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Factors Influencing the Performance of Fire Safety Management Program in Nigeria

Cyprian Bella Omunagbe*, Alao Mohammed Kaseem

Department of Building Technology, School of Environmental Studies, Federal Polytechnic Auchi, Auchi, Nigeria

Email address:
cyprainom@yahoo.com (Cyprian Bella Omunagbe), kaseemalao@yahoo.com (Alao Mohammed Kaseem)
*Corresponding author

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Abstract: Proper fire safety management program plays a critical role in achieving a desire fire safety objective in building. Therefore, several-studied have been conducted and shown that ineffective fire safety management program implementation is the main cause of failure in fire safety management. Thus, this paper aim at identify component influencing the performance of fire safety management program in building. One hundred and twenty (20) questionnaires were distributed to the relevant participants, which include Architects, Builders, Quantity Surveyor, Engineer, and Fire safety experts. In the end, 100 completed questionnaires were retrieved and analyzed with the use of descriptive and ranking analysis. The finding of the study revealed that the reliability of the instruments was higher than 0.7, and show that maintenance of fire safety equipment is the most influential component that affects the fire safety management program performance, while fire safety training and fire risk assessment were second and third most influential components of fire safety management program respectively. Hence, the study found to be that, non-maintenance, inadequate provision and non- functional fire safety equipment, often led to the main causes of fire disaster in buildings. Thus, the study suggests to the fire safety/building managers to implement adequate maintenance program, carried out proper fire safety training for the occupants, conduct regular fire risk assessment and increase fire safety budgetary allocation to the fire safety department in order to improve the maintenance/ replacement of fire safety equipment's. It is anticipated that by improving the performance of fire safety equipment, provision of adequate training for the occupants/building owners, the rate of fire disasters could be minimized to a barest level.

Keywords: Fire Safety, Management, Components, Performance, Buildings

1. Introduction

1.1. Background

The achievement of fire safety objectives in buildings, dependent on the uniqueness of components of fire safety management integrated into the strategy for the management of fire [1]. Therefore, incorporating the proper components of fire safety management into the fire safety guidelines will translate into the attainment of an acceptable level of fire safety in buildings [2]. Thus, failure to integrate such unique components could lead to poor management of fire and, subsequently, lead to fire disaster incidences.

Fire is an excellent servant to humanity, but become an enemy when it is not needed. However, the fire had destroyed many buildings, properties, and killed several persons across the globe [3]. The possibility of occurrences of fire outbreak and its significant loss will depend on the proper fire safety management implemented and whether suitable critical components of fire safety management are incorporated into the guidelines to manage the fire. The innovative buildings approach leads to being concerned about choosing the suitable components to be integrated into the fire safety management program for the achievement of fire safety objectives [4].

The recent increases in fire disasters across the states of the federation in Nigeria have drawn the attention of both private, government and the stakeholders on how fire can adequately manage so that the risk to life, injuries, and destruction of property can be minimized to an acceptable level [5].

However, the fire situation in Nigeria has become recurrent issues; this is indeed worrisome. In general, fire

ignite with a little volume of fuel, the smoke formed from the burning combustible materials, then transported by a smoke trail and collects the top slice of space as the film [6].

Although, fire disasters in a building are said to be caused by several factors such as electrical appliances, illegal and old wiring systems, and wrong selection of electrical cables. In similar research conducted by N. a. S and R. J Beard [7], the author revealed that illegal electrical connection, the old wiring system, and the attitude of building occupants at home and work contributed to the primary cause of frequent fire outbreaks in buildings. According to, S. M. I. Y Ebenechi [8], the United Kingdom established British fire service to proffer a lasting solution to the incidence of fire in the country in which fire safety management system was identified and executed as the best practice to minimize the fire risk in building.

Given the several existing research findings and literature review, enhancing fire safety standards is one of the keys aspects of the economic growth of any country. Hence, this study aims to establish the perception of fire safety practitioners in Nigeria on the critical components of fire safety management which are influential in achieving fire safety objectives.

1.2. Research Problem

The constants increase in the world population, the complexity of society, and the strength of the interface between humans and their immediate environment expose humans to several risks, which include fire disaster, flood disaster [9, 10].

