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Framework for Fire Safety Management of Hotels in Nigeria: A Structural Equation Modeling Approach

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ABSTRACT

Recent findings indicate Nigeria is among the top countries with devastating consequences of fire incidences. The volatile position of Port-Harcourt as an oil-producing capital city is seen as one of the reasons why fire disasters occur in hotels, among other high rises institutional building structures. This study, therefore, explored the factors responsible for the high incidences of fires in Port-Harcourt, Nigeria. As phenomenological research involving humans, a 5-point Likert scale cross-sectional questionnaire survey instruments were developed using online Google forms to evaluate people's awareness, identify the material factors that promote fire incidents, and assess the present policy and standards to control fire incidents. The ordinal scaled data collected from 108 respondents were tested to be reliable with a Cronbach alpha of 0.958 using the SPSS Statistic software and further analyzed using the Structural Equation Modelling approach. Results show that hotel workers in Port-Harcourt are aware of fire safety management issues, though periodic retraining is required as new technologies evolve. Safety standards are also relatively maintained in the placement of equipment power points, extinguishers, and emergency controls. However, the significant causes of the fire were attributed to electrical and mechanical devices installed and utilized on the hotel premises. While the study calls for the installation of high-quality equipment in hotels, more inquiry is needed to check the reliability of individual equipment. A framework was finally conceptualized for further research and replicating the study in other contexts. This study's findings are essential to hotel entrepreneurs and managers, fire experts, building designers, and researchers.

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1. Introduction

Fire safety management can be described as applying fire protection measures to research, evaluation, and control of fire using policy, standards, and tools, among other information available (Furness & Muckett, 2007; Sari, Rafrita, Rahayuningsih, & Alfianto, 2019). It may also be viewed as an organized plan for ensuring that people's responsibilities under the fire safety directive are met, typically through a fire safety policy (Della-Giustina, 2014).

Though following fire safety norms and guidelines does not necessarily imply that fires are wholly avoided, fires are limited so that loss of lives and property are put to the barest minimum. Natural fire safety regulations have existed for centuries, with new standards developed chiefly in response to disasters (Barau & Barau, 2017; Maluk, Woodrow, & Torero, 2017). When a fire is contained and regulated, it naturally keeps people warm while also allowing for the creation of novel resources through reprocessing and other means of production, as without heat and fire, civilization would be adversely different. However, it can also destroy lives, buildings, and companies when it goes out of control (Hassanain, Al-Harogi, & Ibrahim, 2022; Wang, Li, Feng, & Yang, 2021). When people exposed to fire outbreak are psychologically affected, the trauma kills in most situations more than the physical burns (Nimlyat, Audu, Ola-Adisa, & Gwatau, 2017; Ogochukwu, Oduduabasi, & Anake, 2019). Every structure contains something that might easily cause a fire, and it is nearly impossible to eliminate the possibility of a fire in a building. This informs the preference for adopting the term "fire-resistant" against "fireproof" when describing building materials (Chen & Liew, 2003). Building damage from a fire is often difficult to repair. Even when fixed, it last just for a short time. As a result, fire may be seen as a decent servant but a nasty boss, a valuable tool with a dreadful nightmare.

Generally, fire disasters are one of the world's most prevalent and damaging calamities that have proven difficult to address, especially in developing countries (Agbola & Falola, 2021; Salazar, Romão, & Paupério, 2021). Due to rapid global technological development, the frequency of building fires has altered significantly. Nevertheless, in terms of their severity and resilience, they have become a growing source of concern in recent years. Reports indicate that there have been over a hundred million fire incidences between 1993 and 2020, with 7-8 million occurrences and 70-80 thousand deaths (Brushlinsky, Ahrens, Sokolov, & Wagner, 2016; Brushlinsky, Sokolov, Wagner, & Messerschmidt, 2022). In the 2022 report, the Czech Republic tops the frequency of fire calls, Cyprus in number per thousand, Russia in total deaths, and Belarus in death per hundred population. Citing a media article by Tolofari in 2010, Nimlyat et al. (2017) put the annual fire outbreak in Nigeria at about 7,000, with resultant deaths of over 1,000 persons (p.775). However, the recent report on World Fire Statistics by Brushlinsky et al. (2022) indicates that Nigeria recorded 2,056 fire occurrences and 147 deaths in 2020 (p.26). According to the report, Nigeria is not among countries with the highest frequency of fire incidences, the country comes only to Belarus in the number of deaths per hundred fire occurrences (p.40). Explaining further, Nimlyat et al. (2017) link the improvement in the number of fire occurrences to the recent approval of the National Building Code (NBC) and National Fire and Safety Code (NFSC) by the Nigerian Government.

Though fire incidences are mostly under-reported, the reported 2,056 incidents in Nigeria (Brushlinsky et al., 2022) make the average for the 36 states and the Federal Capital Territory (FCT), amounting to 56 cases. Considering the numerous fire occurrences due to oil exploration, accidents, and other cultural practices, Nwaichi (2022) puts the frequency of fire incidents in Rivers State – Nigeria, at 100 per year. It is on record that the great fire of Ogoniland destroyed one-tenth of the city in 1999, including hotels and other high-rise structures. Also, studies on fire outbreaks in hotel buildings are still emerging due to inadequate empirical research on fire safety management. Although fires affect various building structures, Ronchi and Nilsson (2013) advise that hotel employees must be ready to act swiftly, as the first five minutes of a fire emergency are essential to its control. Even though hotel buildings have the most sophisticated fire safety features, human factors such as indifference, ignorance, or a deficiency in design and safety awareness are usually blamed for fire outbreaks and poor enhancement of fire safety.

Furthermore, inadequate policy implementation and fire safety awareness affect the attitude of staff and workers in the hotel buildings, with numerous negative consequences for the community and environment. The attitude of employees in the workplace depends on their awareness of occupational hazards. Consequently, there is a critical requirement to evaluate the degree of knowledge of and application of fire safety policies at the hotel buildings. In their study on reducing the likelihood of fire and mitigating repercussions of its occurrences, Sun and Luo (2014) posit that "Good management of fire safety" is essential to lower the probability of fire occurrence and to mitigate the consequence if a fire does occur (p.492).

