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EXPERTS INFLUENCE ON FIRE SAFETY CRITERIA RANKING FOR FACTORY BUILDINGS IN NIGERIA

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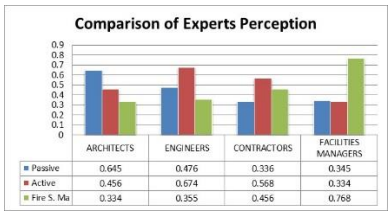
Graphical abstract



Abstract

The Ranking of fire safety attributes has been widely recognised in the evaluation of building fire safety. The ranking of the criteria and attributes depends solely on the experts' opinion and judgments. However, the decision of the experts may be influence by their different background and professional training. This paper examines how experts' professional background affects their decision regarding ranking of fire safety criteria and attributes. Four different groups of professional were participated in this study, which includes: Architects, Engineers, Contractors and Facility Managers. Survey questionnaire was administered to rank the fire safety attributes according to their level of importance using Analytical Hierarchy Process (AHP) judgment scale. Expert choice software was utilised in the analysis. The finding suggests that the perception of the experts differs from one group of expert to another. Each expert attached more important to the attributes that are more relevant to his profession, which greatly influenced their decision.

Keywords: Fire safety, attributes, factory buildings, professional background, experts

1.0 INTRODUCTION

Factory fires are devastating it can ruined lives, properties, building fabrics equipment, finished goods and frequently interrupts production. It has been estimated that 65% of the overall damage as a result of fire is in manufacturing operation. According to the Statistic from the national research council of Canada, 10-15% of direct properties was damaged by fire However, fire statistic in Australia shows that an equivalent of $68 million properties were lost in fire [1], [2]. In the same way, Nigeria has experienced many fire incidents which includes factory fires this seriously upset the nation's economy. Therefore, safeguarding lives and protecting properties including the building fabrics is very crucial in fire safety [3].

Risk is define as an unwanted anticipated effect that can be caused by a fire [1],which commonly denote as an arithmetical value, that is a function of probability and consequence[2].Research in fire safety evaluation has been established since the beginning of 1970s. A lot of funds have been invested on fire safety in several European countries and America with significant percentage to the performance-based fire design. The standard and the practices of fire safety engineering employed in the performance based design to assess the extent of risks and the distraction of the building based on the certain condition, such as building structure, internal

combustible function, and materials. Therefore a fire safety improvement can be achieved and the building could reliably be safeguarded [3]. However, despite the international recognition of performance based fire safety; the prescriptive type is still relevance in many under developed countries including Nigeria.

There is paradigm shift in the evaluation of fire safety [4]. Attributes of fire safety are weighted and prioritised to achieve a more efficient fire safety evaluation or risk assessment. The weighting and prioritisation are obtained through experts' opinion from different professions and trainings. Fire safety evaluation study cuts across different disciplines ranging from engineering environmental studies and management. This makes it difficult for one particular discipline to provide what is required for the evaluation of fire safety in building structure. However, while different experts must to be involved in the decision making for evaluation of building fire; different opinions which are based on the inclination of experts' professions must also be expected

Fire risk evaluation encompasses significant number of diverse factors, therefore, the assessment of these factors can be very challenging due to its diverse nature [5]. Assessing all the attributes of fire safety may also be impossible, and this why the prioritization become necessary. The criteria and attributes of fire safety have been reviewed by many researchers[6]–[8]. However, their views concerning some attributes were not in agreement with others in opinion, for different building occupancies because of the differences in experts' professional background and the type of buildings that were evaluated.

2.0 METHODOLOGY

Survey questionnaire was developed using Analytical hierarchy process (AHP) judgment scale [9] to elicit data from the following groups of experts: Architects, Engineers, Facilities Managers and Contractors. The experts were first interview to suggest the criteria of fire safety suitable for factory buildings. There after followed by survey questionnaire to rank the criteria according to their level of importance. The criteria that were selected for the study according to the experts are: Active Fire Protection, Passive Fire Protection and Fire Safety Management. Each of the criteria has sub-criteria or attributes. Table 1 to 3 shows the fire safety criteria and their corresponding attributes. The data was the analysed using Expert Choice Software.

Table 1 Passive fire protection criterion/attributes

Goal: Level of fire safety in factory buildings	
Criterion	**Attributes**
Passive fire protection	Occupant load
	Width of exit routes
	Max.Travel distance
	Number of exit routes
	Exit doors
	Exit signage
	Corridor width
	Site accessibility