Constants increases in disaster alert the stakeholders of the need to prepared for emergency management of these disasters. The direct consequences of these disasters have been enormous in terms of injuries, death, destruction of property, and constants closure of the business [11]. However, most of this disaster usually lead to an enormous social-economic loss on the parts of the government at all level and private individual. Additionally, lives lost as a result of these disasters may eventually lead to a decrease in the productivity of the country in terms of output. The effect of this disaster on both private and public sectors cannot be ignored. Though several researchers have agreed on the level of fire disaster on the economic growth and expansion, some of the studies tend to address fire disaster issues basically by focusing on the economics and social aspect of fire outbreak.

The consequences of inadequate fire safety management programs and lack of proper fire safety guidelines are particularly severe in buildings where several combustible materials could pose a severe threat to the occupants, buildings and their contents, and the environment in the fire event. R. Roslan and S. Y said [45, 12] suggested the objectives of fire safety as life safety, protection of buildings, and its contents and reduction of fire threat to the environment. Hence, all these objectives are better to achieve through effective fire safety management.

This trend with respect to fire safety research is also an evidence with regard to study which concern the fire safety management. Inspite of the fact that, there are no evidence of adequate study on identify components of fire safety management program, the fire safety management performance components in buildings should be known. Hence, there is need to identify the most influential components of fire safety management which enhances the achievement of fire safety objectives. The study aim at identify the most influential component of fire safety management program in building.

2. Fire Safety Management in Buildings

Fire safety management in a building is an essential aspect of building management that plays a significant role in the safety of occupants in a building. Fire safety management is to view and defines by different researchers. According to, I Ebenechi and Mahmoud [13] describe FSM as coordination of activities in a building to achieve the specific aim and objective of fire safety, these activities include inspection, education, and training, fire suppression, emergency services, evaluation of fire possibility, communication. J. K. M [14] define fire safety management (FSM); as an activity that comprises of coordination of program to minimized the cases of fire disasters in building to an acceptable level, the program includes fire risk assessment, fire safety organization, fire safety training, compliance with fire safety procedure, communication and information, reporting and investigation fires, maintenance of equipment and standards, fire audit and fire budget,

FSM is a kind of activity carried out in order that both the occupants of a building, buildings, and its content, include the environment, are safe from fire disaster. However, FSM has a significant influence on the fire safety systems and the overall buildings [15]. The safety of building occupants and contents is more than just a situation where occupants are protected against injury, death, or loss C. A. H Tan [16], describe fire safety as prevention, minimizing the spread of fire and smoke, extinguishing a fire, and the chance of a fast and safe exit. W. L. J Yayun [17] describe fire safety as a situation in which the fire risk of injury to the building occupants or any person or damages to the building and its contents is under the prearranged condition with an acceptable level of fire risk. Although, S. Roh [18] revealed that fire safety management is an aspect of the overall management role which determines and executes the organization of fire safety policy. It includes a sequence of activities, creativities, and programs that concentrate on technical, human, and organization parts and refers to all the separate activities within the organization. Furthermore, these activities are connected with the concept of fire safety tree for development and implementation of a fire safety management program through lifecycle management and improvement of buildings through involve inspection, education and training, fire suppression, emergency service, evaluation of fire possibility, fire prevention, reports, and record-keeping and fire communication.

3. Factors Affecting Fire Safety Management

Several researchers in the field of fire safety have studied and identifying components of fire safety management, which are influential in achieving the high standard of fire safety in buildings. [19] identified ten critical components of fire safety management in which he integrated into a model to manage fire in the passenger terminal. J. K. M [14] suggested eight components to be incorporated into a model to manage fire in buildings, and these components have been proving to be successful in the achievement of these objectives. Therefore, having been identified and were incorporated into a program to manage fire in their various organization or buildings as revealed in the past researches. But their importance has not been wholly examined under the context of Nigeria fire safety practitioners in order to identify the factors of fire safety management, which are influential in achieving fire safety objectives to integrate them into a program to manage fire in Nigeria. Therefore, the selected components identified are thereby listed, and their effects on the proper fire safety management program are thereby explained as follows:

3.1. Fire Safety Assessment

This is an essential approach to fire safety management. It is, however, the most effective measure of fire safety management, that can enhance building design and upsurge the capability to avert and control fire [20].

3.2. Fire Safety Training

The need for implementing effective fire safety management in a building is essential. However, the fire safety manager must train, educate, and instruct the occupants on how to operate and handle fire safety equipment/systems. According to H David [21] it was clearly revealed that failure to educate, trained, and give adequate orientation to occupants/ general public on how fire safety equipment is in the building is to be operated, and inadequate fire safety awareness of the occupants are responsible for an increase in fire disaster in buildings, particularly in developing Nation.