This study attempts to determine the most critical aspects of fire safety management that impact hotel building occupants' fire safety and actions to enhance it. It sets to statistically measure the workers' awareness of fire hazards in hotels and assess fire incidents relating to cultural and safety management standards, using the Structural Equation Modelling (Tuhul et al.) approach. The study suggests a unified framework for workers' awareness, fire assessment, hotel fire incidents, cultural practices, and safety standards in hotel fire management. The suggested framework is distinctive as it incorporates human and material factors and policy and management standards. Detailed recommendations are offered to solve these boundaries using the suggested fire safety framework to demonstrate the applicability of enhancing fire safety in Port Harcourt, Rivers State, Nigeria. As a result, the design and cost-effectiveness of recommended remedies are given specific attention, highlighting the need for additional research and training to improve hotel building safety.

2. Methodology

The methodology for this study involves a cross-sectional survey, where one-time data was collected from different gender and age grades. The data were analyzed and ranked through the Confirmatory Factor Analysis (CFA) approach that forms the first-order level of the Structural Equation Modelling (Tuhul et al.)

(Aule, Majid, & Jusan, 2022a), using the Analysis of Moment of Structures (AMOS) software.

2.1 Data Collection

The data for this study was collected from varying types of workers in hotels, motels, guest houses, restaurants, and bars in Port-Harcourt – Nigeria. The different hospitality sectors formed a basis for the stratified probability sampling, where data was drawn from each population. Closed-ended structured questionnaires were utilized as the primary data source for hotel fire safety management. The structured questionnaires consist of a series of questions with multiple-choice options targeted to systematically gather valuable information from respondents on fire safety management in hotels directly from respondents. Compared to other data collection methods, the technique is more straightforward and less costly, requiring simplified effort from the researcher and undue pressure of probing physical enquiry from participants.

The five-point Likert-scaled ordinal survey instrument was grouped into eight sections: A, B, C, D, E, F, G, H, and I. Section A entailed gathering demographic information on the respondents, as presented in Table 1. The other sections collected data on workers' work experience, awareness of fire safety, management commitment to fundamental causes of fire, observance of basic fire safety policy, assessment of fire incidents, cultural practices, and fire safety management, respectively. In completing the survey, statements were made for respondents to select their choice on a 1 to 5 rating scale, from strongly disagree (SD), disagree (D), undecided (U), agreed (A), and strongly agreed (SA), in that order.

Table 1 Respondents' demographic data distribution

Description	Category	Frequency	Percentage (%)
Gender	Male	60	55.6
	Female	48	44.4
Age Range	20-30	12	11.1
	31-40	44	40.7
	41-50	40	37.0
	51 & above	12	11.1
Educational Background	Secondary School/High School	4	3.7
	Graduate/College	60	55.6
	Postgraduate (Master/Ph.D.)	44	40.7
Hotel apartment	Standard High-rise Hotel	20	18.5
	Medium Standard (Motel) Hotel	24	22.2
	Restaurant and Bar	8	7.4
	Guest House	8	7.4
	Others	48	44.4
Hotel's year	0-5yr(s)	28	25.9
	6-10yrs	48	44.4
	11-15yrs	20	18.5
	above 15yrs	12	11.1

For quick and efficient delivery in line with modern practices, the online Google form was utilized for packaging and delivering the survey, conducted between July and September 2022. With the online resource, respondents were required to "click" the option corresponding to their answer choice. The survey was designed to exclude people without work experience in a hotel from the first question. The "required" constraint was also employed to manage occurrences of "missing data," where respondents may leave out some questions unanswered.

A paragraph space was also provided toward the end of the survey section for unstructured feedback from respondents regarding the issue under study. Some academic specialists and other experienced researchers assessed the survey questionnaire to ensure content reliability further. The questionnaire was, therefore, thoroughly reviewed for clarity, readability, accuracy, comprehensibility, and consistency. Finally, a link to the survey was generated and shared with some known hotel workers, who then snow-balled it to colleagues, official groups, and other respondents with hotel work experience in Port Harcourt, Rivers

State, Nigeria. A total of 108 completed responses were received from the online ordinal scale survey. With about 50% internet coverage in Nigeria and a high cost of access, in addition to limited workers in hotels, the returned data was deemed sufficient to carry out the study.

2.2 Data Analysis

The dataset obtained from the online survey was first subjected to some descriptive analysis in the form of percentages, tables and charts using the Statistical Package for Social Science (SPSS). Preliminary tests were performed on the data to check redundant respondents that selected the same option for all questions, outliers whose responses do not correlate with others, variable commonalities, reliability, and validity. However, as shown in Table 2, a Cronbach's alpha of 0.954 was attained in the collected data for this study, above the 0.7 thresholds appropriate for utilizing a data set for the subsequent statistical procedure. Furthermore, the Principal Component Analysis (PCA) produced a Kaiser-Meyer-Olkin (KMO) value of 0.66, above the required minimum of 0.6 measure (Achoba, Majid, & Obiefuna, 2021a; Aule, Majid, & Jusan, 2022b). Bartlett's Test of Sphericity also produced a significant 0.000 value, confirming the suitability of data for SEM.

Table 2 High Cronbach Alpha showing Internal Reliability of Collected Data

Reliability Statistics

Cronbach's Alpha	Cronbach's Alpha Based on Standardised Items	N of Items
0.954	0.958	49

Case Processing Summary

		N	%
Cases	Valid	108	100.0
	Excluded	0	0.0
	Total	108	100.0

a. Listwise deletion based on all variables in the procedure.

Survey data is reliable, with a Cronbach alpha greater than 0.7

Structural equation modelling (Tuhul et al.) assesses intangible impressions, such as values, accomplishments, esteem, preferences, and pleasure, which cannot be measured using some physical equipment (Aule et al., 2022a). Since the abstract qualities of people cannot be measured directly like physical entities, such as the number of people, weight, height, cars, and temperature, among others, they can effectively be measured with an ordinal scale (Kline, 2016). As a result, Achoba et al. (2021) view the CFA and SEM are instruments to explore and test correlations in ordinal scale data, particularly in social science studies.

