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Fire Safety Management Strategy in Nigeria Public Buildings

Alao, Mohammed Kaseem, Yahya Mohamad Yatim & Wan Yousuf Wan Mahmood

Faculty of Build Environmental and Surveying, Universiti Teknologi Malaysia, 81310 Johor Bahru, Johor

**Corresponding author: kaseemalao@yahoo.com*

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ABSTRACT

Ineffective fire safety management is one of the severe issues in public buildings, especially in Nigeria. There has been a significant increase in fire disaster cases in Nigeria in the last 25 years, the incidence of fire disasters becomes the most significant and ultimate threat to building occupants, building and its contents, as well as the economic growth of the nation. Therefore, in order to ensure the safety of building occupants, building contents, the essential features depend on the fire safety protection system, which should be under the fire safety regulation requirements. Nonetheless, practical fire safety management could remedy the damages or rates of injury in fire events. This study presents the findings on the investigation of the effectiveness of fire safety management strategy in Nigeria public buildings. This study attempts to determine the factors affecting improper fire safety management and determine the level of effective implementation of fire safety management components. From the study, safety training and adequate fire safety compliance are the factors that affect improper fire safety management the most. The level of effective implementation of fire safety management strategy is low, which translated to inadequate fire safety management. The most effective approach identified to improve the fire safety management and achievement of fire safety objectives is through effective fire safety management strategy and improvement in fire safety training arrangement and absolute compliance with the fire safety regulations.

Keywords: Public buildings; fire safety management; fire safety; fire safety components

INTRODUCTION

Adequate fire safety management of public buildings, such as higher institutions, office buildings, market place, hotels are essential to fire safety; without it, all other elements of the fire safety system could be useless. However, adequate and well-structure fire safety management is critical to ensure that all other parts of the fire safety system are applied effectively. (Xie 2014). Despite the installation of passive and active fire safety measures at the construction stage of building development, proper fire safety management at post construction stage of building is essential to enhance the achievement of fire safety objectives.

A public building is an essential part of the economy and often seen as drivers of economic growths, particularly in developing countries, as most of the social-economic activities take place in public buildings. Therefore, in public buildings, the fire risk of a fatality is higher than many other types of buildings due to the populations of occupants, different classes of people and visitors to the buildings on a daily bases, nature of the activities, and amount of combustible materials in the public buildings

Public buildings are structures where fire safety management implementation is very critical. Thus, large numbers of public buildings occupied by the occupants who are prone to panic and it can be challenging to manage in the event of a fire emergency. Adequate fire safety management can assist in dealing with fire safety situation in order to prevent fire occurrence. The incident of fire could result in deaths, injury, destruction of the building, and interruption of academic activities (Hassainain 2006).

Several fire statistics and researches have revealed that quick and safe escape from building during fire incidence is usually a significant challenge for the occupant. Therefore, the provision of the fire safety system in buildings, such as active and passive systems, is crucial to minimize the fire spreading across the entire building. Therefore, a well-trained occupant of buildings with the knowledge of fire equipment operation can stop the fire outbreak before its growth. In managing building fire, there are specific aspects that require proper regulation and control which include; identification of combustible materials, fire risk areas, and probable consequences of fire. However, it is essential to know that integrating standard components of fire safety management into a fire safety management program is tantamount to the achievement of fire safety standards in the building.

