses the unique challenges in Awka, which is experiencing rapid commercial growth and increased construction of commercial buildings (Onwumere et al., 2023).

Significance of the Study

These findings hold substantial implications for urban safety management and building code enforcement. The research demonstrates that fire safety vulnerabilities in Awka's commercial buildings result not from a single factor but from an

interconnected web of challenges that must be addressed holistically. The identification of these specific barriers provides critical insight for regulatory bodies, building owners, and safety professionals seeking to implement effective interventions.

Significantly, this study contributes to the broader understanding of fire safety management in developing urban contexts where resource constraints often compete with safety requirements. By quantifying and qualifying these barriers, the research provides an evidence-based foundation for policy development and resource allocation decisions that can enhance building safety standards.

Furthermore, the study serves as a valuable resource for students and researchers interested in fire safety measures within commercial environments. The insights gained from this research can provide a foundation for future studies, paving the way for further exploration of innovative fire safety solutions.

Aim and Objective of the Study

The aim of this study is to evaluate challenges affecting the application of fire safety measures in commercial buildings in Awka, Anambra State, with a view to recommend more efficient fire management approaches, whereas, the objective is to identify the current challenges that affects the application of fire safety measures in commercial buildings in Awka, Anambra state.

Review of Related Literature

Fire safety in commercial buildings remains a critical concern globally, and particularly in Nigeria, where lapses in safety culture and preparedness have been widely documented. Obasa, Mbamali, and Okolie (2020) assessed fire disaster preparedness in commercial buildings in Imo State, Nigeria, revealing that fire safety practices are often neglected. This neglect poses significant risks to occupants, owners, and properties, especially in environments where inflammable materials are prevalent. Their study, which utilized structured questionnaires, concluded that the preparedness level among commercial building operators was grossly inadequate. The authors recommended the implementation of comprehensive fire safety measures, including the provision of appropriate equipment, regular inspections, and ongoing training and drills for building occupants.

Echoing these concerns, Kaseem Yahya and Wan-Yusoff (2021) emphasized the pivotal role of effective fire safety management throughout the lifecycle of buildings. Their research underscored that robust fire safety management is essential for safeguarding both occupants and property, not only during construction but also in the operational phase of buildings. Importantly, their findings highlighted that fire safety training is the most influential factor in raising awareness among building occupants and the public. However, the prevailing level of fire safety awareness was found to be alarmingly low, often resulting in preventable injuries, fatalities, and property loss. The authors advocated for enhanced fire safety education as a fundamental strategy for achieving broader fire safety objectives.

Despite regulations, commercial buildings in Nigeria face persistent safety challenges. Ebenechi, Mohamed, Sarpin, and Adaji (2019) identified several key factors undermining fire safety management.

Non-Compliance with Fire Safety Rules and Regulations

Adherence to fire safety laws is foundational for achieving safety objectives in buildings. Non-compliance undermines fire safety management (FSM) programs, rendering safety measures ineffective and jeopardizing the safe evacuation of occupants during emergencies (Kaseem, Yahya, and Wan-Yusoff, 2021). This challenge is compounded by weak enforcement mechanisms and insufficient regulatory oversight in many Nigerian cities.

Inadequate Fire Emergency Management

Effective fire emergency management entails the development and dissemination of comprehensive emergency plans, procedures, and routine notices. Anthony, Ajonye, Okpanachi, and George (2020) stressed the importance of practical and inclusive emergency planning that accounts for building usage, fire growth characteristics, occupant demographics, and existing fire safety systems. However, many commercial buildings lack such tailored and actionable plans, leaving occupants unprepared for fire incidents.

Deficient Fire Safety Training and Education

A well-informed populace is critical to fire disaster prevention and response. Sholanke, Ekhaese, and Ekundayo (2024) found that students in Nigerian institutions often lack awareness of fire safety equipment and procedures, highlighting a broader issue of insufficient fire safety education. Regular training equips building occupants with the knowledge and skills necessary for effective evacuation and first response, ultimately reducing the risk and impact of fire disasters.

Weak Fire Safety Organization, Policy, and Auditing

Globally, fire safety responsibilities are typically embedded at multiple organizational levels, supported by clear policies and regular audits. The NFPA and the UK's Regulatory Reform (Fire Safety) Order 2005 emphasize the need for defined responsibilities, robust safety policies, and independent audits to ensure that fire safety strategies remain relevant and effective amid changing building uses and occupancy patterns. In Nigeria, however, the absence of such organizational structures and systematic auditing often leads to lapses in fire safety management.