Despite having different names in the same family, such as covariance structure modelling or analysis (Kline, 2016), SEM is frequently carried out in two processes known as orders. The two components are the first-order CFA and the second-order SEM. In most cases, CFA requires generating path diagrams and covariances before loading the factors, observed or measured variables. The loaded CFA model is then run and examined to remove insignificant components with less than 0.5 standardized regression weights (Achoba et al., 2021a; Achoba, Majid, & Obiefuna, 2021b; Aule et al., 2022a). The first-order CFA is complete when model goodness-of-fit is attained, and the criteria for reliability and validity are met. The second order creates a comprehensive model using the results of the SEM, which generates a series of dependent relationships between a group of concepts or constructs that are each represented by several quantifiable variables (Malhotra, 2020). This study will, however, be limited to the first-order CFA since the objective does not include formulating a hypothesis for statistical testing relationships.

3. Results and Discussion

The general model for fire safety management of hotels in Nigeria is presented in Figure 1. It is developed based on the ordinal variables utilized in the SEM analysis, excluding the categorical constructs of biodata and years of hotel experience. Discussion of the results will be based on the six independent variables of safety awareness, fire incidence, hotel policies, fire assessment, cultural and safety practices, and the dependent construct of overall hotel fire safety management.

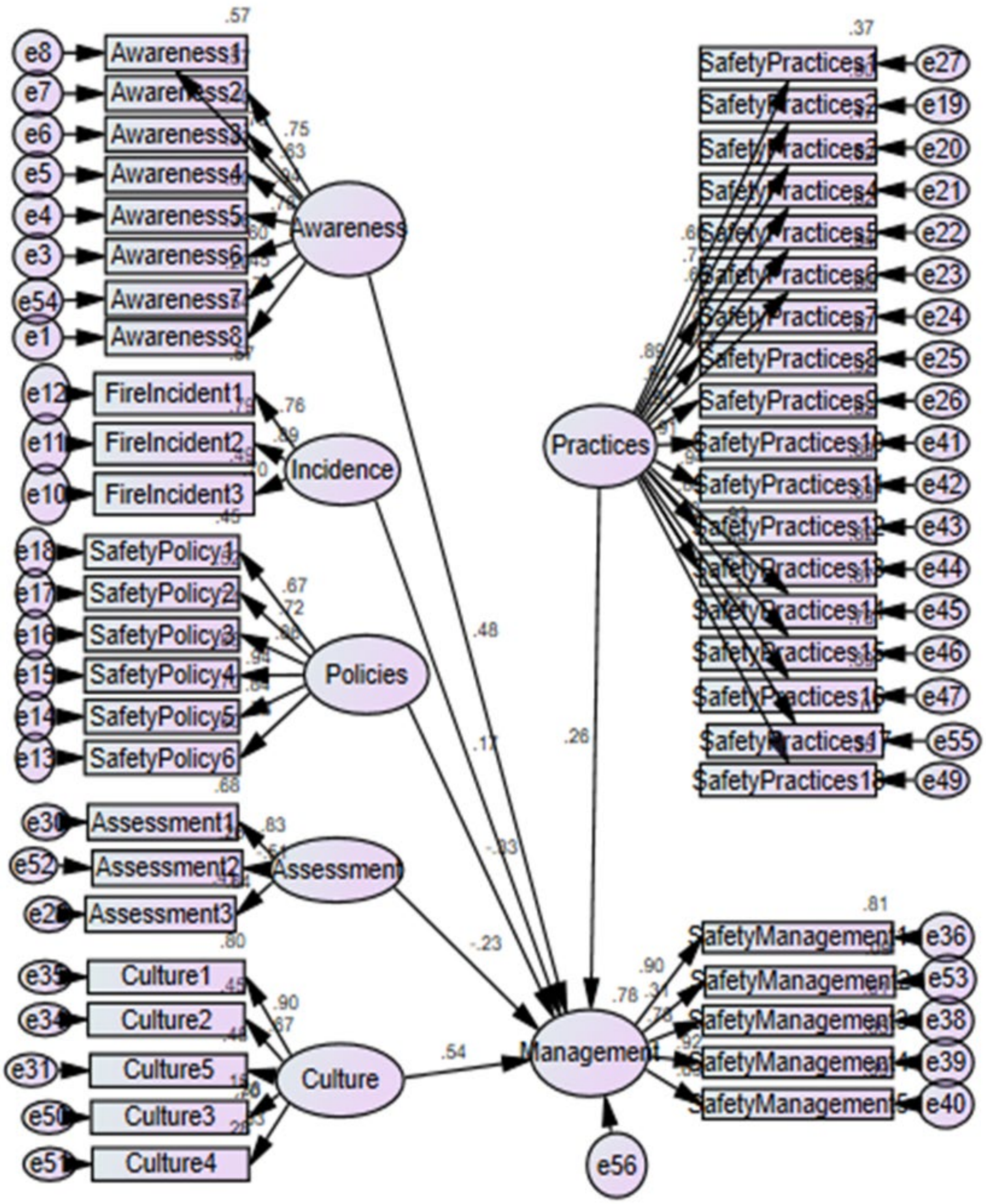

Figure 1 SEM model for fire safety management of hotels in Nigeria

3.1 Worker's Awareness of Fire Safety

The construct for Fire Awareness has eight variables coded from 1 to 8. Results of the standardized regression weights (SRW) squared multiple correlations (SMC), internal validity, and reliability are presented in Table 3.