The fire safety performance of public buildings in Nigeria might have been improved over the past few years. However, the rate of death, acute injuries, caused by fire disasters in public buildings have still not been taken into consideration. Therefore, if public buildings are not adequately managed, buildings occupants, buildings, its contents, and other members of the public can also be killed, and property adjacent to the public buildings can as well be put at risk. Adequate fire safety management of the building is essential for all types of organization that are responsible for protecting and optimizing the efficiency of human resources. Concerning building management, ensuring workplace safety is not an easy task. Fire disaster in public buildings will have a significant impact on social-economic well-being of the countries. Gromadzioska (2019) stated that the public buildings had been plagued by incidents of fire disaster, which results in several injuries, death, and disruption of day-to-day building activities. A proper fire safety management program prevents the occurrence of fire by controlling the combustible materials that ignite the fire. However, to ensure proper operation of fire protection systems is carried out by establishing fire safety maintenance procedures and ensure that provision for the systematic approach of the safe and organized evacuation of the building in fire events (Venkatesh, Kurna & Rafi 2019). Thus, this study focuses on investigating the level of effective implementation of fire safety management program in public buildings in Nigeria.

LITERATURE REVIEW

FIRE SAFETY MANAGEMENT

It is generally agreed that fire is beneficial to humanity and becomes an enemy when it is not requested. It is one of the greatest threats not only to the occupants but also to the building and its contents. The fire has been identified as an enemy of man. Therefore, public buildings need to have proper fire safety management so that an acceptable level of fire safety can be attained. In the construction of the building, there are three fundamental issues that builders ought to put into consideration; they include the safety of the occupants, building, and equipment. According to Debora (2019), suggested that in order to meet safety standards in a building, it is essential to employ several fire safety procedures. However, fire safety management in the building must have an active plan, which should include training and education for occupants in order to minimize the possibility of a fire outbreak.

Evidence from several studies have shown that occupants of buildings are sometimes not only responsible for causes of fire outbreaks, but also help in spreading the fire due to ignorance and panic, which could result in loss of life and destruction to the property if they are not adequately skilled, and lacks knowledge of fire risk. Fire incidents have been increasing in recent times, due to several causes, which include human and building factors. The losses caused by fire incidents could have several negative impacts on the environment and social-economic well-being of a nation and pose a threat to the life of occupants. The negative impacts of fire outbreak on the public building facility across the globe provoke the calls on the practical measures to mitigate the fire risk impacts. Derek (1999) described fire safety management as the application by policy manager, standards, information, and the task of analyzing, evaluating, and controlling fire safety.

The task of building fire safety management involves numerous approaches and factors such as policy knowledge, knowledge in fire safety training, practical fire safety equipment maintenance, well-structured fire safety organization, fire safety communication, among others. According to (Baker, Bouchlaghem & Emmit 2013), fire safety management is an ongoing practice throughout the life cycle of a building. In general terms, management is seen as a combination or co-ordination of some tasks comprises of managers and teams in order to achieve set goals. Thus, looking at management from the perspective of safety. It can be called as co-ordination of some activities towards the fire disaster prevention, and the roles that include fire safety training, fire safety policy, fire safety communication, fire safety investigation and reporting, fire safety audit, fire risk assessment, emergency plan, and fire safety procedure. However, management is essential to achieve the desired safety of an occupant in buildings.

CAUSES OF FIRE OUTBREAK

Fire disasters are not a pleasing incident in any manner. Whenever there is a fire disaster in any place, it brought severe and unquantifiable loss to the victim or the

community, human lives, buildings, and its contents. Fire disasters could be caused by several factors, which could be attributed to human behaviors and building characteristics. Therefore, the recently increased fire disasters in buildings in Nigeria are worrisome (Service 2018). Thus, all stakeholders must cooperate in order to develop a practical mechanism to identify the primary causes, suggest the way forward, and adequate approaches of mitigate against fire disaster. According to the British Columbia District of Canada in 2009, it was revealed that human errors account for 48% of fire disasters. Furthermore, a study revealed that ineffective management and carelessness in handling combustible materials in various buildings mainly cause fire disasters. A research study carried out by Ebenechi (2019), indicated that fire is caused by mainly human errors, and the best approach of curbing fire disaster is to minimize the level of fire risk, building occupants and the facilities that are exposed in buildings.