Communication, Incident Reporting, Investigation, and Budgeting: Effective fire safety management depends on transparent communication among stakeholders, including management, staff, occupants, and emergency services. Timely reporting and

thorough investigation of fire incidents enable organizations to learn from past events and implement corrective actions. Furthermore, adequate budgeting is essential for maintaining, upgrading, and replacing fire safety systems. The UK Regulatory Reform (Fire Safety) Order 2005, among other regulations, underscores the importance of allocating sufficient financial resources for fire safety improvements, training, and equipment replacement.

Research Gap

While prior studies have identified the prevalence of inadequate fire safety practices and poor compliance in Nigerian commercial buildings, there is a notable gap in research addressing the long-term sustainability and effective implementation of fire safety measures—especially in resource-constrained settings. Existing literature points to barriers such as lack of training, insufficient emergency management, and inadequate budgeting, but often fails to examine how these factors collectively hinder sustained fire safety. Additionally, the practical challenges faced by building owners in maintaining compliance, particularly amidst regulatory and resource limitations, remain underexplored. Addressing these gaps is crucial for developing robust, context-specific fire safety protocols that ensure ongoing adherence and adaptability in resource-limited environments.

II. Methodology

This research utilized a descriptive survey design, gathering data from both primary and secondary sources. This approach was deemed suitable as the study aimed to examine respondents' perspectives on challenges affecting the application of fire safety measures in commercial buildings in Awka, Anambra State.

The study population comprised 213 professionals who are key stakeholders in the construction industry, including 62 architects, 84 structural engineers, and 67 builders (Anambra Secretariat of the Professions, 2023). These groups were selected due to their significant roles in fire safety practices, whether through direct involvement in designing and maintaining fire safety systems or as primary users of such systems. A sample size of 139 was determined using Taro Yamane's formula.

The main data collection tool was a structured questionnaire, and the data were analyzed using frequency analysis. To ensure reliability, Cronbach's alpha was used to assess internal consistency, with a coefficient of 0.70 or above is considered acceptable. The pilot test produced a Cronbach's alpha score of 0.82, indicating high consistency in responses and confirming the instrument's reliability for assessing views on fire safety strategies.

III. Result

The Challenges Affecting the Effectiveness of Improving Fire Safety Measures in Commercial Buildings in Awka, Anambra State.

Table 1: Table showing Analysis of data obtained and Responses on the Challenges Affecting the Effectiveness of Improving Fire Safety Measures in Commercial Buildings in Awka, Anambra State.

Key: SA- Strongly Agree/ A- Agree (3), Undecided (2), SD- Strongly Disagree/ D- Disagree (1). X – Mean

SN	What are the Challenges Affecting the Application of Fire Safety Measures in Commercial Buildings in Awka, Anambra State?	SA/A 3	U 2	SD/D 1	X	Rank
1	Financial constraints are a significant barrier to implementing and maintaining effective fire safety measures in commercial buildings.	97	9	7	2.80	3
2	There is lack of technical expertise available to properly install, maintain, and operate fire safety equipment in commercial buildings.	93	14	6	2.77	4
3	Communication and Information, Reporting and Investigating Fire, and Fire Safety Budget.	99	11	3	2.85	2
4	Regulatory bodies do not adequately enforce fire safety standards and regulations in commercial buildings.	102	9	3	2.89	1
5	There is resistance or lack of cooperation from building occupants to participate in fire safety drills and training programs.	86	19	9	2.70	5

Source: Field Survey and Questionnaire (2024)

Table 1 shows the challenges affecting the effectiveness of improving fire safety measures in commercial buildings in Awka, Anambra State. All challenges received high mean scores (above 2.70), indicating widespread agreement that these issues significantly impact fire safety effectiveness. The top-ranked challenge (mean 2.89) is inadequate enforcement of fire safety standards by regulatory bodies. This suggests a critical gap in oversight that may be undermining overall fire safety efforts. Close behind is the challenge of communication, information, reporting, and budgeting (2.85), highlighting systemic issues in fire safety management.