Table 3 Workers' awareness of fire safety

Construct	Code	Variable	SRW	SMC	Validity	Cronbach alpha
Awareness	Awareness1	Awareness of fire	0.739	0.546	0.000***	0.881
	Awareness2	Fire risk training	0.817	0.668	0.000***	
	Awareness3	Poor housekeeping	0.689	0.475	0.000***	
	Awareness4	Report injuries and hazards	0.896	0.802	0.000***	
	Awareness5	Duties Performance	0.721	0.520	0.000***	
	Awareness6	Fire safety attendance	0.648	0.420	0.000***	
	Awareness7	Risk assessment courses and certifications	0.505	0.255	0.000***	
	Awareness8	Course content of the fire safety	0.729	0.531	0.000***	

Note: SRW > 0.5; SMC > 0.25; Cronbach alpha > 0.7; ***valid at 99% (Kline, 2016; Malhotra, 2020)

The SRWs for the Fire Awareness construct are all high, ranging from 0.896 to 0.505, above the 0.5 minimum thresholds. Consequently, the SMC is also above the average 0.25 lower limits. With a Cronbach alpha of 0.881, above the 0.7 satisfactory level, all the eight variables under the Fire Awareness construct are also statistically significant at a 99 percent confidence level. However, the top Fire Awareness variables are the procedure to report fire hazards and risk training, among other factors. While Fire Awareness seems high among the workers, there is still a chance to improve attendance to risk assessment courses and fire safety training.

The results agree with previous findings that Fire Safety Awareness is a standard measure used in the fire safety management of workers in a hospitality environment (Agbola & Falola, 2021; Hassanain, Aljuhani, Hamida, & Salaheldin, 2022; Kim et al., 2021; Li, Hasemi, Nozoe, & Nagasawa, 2021; Ogochukwu et al., 2019). The results also showed that over 80% of respondents agreed to be conversant with the fire safety awareness in the hotel building. For this reason, efforts are needed to maintain a steady awareness of managing fire protection systems in buildings, and workers should be thoroughly trained and equipped with the fire safety measures and guidelines associated with the hotel premises (Alli, 2008; Hughes & Ferrett, 2011; Wood, 2017).

3.2 Causes of Fire Incidents in Hotel Buildings

The construct Fire Incidence has four variables coded from 1 to 4. Results of the standardized regression weights (SRW), squared multiple correlations (SMC), internal validity, and reliability are presented in Table 4.

Table 4 Causes of Fire Incidents

Construct	Code	Variable	SRW	SMC	Validity	Cronbach alpha
Incidents	FireIncident1	Negligence	0.764	0.584	0.001***	0.378
	FireIncident2	Electrical work	0.893	0.798	0.000***	
	FireIncident3	Electrical and mechanical equipment	0.686	0.470	0.000***	
	FireIncident4	Fire-fighting facilities and equipment	0.057	0.003	0.022**	

Note: SRW > 0.5; SMC > 0.25; Cronbach alpha > 0.7; ***valid at 99%; **valid at 95% (Kline, 2016; Malhotra, 2020).

The construct's SRWs range from high as 0.893 to as low as 0.057. while three of the constructs are high, above the 0.5 minimum threshold, and one of them was 0.057, below the minimum limit. Consequently, apart from inadequate fire-fighting equipment, the SMC for the other three variables is above the average 0.25 lower limits. With a Cronbach alpha of 0.378, below the 0.7 satisfactory level, only the first three variables under the Fire Incidence construct are also statistically significant at a 99 percent confidence level.

Since Fire Incidence is a negative construct, it could be inferred that most of the fires in hotel premises are caused due to workers' negligence, electrical and mechanical equipment. Hence, the study agreed with previous findings indicating that a significant fire outbreak occurs in hotel buildings due to the occupants' irresponsibility, negligence, violation of construction codes, unawareness of safety measures, carelessness, and lack of training (Amin, Alisjahbana, & Simanjuntak, 2018; Nimlyat et al., 2017; Ogochukwu et al., 2019). However, workers' carelessness, loss of health and safety understanding, and a lack of knowledge and competent staff were major variables that caused the fire, according to another study in Dubai, United Arab Emirates (Adhakari et al., 2020; Tuhul et al., 2021; Zekri, 2013). Perhaps fire dangers are the source of fire, and minimizing them will reduce the number of fire events (Buchanan & Abu, 2017; Jones et al., 2019). Improving the identified variables is desirable and recommended to combat fire incidence in hotels.

3.3 Management's Commitment to Policy

The Fire Safety Policy construct has six variables coded from 1 to 6. Results of the standardized regression weights (SRW) squared multiple correlations (SMC), internal validity, and reliability are presented in Table 5.

Table 5 Fire Safety Policy

Construct	Code	Variable	SRW	SMC	Validity	Cronbach Alpha
Policies	SafetyPolicy1	Fire safety policy	0.681	0.464	0.000***	0.914
	SafetyPolicy2	Policy available	0.728	0.529	0.000***	
	SafetyPolicy3	Safety policy reviewed	0.865	0.748	0.000***	
	SafetyPolicy4	Management policy	0.933	0.871	0.000***	
	SafetyPolicy5	Management culture	0.839	0.704	0.000***	
	SafetyPolicy6	Fire Safety training	0.766	0.587	0.000***	

Note: SRW > 0.5; SMC > 0.25; Cronbach alpha > 0.7; ***valid at 99% (Kline, 2016; Malhotra, 2020).

The SRWs for the Fire Safety Policy construct are all high, ranging from 0.933 to 0.681, above the 0.5 minimum threshold. Consequently, the SMC is also above the average 0.25 lower limits. With a Cronbach alpha of 0.914, above the 0.7 satisfactory level, all the six variables under the construct are also statistically significant at a 99 percent confidence level. However, the top Fire Safety Policy variables are the management's adoption of fire hazards identification, safety policy, and the culture of Fire Safety inspections. While responses to Fire Safety Policy seem to be high among the workers, there is still a chance to improve hotel management's general fire safety policy.