3.3. Fire Safety Organization

The proper organization of the fire safety department is imperative in order to achieve the management set goals and objectives and give the best service to the client. According to A Giwa and J. Chae [44, 22], revealed that the best fire safety system or equipment installed in a building could never guarantee fire safety for occupants of a building if the fire department is not organized correctly. Hence, fire safety organizations in a building are essential in achieving fire safety objectives.

3.4. Compliance with Fire Safety Regulation

Compliance to existing fire safety regulations and the standard is paramount to the fire safety manager, at the construction or design stage of every building, it is imperative to involve fire safety experts in ensuring that passive and active protection system is adequately installed. While at the post-construction stage of the building, the maintenance, replacement, compliance to all the regulations are observed and adhered to by the occupants. It is the pertinent functions of the fire safety management department in the building. According to D. Gariocha and J Chae [44, 23], failure to comply with the relevant fire safety regulations and standard-rated as the most causes of fire disaster in many parts of the world.

3.5. Communication and Information

It is very imperative for management of building to have a way of dialoguing with the occupant regarding their goals and short-long term view on how to achieve a safe and comfortable works environment. Communication and information as an aspect of fire safety management are essential functions of the department that increase the confident of the occupants in term of fire safety [24, 25].

3.6. Emergency Plan and Fire Safety Procedure

Building owners and managers need to make a plan ahead to respond to a fire emergency [26]. An emergency plan is strategic in place to facility fire safety managers in finding solutions to most critical fire safety issues in buildings. Rushing to solve fire safety issue often time result in failure and frustrate the aim of solving the issues [27, 28].

3.7. Reporting and Investigating Fires

Building manager/owners need to take into account their experience, particularly fire disaster, and discuss with the relevant authority the positive and negative impacts of the incidents and possible steps to avert similar issues in further. This will, however, increase the confidence of the organization's incapability of the fire department to tackle fire events. Thus, lessons are equally leaned from the incidents, which can help both the occupants and the policymaker to implement practical ways to avoid similar problems in the future [29, 30].

3.8. Maintenance of Fire Equipment and Standard

Failure in fire safety management system or operation happened in most cases as a result of non-functional or damaged fire safety equipment's in building, also, escape route in the building are often obstructed, under lock and key when it supposed to have opened, due to lack of proper maintenance. According to S. O Ugochukwu [31] highlighted that when maintenance of fire safety equipment and an escape route is incorporated into the fire safety management program, the objective of fire safety will be adequately achieved.

3.9. Fire Safety Audit

Auditing fire safety equipment in a building allows fire safety managers to known the level of fire safety preparation

at that point. This will further give the managers of building the idea of the area in a building that requires more attention. Besides, the managers/owners of buildings can know the level of fire risk their building and occupants are exposed to. Hence, it is imperative to incorporate auditing as part of the fire safety management program [42, 32].

3.10. Fire Safety Budget

An adequate budgetary fund to an established fire department in the building is imperative; this could assist the fire safety managers in achieving the set goal of the organization. The owner and managers of buildings are stands to benefit allot when the fire safety department is adequately funded. According to S. Gwyme [33], inadequate funding of the fire department is ranked as the leading cause of fire outbreak in building, particularly in developing nations.

4. Research Methodology

Fire safety management is a unique and complex aspect of management because there are several factors and components affecting the success of fire safety objectives. Therefore, adequate planning and development of research methodology are essential in achieving the objectives set out for this research. The research approaches adopted for this study are intended to achieve the purpose of the study. The purpose of this study is to identify the most critical factors which are influential in achieving fire safety objectives in Nigeria. Therefore, data and other information needed to achieve the research purpose were extracted from two major sources. The firstly, information regarding successful fire safety management components were retrieved from existing literature and fire safety management program which were developed, implemented and proven to succeed in achieving fire safety management objectives in the organization across the globe, the extracted components from the literature were ten in numbers. The second approach was to collect data from the field research, with the uses of questionnaires survey and the questionnaire was administered personally and through the mailed.

The questionnaires comprise two sections: section one has to do with the demographic information of the participants, which includes the professional years of working experiences in the field of fire safety and building management, professionals affiliation of the participants, and Educational qualification of the participants. Section two consists of the perception of the participants on the factors influencing the optimum performance of the fire safety management program in Nigeria.