FACTOR AFFECTING IMPLANTATION OF PROPER FIRE SAFETY MANAGEMENT PRACTICE

Implementation of proper fire safety management program should be addressed at construction and post construction stages of buildings (Samuel 2019) . Therefore, studies have proven that proper implementation of fire safety management program at aforementioned stages has played an essential role in achieving fire safety objectives. The request for safe, health, and comfortable working and living environment has increased drastically. However, factors affecting implementation of proper fire safety management practice in building are, discussed as follows.

FIRE SAFETY EQUIPMENT MAINTENANCE

Prevalent fire outbreak in buildings are usually attributed to non-functional or absence of fire equipment, which are critical in fighting and controlling fire (Ramachandran 1999). NFPA (2018) revealed the performance of several fire protection systems and concluded that fire safety equipment is such as active and passive measures are critical in achieving fire safety standard in buildings. In addition, Hall (2002) conducted a study on contributing factors to numerous fire disaster in higher institution, and the result shows that the significant causes of such disaster were attributed to non-performance of fire safety protection system installed in the building and in some cases, the right equipment are not installed. Adequate fire prevention measures should be installed and ensure that they are functional at all time to enhance the achievement of fire safety objectives (Thorne 2018):

FIRE SAFETY POLICY

Every organization is likely to make provision for a practical fire safety policy. The contents of the policy shall be formed by the top executive council, which may include fire director of the organization or person responsible for safety in the organization (Mufida 2018). Usually, every organization has different organization fire safety policy, but the overall contents and the purpose is to achieve fire safety standard. Chow (2001) stated that the contents of fire safety policy in all the organizations are highlighted on the primary responsibilities of everyone concerned in fire safety in order to prevent the incidents of fire. Therefore, the primary objective of all organization is to achieve fire safety objectives for the safety of workers and comfortable working environment. Hence, fire safety policy is essential in order to achieve the purpose of the organization concerning fire safety.

COMPLIANCE WITH THE FIRE SAFETY REGULATION

The safety performance of any building in terms of fire is usually improved by absolute compliance with existing fire safety regulations through regular auditing of the building using the fire safety regulation requirements as a yardstick in measuring the level of compliance of buildings (Julia 2017). The checklist developed from fire safety code and standard enhances the level of fire safety standards; the fire safety regulations which include National Fire Safety Code, 2013, National Building Code, 2006, and National Fire Protection Association, among others, are the common legislation available to comply. Although, every country has developed its legislation standard.

EMERGENCY PLAN AND FIRE SAFETY PROCEDURE

The organization should provide an adequate emergency plan support for the building occupants for safe evacuation during a fire disaster. It comprises an evacuation plan, first aid, and affiliated to a close medical facility for the treatment of fire organizations (Nano 2017). Therefore, the organization's emergency plan and fire safety procedure prevent the occurrence of fire by the control of fire risks in the building. NFPA (2018), further stated that the fire safety emergency plan provides an organized approach for safety and orderly evacuation of the building in the event of a fire. Moreover, a proper fire safety emergency plan is required to be developed in order to achieve fire safety objectives.

FIRE SAFETY TRAINING AND AWARENESS

Training of building occupants in order to create fire safety awareness help in fire disaster prevention, in ensuring that occupants of the building knows exactly what to do during fire emergency. Regular training of occupant is essential for the achievement of fire safety objectives. However, study by Malhotra (1987) revealed that fire safety training is one of the essential components of fire safety management, which when is adequately implemented, can enhance the fire safety standard of an organization. In similar studies conducted by Daily (2000), the study asserted that there is a general agreement among the participants of their study that fire safety training is a critical component of fire safety management that influences a better fire safety performance of an organization. Derek (1999) indicate that occupants' attitude to fire safety determines the kind of response, either favorable or unfavorable, toward safety situations. Furthermore, public building occupants have diverse perceptions toward risks and willingness to the risks involved. Practical fire safety program of an organization can only be successful if the attitude of the occupants toward fire safety is improved.