The results agree with the findings by Kim et al. (2021), for overall improvements in Fire Safety, especially in high-rise buildings, in line with the British Standard (-8) 9999 policy (Alianto, Nasruddin, & Nugroho, 2022; Brzezinska & Bryant, 2021; Hopkin & Spearpoint, 2021). As hypothesized, each of these dimensions was found to be a significant factor in safety policy, as in management commitment to fire safety, supervisor support, safety communication, safety policies, and safety programs. Also, as predicted, safety policy was significantly related to both safety compliance and safety participation, or worker behaviours. Both safety behaviours were negatively associated with self-reported injury for firefighters not in the "always zero" or no injury group (Smith, 2010; Smith & DeJoy, 2014). According to this theory, investing funds in cascading and implementing safety measures in hotels with safety policies and safety concerns in their strategies makes managers more committed to their roles (Dillette & Ponting, 2021; Pescaroli & Alexander, 2016). According to the finding, fire incidents will have fewer risk factors when organizational safety rules and strategy issues are correctly applied and performed. Therefore, the frequency of fire incidents at work will consequently decrease as a result. Management commitment to fire safety, supervisor support, safety communication, and safety policies and programs. As hypothesized, each of these dimensions was found to be a significant factor in safety policy. Also as predicted, safety policy was significantly related to both safety compliance and safety participation, or worker behaviors. Both categories of safety behaviors were negatively associated with self-reported injury for firefighters not in the "always zero" or no injury group.

3.4 Fire Safety Management Practices

The construct for Fire Safety Practices has eighteen variables coded from 1 to 18. Results of the standardized regression weights (SRW), squared multiple correlations (SMC), internal validity, and reliability are presented in Table 6.

Table 6 Fire Safety Practices

Construct	Code	Variable	SRW	SMC	Validity	Cronbach alpha
Practices	SafetyPractices1	"No Smoking" signs	0.604	0.365	0.000***	0.957
	SafetyPractices2	Ventilation outlets	0.710	0.504	0.000***	
	SafetyPractices3	First aid kit	0.687	0.472	0.000***	
	SafetyPractices4	Emergency procedure	0.787	0.619	0.000***	
	SafetyPractices5	Emergency telephone numbers	0.907	0.823	0.000***	
	SafetyPractices6	Assembly (Muster) point	0.736	0.542	0.000***	
	SafetyPractices7	Fire extinguishers	0.894	0.799	0.000***	
	SafetyPractices8	Service/maintenance	0.932	0.870	0.000***	
	SafetyPractices9	Debris and damage	0.959	0.920	0.000***	
	SafetyPractices10	Unobstructed access	0.906	0.820	0.000***	
	SafetyPractices11	Padlocks keys and others	0.936	0.876	0.000***	
	SafetyPractices12	Emergency exit training	0.830	0.876	0.000***	
	SafetyPractices13	Adequate PowerPoint	0.903	0.815	0.000***	
	SafetyPractices14	Switches/ PowerPoint	0.934	0.872	0.000***	
	SafetyPractices15	Breaker switches	0.886	0.785	0.000***	
	SafetyPractices16	Suitable fire extinguishers	0.626	0.392	0.000***	
	SafetyPractices17	Electrical units and cables	0.163	0.027	0.562	
	SafetyPractices18	Procedure in place	0.592	0.351	0.000***	

Note: SRW > 0.5; SMC > 0.25; Cronbach alpha > 0.7; ***valid at 99% (Kline, 2016; Malhotra, 2020).

The SRWs for the Fire Safety Practices construct are high, ranging from 0.936 to 0.592, above the 0.5 minimum threshold, except the care for Electrical units and cables, which has 0.163, below the minimum acceptable level. Consequently, most of the SMC is also above the average 0.25 lower limits, except for the care for Electrical units and cables. With a Cronbach alpha of 0.957, above the 0.7 satisfactory level, seventeen of the eighteen variables under the construct are also statistically significant at a 99 percent confidence level. Consequently, the top Fire Safety Practices variables are the compartmentalization of spaces by locks, appropriate placement of control switches, and the culture of regular equipment maintenance and servicing. While most of the responses for Fire Safety Practices seem to be high among the workers, there is still the chance to improve the quality of electrical units and cables to effectively check fire in hotel environments.

The results align with the International Fire Safety Standard Common Principles (IFSS-CP) that fire safety practices enhance public confidence in line with the United Nations' sustainability goals (Hassanain, Al-Harogi, et al., 2022; Ivanov, Chow, Yue, Tsang, & Peng, 2022; Roslan & Said, 2017). According to the finding, most hotels have fire sprinklers, emergency exits, assembly (Muster) points, emergency procedures, and telephone numbers; suitable fire extinguishers are in place, and associated pumps are in good shape and up-to-date. However, implementing quality safety practices in the hotel can boost and enhance the hotel's prestige, thereby limiting the extra cost spent on fire incidents/accidents (Gstaettner et al., 2019; Ogetii, 2019).

3.5 Fire Incidence in Hotel Buildings

The Assessment of Fire Incidents constructs three variables coded from 1 to 3. Results of the standardized regression weights (SRW) squared multiple correlations (SMC), internal validity, and reliability are presented in Table 7.

Table 7 Assessment of Fire Incidents

Construct	Code	Variable	SRW	SMC	Validity	Cronbach Alpha
Assessment	Assessment1	Major fire incidents	0.828	0.686	0.001***	0.015
	Assessment2	Minor fire incidents	0.529	0.280	0.006***	
	Assessment3	Injury and loss of life	0.624	0.390	0.001***	

Note: SRW > 0.5; SMC > 0.25; Cronbach alpha > 0.7; ***valid at 99% (Kline, 2016; Malhotra, 2020).

The SRWs for the Assessment of a Fire Incidents construct are high, ranging from 0.828 to 0.529, above the 0.5 minimum threshold. Consequently, the SMCs are also above the average 0.25 lower limits for construct acceptability. With a Cronbach alpha of 0.015, below the 0.7 satisfactory level, all three variables under the construct are also statistically significant at a 99 percent confidence level.

Consequently, they reported that most hotel fire incidents were major ones that resulted in severe injuries or even loss of life. Therefore, employers and workers must adhere to prescribed fire safety practices and techniques that decrease the danger and impact of fire (Ivanov et al., 2022; Shariff, Yong, Salleh, & Siow, 2019; Sun & Luo, 2014). It is recommended that a customized fire safety strategy should be created and implemented right at the planning and design stages before building work is completed to achieve the recommended control systems for fire safety (Navitas, 2014; Poliakova & Grigoryan, 2018).