However, the participants were asked to indicate their perception on the scale 1 to 5 in terms of not- influential to extreme influential. Hence, as this study is exploratory, types of research, which implied that it is carried out in order to get the participant's perception. The response rate is considered to be adequate as propose by J. Creswell [34], as cited by D. k [35], the authors suggested that when the sample size is more than 30 and less than 500 is suitable for study. However, with a sample of 120 for this research is essential. In this research, 120 questionnaires survey were administered, and 100 were filled, completed, and retrieved, which form 76 percent of the total administered questionnaire survey and higher than sufficient response rate of 10-20 percent for questionnaire survey [36]. The retrieved questionnaires were further analyzed with the uses of SPSS. In order to determine the reliability of the internal consistency of the scale, the calculation was carried out with the use of Cronbach's Alpha value. The ranking analysis was used by ranking the most influential factors, the means scores with 1 not influential to 5 extreme influentials, was used to rank the factor influencing fire safety management program in Nigeria, the primary reasons of ranking are to show the differences in the level of influential factors on the fire safety management among the component [37].

5. Results and Discussion

The participants in the questionnaires survey consist of 120 fire safety practitioners and professionals in the building industry in Nigeria. Among 120 questionnaires distributed, 100 were filled, completed, and retrieved for the analysis. From the information indicated in the figure 1, the highest number of participants was quantity surveyors (28%), follows by Architect (24%), Builders (18%), Engineer (17%), and the fire safety experts (13%). Although, the majority of the participants were government employers, follows by consultants.

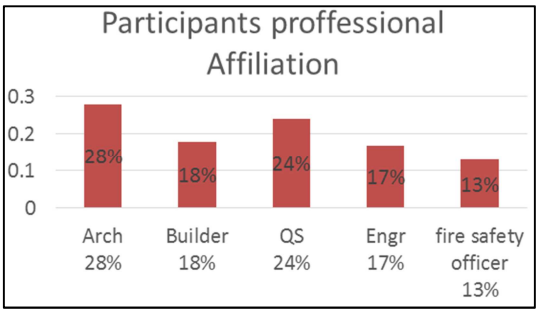

Figure 1. *Composition of Participants by Affiliation.*

Figure 2. *Distribution of the numbers of years of service among the participants.*

The second section of the analysis was the numbers of years of working experiences of the participants in the field of fire safety, and in the building industry, this section was broken down into five categories which include, 6-10 years, 11-20 years, 21-25 years, 26-30 years, and 31 years and above,

therefore, from the figure 2, the highest percentages of participants years of experiences are 31 years and above (29%), while 21-25 years was second highest with (20%), follow by 26-30 years was third highest with (19%), 11-12 years was fourth with (17%), and 6-10 years was the least with (15%). The finding from this section suggested that the majority of the participants in this survey were those that have been working in the field of fire safety for the past 20 years.

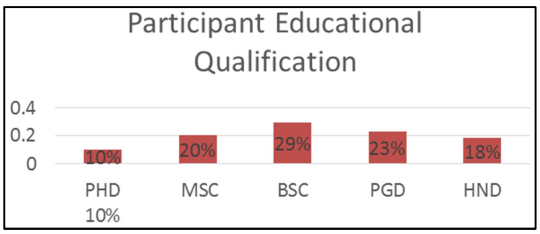

Figure 3. *Composition of participant's Academic qualification.*

Finally, this section presents the educational qualification of the participants, from the figure 3, (10%), of the participants, have Ph.D. degree, (20%) participants have MSc, degree, (29%) participants have BSc degree, (23%) participants have Postgraduate Diploma, and (18%) participants have Higher National Diploma respectively.

Table 1, the results from reliability analysis, as shown in Table 1. The data collection 12 fire safety practitioners and professionals in the buildings industry were selected and used for the pilot survey. Therefore, the questionnaires for the respondents were completely administered, filled, and returned. Although 10 percent of a total of 120 anticipated numbers of the participant was used for the pilot survey, according to J Creswell [38], revealed that, whenever there are challenges with 5 or 10 percent possibility in the potential research participants, then the challenges will surely be identified with 95% or 90% degree of the confidential. In addition, table indicates that the reliability of the instrument used. [39], Cronbach alpha usually measures for scale reliability of 0.7 as a benchmark. Hence, from the Table, the Cronbach alpha coefficients for the instrument used are highly reliable at 0.9, which is above the acceptable values of 0.7.