FIRE SAFETY ORGANIZATION

Fire safety organization is one of the most essential components of ensuring the success of fire safety management program. Fire safety organization is an aspect of management that addresses the issues of fire safety. It plays a primary role in fire safety management. According to Malhotra (1987), organizing activities of management which ensures the provision of resources with respect to the method/recording, personnel fire safety facilities so that the functions of organizational fire safety can be implemented effectively (Chow 2001). The pertinent role of fire safety organization should lead institution or company to develop, operate, and maintain fire safety equipment and services with a view of ensuring control, encourage cooperation of building managers and occupants, ensure effective communication, and encourage competence.

FIRE SAFETY RISK ASSESSMENTS

Fire risk assessment is an important approach to fire safety management; fire risk assessment is the usual means used to implement fire safety regulations in an organization, Ramachandran (1999) indicate that fire risk assessments are one of the approaches that fire safety managers and building manager needs to understand how it is to be applied in addressing fire safety issues. Yeung (2007) suggested that practical fire risk assessment implementation is tantamount to the achievement of fire safety objective.

RESEARCH METHODOLOGY

To achieve the purpose of this study, quantitative and qualitative techniques were adopted. Both questionnaires and interviews were used as the primary research approaches for data collection in this paper.

QUESTIONNAIRES DESIGN

In this research, the questionnaire survey was written and distributed in the English language being an official spoken language in the study area Brown & Edmunds (2011) suggested that to ensure the questionnaires are written in an appropriate arrangement; a pilot test should be undertaken on a small sample. This will test whether the questions are comprehensible, easy to answer, unambiguous, and liable to achieve the desire findings. The questionnaires were divided into three-part. Part A identifies the educational qualifications, years of experience, and designation of the respondents. Part B determined the factors affecting improper fire safety management in Nigeria public building.

Part C determined the level of effective implementation of fire safety management components in public buildings in Nigeria. A Likert scale of 1= Non-effective, 2= Low effective, 3= Moderately effective, 4= Effective, 5= Highly effective was used in all through the questionnaires, with the researchers believing that a Likert scale will be comfortable in use by participants and not need much effort in completion. A pilot study was carried out in order to improve and validate the questionnaires. Naoum (2007) revealed that a pilot test makes provision for a trial run for questionnaires allowing more variables to be tested. The prepared questionnaire was administered to the participants and later collected after completion by some selected fire safety experts and building managers. The suggestion and observation of the fire safety practitioners were implemented to make the questionnaire easier for the participants.

The next stage of the process was the data analysis, which was carried out to determine the factor affecting improper fire safety management and the level of effective implementation of fire safety management components. Then, measurement scales for each factors and proper fire safety management components were developed. Moreover, interview with fire safety experts was conducted before commencement of data collection in order to ensure that correct and efficiency measurement scale and better

questionnaires contents are achieved and lastly, conclusion and recommendations are made.

ANALYTICAL METHOD

The analysis of data was conducted after the data collection. All the data collected from the questionnaires survey was analyzed and then summarized in order to obtain suitable findings. Data collecting techniques was used to analyzed the data collected. However, an approach combined the data to solve problems and a systematic procedure of using data to come up with answers to the research problems. The analysis of the questionnaires was carried out using the relative importance index (RII) and average index approach. The results were then converted to importance index. The data was process through inputting it into an excel spreadsheet in order to get the appropriate relative importance index, and the ranking respectively. The relative importance index was calculated so that factors affecting improper fire safety management and the level of effective implementation of fire safety management strategy.