3.6 Culture and Hotel Fire

The construct for Culture and Fire has five variables coded from 1 to 5. Results of the standardized regression weights (SRW) squared multiple correlations (SMC), internal validity and reliability are presented in Table 8.

Table 8 Culture and Fire

Construct	Code	Variable	SRW	SMC	Validity	Cronbach Alpha
Culture	Culture1	Cultural practice	0.794	0.630	0.000***	0.791
	Culture2	People's cultures	0.662	0.438	0.000***	
	Culture3	Relationships	0.502	0.252	0.234	
	Culture4	Sustainability of hotel	0.604	0.365	0.004***	
	Culture5	Workers' and staff culture	0.761	0.365	0.000***	

Note: SRW > 0.5; SMC > 0.25; Cronbach alpha > 0.7; ***valid at 99% (Kline, 2016; Malhotra, 2020).

The SRWs for Culture and Fire construct are all high, ranging from 0.794 to 0.502, above the 0.5 minimum thresholds. Consequently, the SMCs are also above the average 0.25 lower limits. With a Cronbach alpha of 0.791, above the 0.7 satisfactory level, four of the five variables under the construct are statistically significant at a 99 percent confidence level, with one falling below the minimum threshold.

While the people recognize culture as one of the indices for fire control, their responses show that it does not promote fire danger in hotels. Though it may not be applicable in the study area, previous studies indicate that a people's culture affects fire safety, especially during emergency evacuations (Agbola & Falola, 2021; Alianto et al., 2022; Amin et al., 2018; Cvetković et al., 2022; Ivanov et al., 2022). Furthermore, cultural practice is one of the contributing factors to fire incidents and can negatively influence the sustainability of the hotel if it is not adequately addressed and implemented.

3.7 Fire Safety Management

The construct for Culture and Fire has five variables coded from 1 to 5. Results of the standardized regression weights (SRW), squared multiple correlations (SMC), internal validity, and reliability are presented in Table 9.

Table 9 Hotel's Fire Safety Management

Construct	Code	Variable	SRW	SMC	Validity	Cronbach Alpha
Management	SafetyManagement1	Awareness of fire safety	0.876	0.767	0.001***	0.778
	SafetyManagement2	Safety policy and standards	0.298	0.089	0.047**	
	SafetyManagement3	Good fire safety management	0.755	0.570	0.000***	
	SafetyManagement4	Fire Safety practices	0.942	0.888	0.000***	
	SafetyManagement5	Adequate spacing	0.559	0.313	0.005***	

Note: SRW > 0.5; SMC > 0.25; Cronbach alpha > 0.7; ***valid at 99%; **valid at 95%; (Kline, 2016; Malhotra, 2020).

Four SRWs for Fire Safety Management construct are high, ranging from 0.942 to 0.559, above the 0.5 minimum threshold. Consequently, their SMCs are also above the average 0.25 lower limits. With a Cronbach alpha of 0.778, above the 0.7 satisfactory level, four of the five variables under the construct are statistically significant at a 99 percent confidence level, the other at 95 percent.

While people recognize awareness, culture, and safety practices as the major indices for fire control, there is a need to improve safety policy and standards, which according to scholars, can enhance fire Safety Management in hotels (Ebekozien, Aigbavboa, Ayo-Odifiri, & Salim, 2020; Hassanain, Aljuhani, et al., 2022; Kim et al., 2021; Ouache, Nahiduzzaman, Hewage, & Sadiq, 2021; Wang et al., 2021). It could be seen that the most negligible value is the relationship between evaluation and control of fire safety using policy, information, standards, and fire safety management tools in the hotel, with the least SRW of 0.0298 due to the low level of agreement by respondents. However, good fire safety management could minimize the risk of the fire incident and enhance fire incident management, thereby establishing a high standard of reliability for the hotel in terms of safety measures. It should be "stakeholder duty" to provide and maintain an appropriate level of fire safety management, and the best way to do this is through enhanced training, inspection, auditing, and information. Where quantitative risk assessment is performed, reliable data are essential to the management function. The investigation identified a vulnerability in this area, which management has in various ways acknowledged. Adequate fire safety management is crucial for public safety, which is why organizations that often use a complete quality management approach have found it more straightforward to accept safety elements (Buchanan & Abu, 2017; Samson & Terziovski, 1999).

3.8 Framework for Hotel Fire Management

The high frequencies and death rates of fires in Nigeria call for concerted efforts to tackle the fire problem. The volatile salutation of Port-Harcourt as a city in an oil-producing state makes it prone to fire disasters in hotels, among other high-rise institutions. Three main factors were considered in the study of hotel fires in Port-Harcourt: human, material and standards.

While the human factors included the people's culture and their awareness of fire dangers in hotel premises, the material aspects have to do with the extent of fire due to mechanical, electrical among other tangible elements. Policy and standards entail regulated strategies and practices of the management and workers regarding fire safety. The framework, as presented in Figure 2, is based on novel findings, providing a basis for further research in the fire safety management of hotels in Nigeria.