Table 2 Active fire protection criterion/attributes

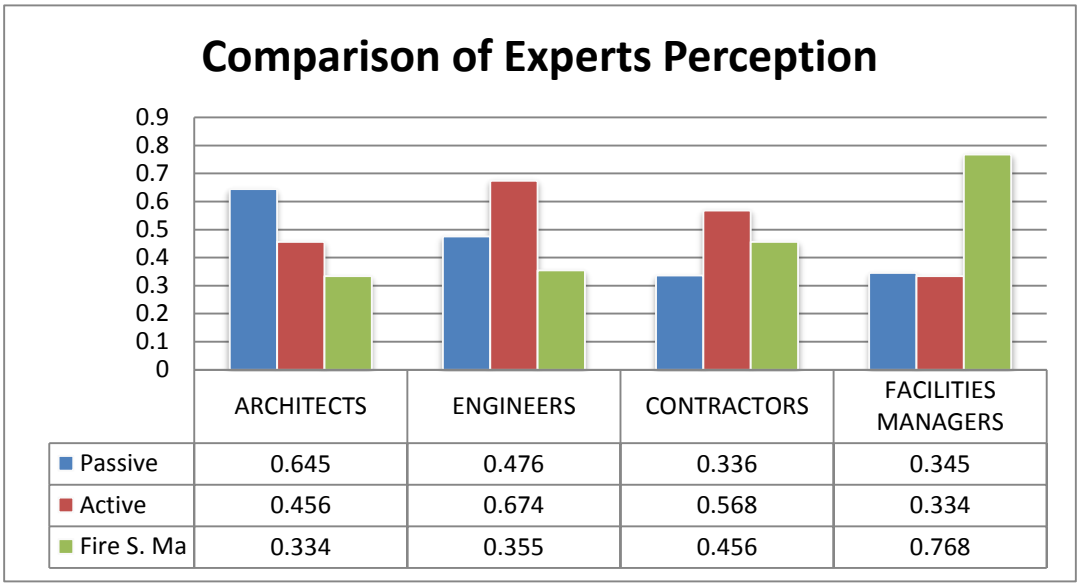
Goal: Level of fire safety in factory buildings	
Criteria	**Attributes**
Active fire protection	Fire alarm
	Fire hydrant
	Portable extinguisher
	Automatic sprinkler
	Hose reel
	Emergency lighting

Table 3 Fire safety management criterion/attributes

Goal: Level of fire safety in factory buildings	
Criterion	**Attributes**
Fire safety management	Fire safety inspection
	Fire safety plan
	Fire safety evacuation plan
	Maintenance of exit routes
	House keeping
	Staff training

3.0 RESULTS AND DISCUSSION

The results from the four different professionals are presented in Figure 1.



	ARCHITECTS	ENGINEERS	CONTRACTORS	FACILITIES MANAGERS
Passive	0.645	0.476	0.336	0.345
Active	0.456	0.674	0.568	0.334
Fire S. Ma	0.334	0.355	0.456	0.768

Figure 1 Comparison of experts views on the relative importance of fire safety criteria and attributes

The Ranking and of criteria and attributes of fire safety are usually obtain through experts' opinion, which possibly be selected from diverse professions. The fire safety evaluation study comprises the involvement of different disciplines mostly of building industry experts and fire safety staff. Thiss makes it very challenging for only one expert to provides what is required for the evaluation of fire safety in buildings. Nevertheless, while different expert must to be involved in the judgment, for the evaluation of building fire safety; different opinions which are based on the inclination of experts should acknowledge.

Several professionals participate in the design and installation of fire safety provisions in factory buildings. However, the professionals observed fire safety from their individual expertise, which surely affects their decision concerning the ranking of fire safety criteria and attributes. The differences due to their diverse background could not be avoided; however, it can be utilised prudently to rank the criteria and attributes of fire safety. Analytical Heirararcht Process (AHP) is very good synthesizing the different opinion of experts, as it can combine all the opinions and get a rational weightage of the criteria and attributes. The criteria and attributes weightage could then be used for the prioritization and evaluate the level of risk related with the factory buildings and consequently make the ranking of fire safety and suggest for improvement.

The Architects attached more importance to Passive Fire Protection than any other criteria. This is because they are responsible for the provision of escape facilities in the design of any building. Escape routes can facilitate the evacuation of occupants to place of safety if they are design appropriately, and this is the view of the Architects [10] [11]. However, there are certain things that may happen before the evacuation process reach the exit facilities; such as providing immediate information in case of emergency. Activation of fire alarm system which is Active Fire Protection provision will alert the occupants if there is any emergency before the process of evacuation begins. In this case the exit facilities may be unusable if the occupants are not informed about the emergency situation in an appropriate time. This means that Passive fire protection may not work efficiently without other fire safety provisions.

Engineers view differently from what Architects perceived; this is due to their commitment in the design and installation of Active Fire protection provisions. According to the engineers the most important criterion is Active Fire protection as it serves as the fire safety provision to be used in informing the occupants as well as extinguishing the fire when there is outbreak. However, many casualties was recorded as a result of lack of emergency sign, example"Cocoanut Grove nightclub fire" (1942) which killed about 492 people [12]; even though the occupants of such building where notified about the incident using the active fire safety equipment. This means that Active Fire Protection alone cannot provide full protection in case of fire outbreak.

Contractors considered Active Fire protection as the most important criterion because they involved in the installation of active fire provision which are more profitable than the construction of passive fire provision.

Facility managers perceived Fire Safety Management as the most important criterion of fire safety [14]. Their perception is based on the fact that no matter how good the provision of passive and active are, without good management such provisions will not work. Therefore, passive and active fire safety provision must be managed properly to achieve good fire safety.

4.0 CONCLUSION

Many professionals are involved in the design and installation of fire safety provisions in factory buildings. However, each professional perceived fire safety from his professional background point of view, which definitely affects his decision of ranking the fire safety criteria and attributes. The differences in the perception of the professionals could not be avoided rather it can be manage to rank the criteria and attributes of fire safety. The use of AHP is very essential as it can synthesize all the perceptions and arrived at a reasonable weighting of the criteria and attributes. The criteria and attributes weightings can be used to prioritize the necessary fire safety improvement and also determined the level of risk associated with the factory buildings.

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