INSTRUMENT (QUESTIONNAIRES) RELIABILITY

From Table 1, the participants used for this pilot survey were 12 in number, therefore, the responses for the pilot survey was filled and retrieved. 15% of a total 150 expected participants was used for the pilot survey. Osborne & Blanchard (2010) declared that if an issue exists with 10% likelihood in a potential study participant, then the results are most likely to be achieved within the 90% level of confidence. In addition, Table 2 illustrates the reliability of the instrument used. However, several studies suggested measurements scale of 0.7 reliability as a benchmark value for Cronbach alpha. Thus, Anelli (2018) suggested that a value of equal or greater than 0.7 shows high reliability as well. Thus, from Table 2, the Cronbach Alpha coefficient for the instrument used is highly reliable at 0.801 value, which is higher than acceptable value of 0.7

TABLE 1. Case process summary

CASE	N	%
Valid	12	100
Exclude	0	0
Total	12	100

TABLE 2. Reliability statistics

Cronbach Alpha	No. of Item
0.801	19

DATA ANALYSIS

DATA PRESENTATION AND DISCUSSION

Table 3, 4 and 5 presents the demographic information of the participated fire safety practitioners and building managers that partake in the study. From the tables, the following were the result from the participant demographic data. The result from Academic Qualification shows that the participant with Higher National Diploma was 22%, Post-graduate Diploma 25%, Bachelor Degree 33% and Masters Degree 20% respectively. Thus, the results revealed that, the participated fire safety practitioners possess the relevant qualification to provide valid answers to the questions asked

Table 3. Academic qualification of the participants

S/NO	Academic	Frequency	%
1	Higher National Diploma	26	22
2	Post Graduate Diploma	30	25
3	Bachelor Degree	40	33
4	Master Degree	24	20
5	Total	120	100

Table 4 shows participants years of experience, where the respondent with 10-15 years 30.8%, 16-20 years 42.5% and with the of above 21 years were 26.66%, the result shows that those that participated in the survey have the require years of experience to provide a valid response to the questions.

TABLE 4. Years of experience of the participants

S/No	Years of Exp.	Frequency	%
1	10 – 15 years	37	30.8
2	16-20 years	51	42.5
3	21 and above	32	26.66
4	total	120	100

Table 5 indicates the designation of the participants that partake in the survey, where fire safety manager of an organization were 30%, Experienced Building Managers 35.8%, Fire Safety Directors 24.1% and Directors of Work and Maintenance of Organization 10% respectively. Hence, the revealed that all the participated fire safety practitioners are better position to provides a valid answer to the research questions asked.

TABLE 5. Designation of the participants

S/No	Designation	%	Frequency
1	Fire Safety Manager	36	30
2	Building Manager	43	35.8
3	Fire Safety Director	29	24.1
4	Director of Work	12	10
5	Total	120	100

RESULTS FROM THE FACTORS AFFECTING IMPROPER FIRE SAFETY MANAGEMENT

Table 6 and Figure 1 shows the results of factors affecting improper fire safety management in public buildings in Nigeria. From the results, participants ranked the relative importance index (RII), value / average index and the factors were measured based on their responses. The RII and average index were based on the overall 120 questionnaires that were retrieved and analyzed.

Therefore, the overall response given by fire safety management practitioners/experts ranging from non-effective to highly effective. The respondents ranked the adequate fire training arrangement and adequate compliance with fire safety regulations grade one, with a RII of 0.64 and average index of 3.2, which indicates both components play a very important role in FSM of an institution building. An effective fire safety communication and fire outbreak report/investigation ranked grade two with RII of 0.60 and average index of 3.0. Moreover, the respondents ranked organized fire risk assessment and fire safety auditing as grade three with RII of 0.50 and average index of 2.8.