Table 1. *Cronbach Alpha.*

Cronbach's Alpha	No of Item
.901	10

Table 2, showing the ranking of the variables of the factors influencing the performance of the fire safety management program in Nigeria. The table indicates that maintenance of fire safety equipment ranks the highest, this implied that maintenance of fire safety equipment had become the most influential component in the performance of fire safety management program among the other components that make up the program with the value of (M=4.28). Thus, according to [13, 21], the authors, revealed that fire safety equipment maintenance on regular bases could enhance the optimum performance of both active and passive protection and prevention of fire system in which will further translate to the optimum performance of fire safety management program in achieving its objectives.

Table 2. *Means and standard deviation of fire safety management program.*

Components	No	Means	Standard Deviation	Rank
Fire safety organization	100	4.0600	.83811	9
Fire Safety Compliance	100	4.0800	.70611	8
Fire Safety Budget	100	4.0900	.84202	7
Emergency Plan/ Fire Safety Procedure	100	4.0900	.84202	7
Reporting/Investigating Fire	100	4.1200	.76910	6
Fire Safety Communication	100	4.1400	.80428	5
Fire Safety Auditing	100	4.2100	.79512	4
Fire Risk Assessment	100	4.2500	.77035	3
Maintenance of Fire Safety Equipment	100	4.2600	.63691	1
Fire Safety Training	100	4.2800	.64542	2

The results of this analysis have proven that the study by [7], declared that the fire safety maintenance equipment was considered to be the most factor influencing the achievement of fire safety objectives in buildings, fire safety training is ranked second with the value of (M=4.26), as a factor influencing the performance of fire safety management program.

This finding validates the suggestion of [40, 41], which revealed that training the occupants, stakeholders, practitioners about the knowledge of fire safety and skill on how the install fire safety equipment can be operated enhance the achievement of fire safety objectives, as a result, one of the essential components to incorporate into the fire safety management program is fire safety training components. Fire risk assessment was ranked third with the value of (M=4.25) as a factor influencing the performance of the fire safety management program in Nigeria.

However, fire risk assessment allows the fire safety manager or building owners to know the level of fire risk expose by the organization, building, and the occupants to enable the manager to determine the prevention approach to enhance the achievement. The fire safety audit, fire safety communication, and reporting and investigating of fire were ranked 4^{th}, 5^{th}, 6^{th} respectively, while emergency plan and fire safety procedures, fire safety budget was ranked 7^{th} and fire safety compliance and fire safety organization were ranked 8^{th}. Respectively. As cited by [3, 20, 8, 4, 11], described the integration of all these components selected components into a fire safety management program would influence the performance of fire safety management program for building or organization and in a similar studied, [6], integrated all these identified components

into the fire safety management program for passenger terminals which was proven to succeed in the achievement of fire safety standard. These findings are in line with fire safety concept tree postulated by NFPA (2007), which suggested integrating proper components the fire safety program could guarantee the achievement of fire safety objectives.

English citation first, followed by the original foreign-language citation [13-15].

6. Conclusion

The research carried out an intensive literature survey in which ten components that were influencing the optimum performance of fire safety management program for Nigeria were identified. Therefore, after the data collection and analyzed, the results revealed the ranking of the most influential factors which guarantee the achievement of fire safety objectives as follows: the maintenance of fire safety equipment rank 1st, fire safety training was ranked 2nd, fire risk assessment was rank 3rd, and fire safety audit was rank 4th, fire safety communication ranked 5th while reporting and investigation of fire ranked 6th, emergency plan and fire safety procedure 7th, fire safety budget 7th, fire safety compliance, and fire safety organization was rank 8th and 9th respectively.

Based on the findings, the paper tinted key components that influence the performance of fire safety management program implementation, and it can be concluded, therefore, that the maintenance of fire safety equipment has the most influential role in supporting the performance of fire safety management program implementation in Nigeria. In addition, this should be supported by conducting adequate fire safety training and fire risk assessment with the aim of achieving fire safety objectives. Finally, suggest to the fire safety/building managers to implement adequate maintenance program, carried out proper fire safety training for the occupants, conduct regular fire risk assessment and increase fire safety budgetary allocation to the fire safety department in order to improve the maintenance/ replacement of fire safety equipment's. It is anticipated that by improving the performance of fire safety equipment, provision of adequate training for the occupants/building owners, the rate of fire disasters could be minimized to a barest level.

These findings can be used to assist as a guideline for fire safety manager, building manager, facility manager to help in developing a strategy to implement the effective fire safety management programs appropriately.

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