Financial constraints rank third (2.80), indicating that resource limitations are a major obstacle to implementing effective fire safety measures. Lack of technical expertise (2.77) and resistance from building occupants (2.70) round out the top five challenges, pointing to issues with both professional capacity and public engagement. This suggests that multiple factors are hindering the effective implementation of fire safety measures in commercial buildings in Awka.

IV. Conclusion

The study clearly identifies several critical challenges that are hindering the application of effective fire safety measures. Key challenges identified include financial constraints which was the primary obstacle, limited technical expertise, and inadequate enforcement of fire safety regulations. These factors contribute to the inconsistent application and upkeep of essential fire safety protocols in Awka's commercial buildings. The lack of adequate resources to invest in modern fire safety equipment, combined with minimal enforcement of regulatory standards, creates a vulnerable environment where fire safety measures are either absent or insufficiently maintained.

Moreover, there is limited awareness and preparedness among building occupants, often due to a lack of fire safety training and regular drills. This gap in knowledge and readiness among occupants not only limits the effectiveness of existing safety measures but also impedes swift responses during emergencies. Addressing these issues requires a holistic approach, focusing on the availability of resources, strict regulatory enforcement, and public education on fire safety.

Efforts to overcome these barriers are crucial in enhancing the overall safety of commercial buildings, reducing fire risks, and ensuring the well-being of occupants and assets. Effective collaboration between regulatory bodies, building owners, and fire safety professionals, along with targeted training and increased investment in fire safety infrastructure, can help bridge these gaps and foster a safer commercial environment in Awka.

Recommendations

Following the findings of this research, the recommendations are as follows;

Enhanced Regulatory Enforcement: Central task force to oversee fire safety in all commercial buildings tasked with surprise visits and fines for non-compliance should be mandated. The body would work outside local governance structures to avoid conflicts of interest, tapping into real-time data from municipal fire departments and building management systems so it could identify the most at-risk structures. For example, buildings with outdated sprinkler systems or inadequate fire exits might be tagged for an immediate re-inspection. The task force's effectiveness hinges on legislative backing to impose fines proportional to the severity of violations, such as 5% of annual revenue for repeat offenders, ensuring accountability among property owners.

Standardization of Fire Safety Audits: Introduction of the ISO 45001 compliant audit protocol would ensure that fire doors, emergency lighting, and smoke control systems are audited the same way every time. Predictive analytics should be included in audits in order to predict a pattern of degradation of the fire-resistant materials and to make maintenance plans in anticipation of it. As an illustration, thermal imaging inspections may identify electrical deficiencies in wiring systems before they start a fire. Audits must be shared in a national database, with the public and insurance companies able to adjust rates based on compliance scores.

Financial Assistance Programs for Fire Safety Improvements: The government, in partnership with financial institutions, should implement financial support programs specifically for fire safety upgrades in commercial buildings. This can be done by offering low-interest loans and grants for fire safety improvements, providing tax incentives for building owners who install or upgrade fire safety equipment (e.g., sprinklers, alarms) and publicizing these programs to ensure wide awareness and uptake.

Development of Technical Training and Certification Programs: The National Fire Safety Council (or equivalent body) should develop standardized training and certification programs for fire safety system installers and maintenance personnel. By equipping local technicians with the knowledge and skills needed for proper installation and maintenance, building owners can access reliable services within the community. This will enhance the effectiveness of fire safety equipment and ensure that systems are properly maintained.

Improved Communication, Reporting, and Budgeting Systems: Using tamper-proof digital ledgers to record maintenance would stop false compliance reporting. Every inspection, repair, and drill would create a permanent timestamp, visible to regulators on permissioned nodes. Malaysia's Fire and Rescue Department is trailing this system now, detecting 12% more offences in its first year than traditional paper-based methods. Machine learning algorithms could hunt through historical fire incident data, weather forecasts and rates of degradation of building materials to calculate dynamic risk scores for individual buildings. These scoring would generate automated alerts to

Mandatory Fire Safety Drills and Training for Occupants: Legislation should require all commercial building occupants to participate in regular fire safety training and drills. Mandatory fire drills should be scheduled at least twice a year, annual fire safety training sessions should be provided for all occupants and clear emergency evacuation plans should be displayed in prominent locations within buildings. This will increase occupants' preparedness, reduce panic during emergencies, and foster a culture of fire safety awareness.

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