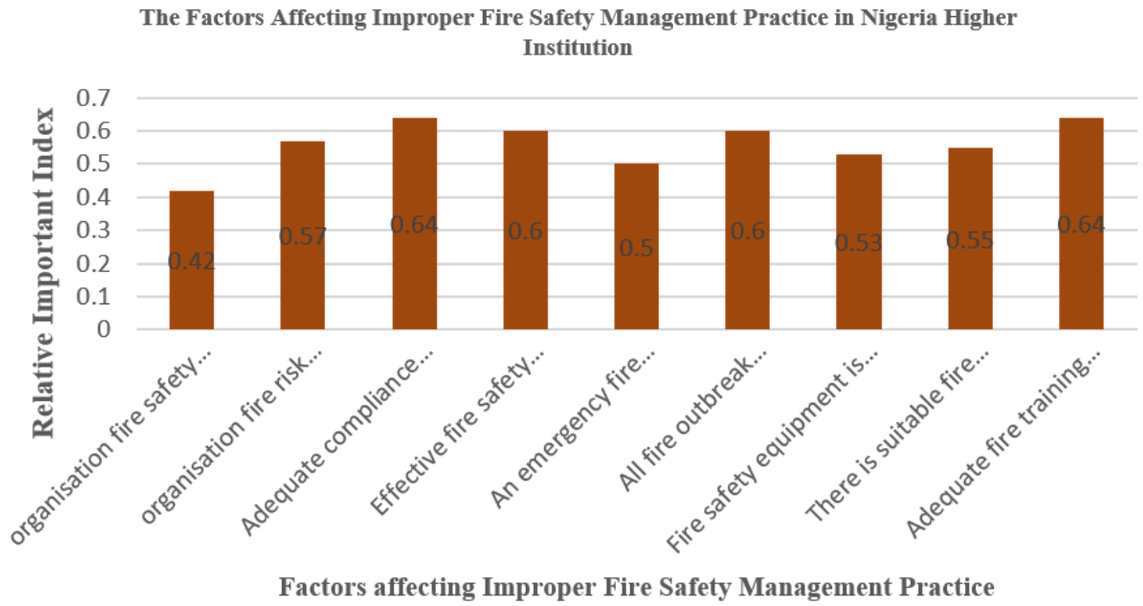

FIGURE 1. Factors affecting improper fire safety management practice

TABLE 6. Summary of the survey results on the factors affecting improper FSM program

S/NO	Factor Affecting Improper FSM	RII means	Items	Rank	Status
1	Organizational fire safety policy	0.42	2.1	5th	Non-effective
2	Organizational fire risk assessment	0.57	2.8	3rd	Moderately effective
3	Adequate compliance with fire safety regulations	0.64	3.2	1st	Highly effective
4	Effective fire fire safety Communication	0.60	3.0	2nd	Effective
5	An emergency fire safety plan	0.50	2.4	4th	Low-effective

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6	All fire outbreak reported and investigated	0.60	3.0	2nd	Effective
7	Fire safety equipment is well maintained	0.53	2.6	4th	Low-effective
8	There is suitable fire auditing	0.5	2.8	3rd	Moderately effective
9	Adequate fire training arrangement	0.64	3.2	1st	Highly effective

Furthermore, the respondents ranked fire safety equipment's maintenance, an emergency fire safety plan and safety policy organization as 4th, 5th, and 6th respectively, with the RII and average index of 0.53:2,6; 0.5:2.4:, and 0.42:2.1, respectively as shown in the Table 6 and Figure 1.

The findings from the analysis revealed poor fire safety organization policy toward fire safety. Therefore, it can be concluded that adequate fire safety training and adequate compliance with fire safety regulation is highly effective, on improper FSM practice in public buildings in Nigeria.

RESULTS FROM THE LEVEL OF EFFECTIVE IMPLEMENTING FIRE SAFETY MANAGEMENT

The essence of effective implementation of fire safety management strategy is to enhance the achievement of fire safety objectives and keep the building occupants and its contents safe from deaths and destruction. From the survey, responses from fire safety practitioners, fire safety experts, and professionals in the industry of buildings indicate that the fire safety organization and maintenance of fire equipment were ranked as grade one with the RII and average index of 0.65 and 3.2 respectively, fire safety budget was ranked as grade two with the RII and average index of 3.0, reporting and investigating fire was ranked as grade three with the RII and average index of 0.57 and 2.8, fire safety audit was ranked as grade four with the RII and average index of 0.56 and 2.7, while fire safety training was ranked as grade five with the RII and average index of 0.53 and 2.6 respectively.