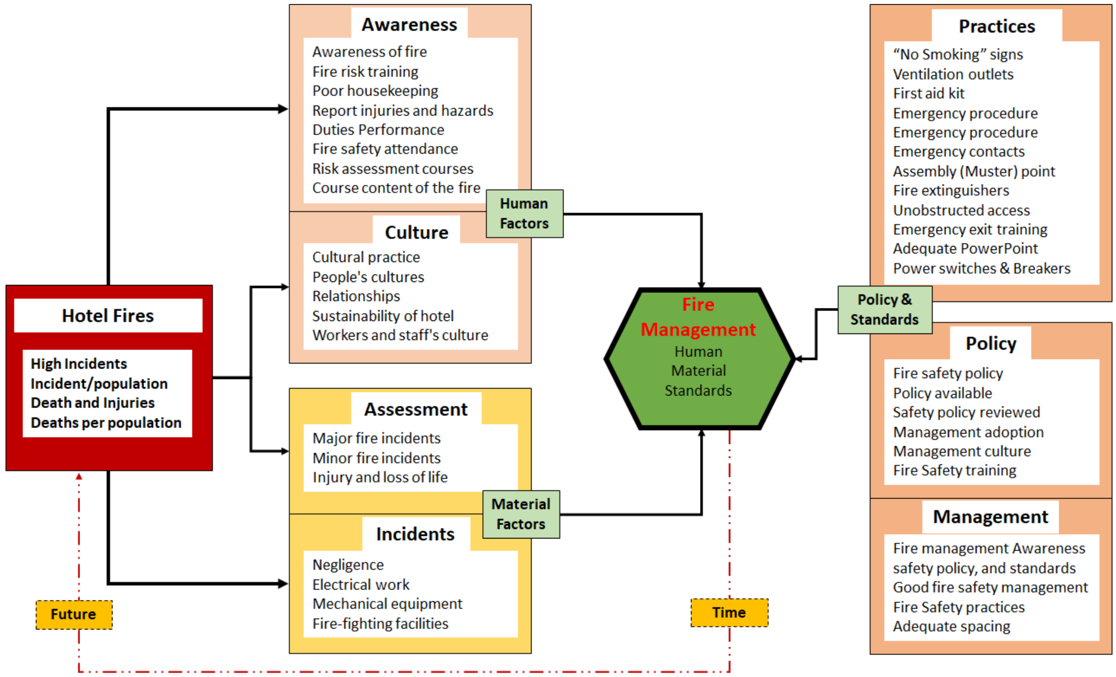

Figure 2 Framework for Hotel Fire Management in Nigeria

4. Conclusion

Though Nigeria does not occupy the top rank of countries in most frequent fire disasters in the world, it ranks among the top countries with a high number of deaths per 100 fire incidents. Furthermore, Nigeria, with an average fire incident of 56 spread among the 36 states and the FCT, Port-Harcourt has higher chances of fire due to high population and oil exploration activities. Hotels, as places of relaxation and leisure, need to be safe and secure from threats of fire disasters. While the level of Fire Awareness seems to be high among the workers, there is still a chance to improve attendance to fire safety training. On their part, hotel management should improve the general fire safety policy among workers and the environment. From the responses, it could be established that most hotel fire incidents were major ones that resulted in severe injuries and loss of life.

Consequently, most fire incidents in hotel premises are caused due to workers' negligence and electrical and mechanical equipment defects. To this end, there is a need to improve the quality of mechanical units and electrical cables to effectively check fire occurrences in hotel environments. While the people recognize culture as one of the indices for fire control, their responses show that it does not promote the danger of hotel fire in Port-Harcourt - Nigeria.

While the respondents recognize awareness, culture, and safety practices as the major indices for fire control, there is a need to improve safety policy and standards, which according to scholars, can enhance fire Safety Management in hotels. It could be seen that the most negligible value is the relationship between evaluation and control of fire safety using policy, information, standards, and fire safety management tools in the hotel. Therefore, employers and workers must adhere to prescribed fire safety practices and techniques that decrease the danger and impact of fire. Right at the planning stage, a customized fire safety strategy should be created and implemented before building work is completed to achieve the recommended control systems for fire safety. Therefore, this study's findings are essential to hotel entrepreneurs, managers, fire safety experts, and building designers.

Conflict of Interest

The authors declare that there is no conflict of interest in this study. Materials from other sources are cited as much as possible. Authors appreciate contributions from their respective institutions, especially research assistants and respondents.

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References

Achoba, M. I., Majid, R. B. A., & Obiefuna, C. O. (2021a). Relationship between window and view factors in the workplace: A SEM approach. International Journal of Built Environment and Sustainability, 8(2): 103–113. https://doi.org/https://doi.org/10.11113/ijbes.v8.n2.667

Achoba, M. I., Majid, R. B. A., & Obiefuna, C. O. (2021b). The relationship between workplace window and seating arrangement. IOP Conference Series: Materials Science and Engineering, 1051(1): 012103. https://doi.org/10.1088/1757-899x/1051/1/012103

Adhakari, E. R., Mishra, A. K., & Joshi, E. K. R. (2020). Causative factor of accidents in commercial buildings of Bharatpur Metropolitan City. Saudi Journal of Civil Engineering. 4(7): 101-112. https://doi.org/10.36348/sjce.2020.v04i07.001

Agbola, S. B., & Falola, O. J. (2021). Seasonal and locational variations in fire disasters in Ibadan, Nigeria. *International Journal of Disaster Risk Reduction,* 54(January): 102035. https://doi.org/10.1016/j.ijdrr.2021.102035

Alianto, B., Nasruddin, N., & Nugroho, Y. S. (2022). High-rise building fire safety using mechanical ventilation and stairwell pressurisation: A review. *Journal of Building Engineering,* 50: 1–31. https://doi.org/10.1016/j.jobe.2022.104224

Alli, B. (2008). Fundamental principles of occupational health and safety. International Labour Organization.

Amin, M., Alisjahbana, S. W., & Simanjuntak, M. R. (2018). Analysis model of master plan fire protection system in building and environment in Dki Jakarta - Indonesia. *International Journal of Civil Engineering and Technology*, 9(11): 60–69.

Aule, T. T., Majid, R. B. A., & Jusan, M. B. M. (2022a). Exploring cultural values and sustainability preferences in housing development: A structural equation modeling approach. *Scientific Review Engineering and Environmental Studies,* 31(3): 149–160. https://doi.org/10.22630/srees.2971

Aule, T. T., Majid, R. B. A., & Jusan, M. B. M. (2022b). Influence of agricultural activities on housing and settlement patterns of Rural communities in Benue state Nigeria. *Journal of Agriculture and Crops,* 8(4): 283–292. https://doi.org/https://doi.org/10.32861/jac.84.283.292

Barau, A. S., & Barau, A. (2017). Land degradation and environmental quality decline in urban Kano. In Kano: The state, society and economy, 141-170. Retrieved from http://www.ipbes.net/sites/default/files/downloads/Decision_IPBES_3_1_EN_0.pdf. Retrieved date: October 11, 2022

Brushlinsky, N., Ahrens, M., Sokolov, S., & Wagner, P. (2016). World fire statistics 21 (No. 21). Russia.