However, fire risk assessment and fire safety communication/information were ranked as grade six with the RII and average index of 0.49 and 2.5, while emergency fire safety plan, procedure, and compliance with fire safety regulation were ranked as grade seven and eight with RII and average index of 0.45:2.3 and 0.42:2.1 respectively.

Therefore, from the results in the Table 7 and Figure 2, it indicates that the participants responses to the FSM components ranging from 0.50 and above as moderately effective, effective and highly effective respectively, and score ranging from 0-49 as non-effective and low-effective. This shows that the fire safety management practice in public buildings in Nigeria is not effective in serving its purpose of achieving fire safety objectives, to protect the buildings occupants, the building itself, and its contents against fire disaster. Adequate implementation of FSM practice requires proper fire safety components to be part of FSM strategy in order to achieve fire safety standard in an organization

TABLE 7. Results of the level of effective implementing FSM

S/NO	Implementation on level FSM	RII means	Items	Rank	Status
1	Fire risk assessment	0.49	2.5	6th	Low-effective
2	Fire safety Organization	0.65	3.2	1st	Highly effective
3	Compliance with fire safety regulation	0.42	2.1	8th	Non-effective
4	Emergency plan / fire safety procedure	0.45	2.3	7th	Non-effective
5	Fire safety Communication/ information	0.49	2.5	6th	Low-effective
6	Reporting and investigating fire	0.57	2.8	3rd	Moderately effective
7	Fire safety training	0.53	2.6	5th	Moderately effective
8	Maintenance of fire equipment and standard	0.65	3.2	1st	Highly effective
9	Fire safety Audit	0.56	2.7	4th	Moderately effective
10.	Fire safety	0.60	3.0	2nd	Effective

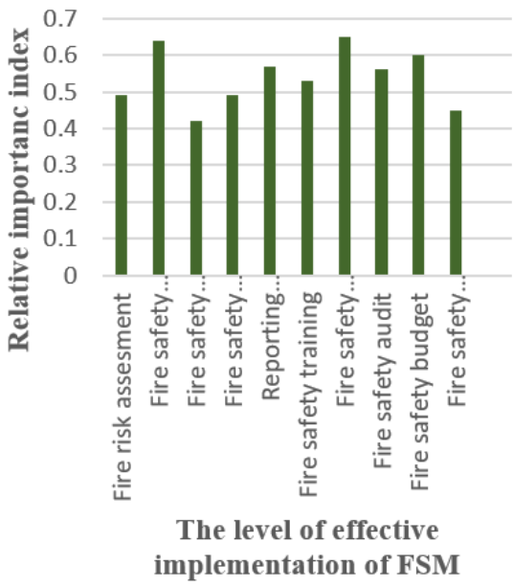

FIGURE 2. The level of effective implementation of fire safety management

CONCLUSION AND RECOMMENDATION

In conclusion, this study has successfully identified the factors that are affecting improper fire safety management and the level of effective implementation of fire safety management components and met with three objectives that were formulated for the study. Therefore, it can be said that the fire safety management strategy of public buildings in Nigeria is poor based on the conclusion to the questions factors affecting improper fire safety management and the level of effective implementation of fire safety management practice in the tables. Therefore, there is need for an improvement in fire safety management practice of the public buildings, especially in the area of integrated proper components of fire safety management into fire management strategy for effective management of fire to achieve safe and comfortable business environment.

However, to achieve acceptable fire safety objectives in Nigeria public buildings, this study recommended that all the ten identified fire safety management components should be integrated into fire safety management strategy, especially those identified from survey as non-effective and low effective implemented. Secondly, fire safety policy, an emergency fire safety plan, and fire safety equipment were identified as a major factor affecting the improper fire safety management in public buildings in Nigeria.

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DECLARATION OF COMPETING INTEREST

None.

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