Brushlinsky, N., Sokolov, S., Wagner, P., & Messerschmidt, B. (2022). World Fire Statistics 27 (No. 27). Retrieved from https://ctif.org/world-fire-statistics Retrieved date: October 17, 2022

Brzezinska, D., & Bryant, P. (2021). Risk index method — A tool for building fire safety sssessments. Applied Sciences (Switzerland) MDPI, 11(3566): 1–16. https://doi.org/https://doi.org/10.3390/app11083566

Buchanan, A. H., & Abu, A. K. (2017). Structural design for fire safety. John Wiley & Sons.

Chen, W. F., & Liew, J. y. R. (2003). The cilvil engineering handbook (Second). London: CRC Press.

Cvetković, V. M., Dragašević, A., Protić, D., Janković, B., Nikolić, N., & Milošević, P. (2022). Fire safety behavior model for residential buildings: Implications for disaster risk reduction. *International Journal of Disaster Risk Reduction,* 76(April): 1-24. https://doi.org/10.1016/j.ijdrr.2022.102981

Della-Giustina, D. E. (2014). Fire safety management handbook. In *Healthcare Hazard Control and Safety Management.* https://doi.org/10.1201/b16667-13

Dillette, A., & Ponting, S. S.-A. (2021). Diffusing innovation in times of disasters: considerations for event management professionals. *Journal of Convention & Event Tourism.* 22(3): 197-220

Ebekozien, A., Aigbavboa, C., Ayo-Odifiri, S. O., & Salim, N. A. A. (2020). An assessment of fire safety measures in healthcare facilities in Nigeria. *Property Management,* 39(3): 376–391. https://doi.org/10.1108/PM-07-2020-0043

Furness, A., & Muckett, M. (2007). Introduction to fire safety management. Retrieved from http://books.elsevier.com Retrieved date: October 11, 2022

Gstaettner, A. M., Kobryn, H. T., Rodger, K., Phillips, M., & Lee, D. (2019). Monitoring visitor injury in protected areas-analysis of incident reporting in two Western Australian parks. *Journal of Outdoor Recreation and Tourism,* 25: 143-157. https://doi.org/https://doi.org/10.1016/j.jort.2018.04.002

Hassanain, M. A., Al-Harogi, M., & Ibrahim, A. M. (2022). Fire safety risk assessment of workplace facilities: A case study. *Frontiers in Built Environment,* 8(861662): 1–9. https://doi.org/10.3389/fbuil.2022.861662

Hassanain, M. A., Aljuhani, M., Hamida, M. B., & Salaheldin, M. H. (2022). A framework for fire safety management in school facilities. *International Journal of Built Environment and Sustainability*, 9(2): 1–9. https://doi.org/10.11113/ijbes.v9.n2.901

Jones, T. S., Black, I. H., Robinson, T. N., & Jones, E. L. (2019). Operating room fires. *Anesthesiology,* 130(3): 492-501. https://doi.org/https://doi.org/10.1097/ALN.0000000000002598

Hopkin, C., & Spearpoint, M. (2021). Numerical simulations of concealed residential sprinkler head activation time in a standard thermal response room test. *Building Services Engineering Research and Technology,* 42(1): 98–111. https://doi.org/10.1177/0143624420953302

Hughes, P., & Ferrett, E. (2011). *Introduction to health and safety at work.* Routledge.https://doi.org/https://doi.org/10.4324/9780080970714

Ivanov, M. L., Chow, W. K., Yue, T. K., Tsang, H. L., & Peng, W. (2022). Upgrading of fire safety requirement for tall buildings in Bulgaria and proposal of implementing fire safety management under facility management. *Facilities,* 40(5/6): 380–393. https://doi.org/10.1108/F-10-2021-0107

Kim, M., Kim, T., Yeo, I. H., Lee, D., Cho, H., & Kang, K. I. (2021). Improvement of standards on fire safety performance of externally insulated high-rise buildings: Focusing on the case in Korea. *Journal of Building Engineering,* 35: 1–12. https://doi.org/10.1016/j.jobe.2020.101990

Kline, R. B. (2016). Principles and practices of structural equation modelling (fourth). Retrieved from www.guilford.com Retrieved date: October 18, 2022

Li, M., Hasemi, Y., Nozoe, Y., & Nagasawa, M. (2021). Study on strategy for fire safety planning based on local resident cooperation in a preserved historical mountain village in Japan. *International Journal of*

Disaster Risk Reduction, 56(January): 102081. https://doi.org/10.1016/j.ijdrr.2021.102081

Malhotra, N. K. (2020). Marketing research: An applied orientation. Harlow, England: Pearson Education.

Maluk, C., Woodrow, M., & Torero, J. L. (2017). The potential of integrating fire safety in modern building design. *Fire Safety Journal,* 88: 104–112. https://doi.org/10.1016/j.firesaf.2016.12.006

Navitas, P. (2014). Improving resilience against urban fire hazards through environmental design in dense urban areas in Surabaya, Indonesia. *Procedia - Social and Behavioral Sciences,* 135: 178–183. https://doi.org/10.1016/j.sbspro.2014.07.344

Nimlyat, P. S., Audu, A. U., Ola-Adisa, E. O., & Gwatau, D. (2017). *An evaluation of fire safety measures in high-rise buildings in Nigeria. Sustainable Cities and Society,* 35(September): 774–785. https://doi.org/10.1016/j.scs.2017.08.035

Nwaichi, P. I. (2022). *Assessment of fire safety management system in selected hotels located in Port-Harcourt, Nigeri*a. Universiti Teknologi Malaysia.

Ogetii, J. B. (2019). *An Assessment of Occupational Health and Safety Practices at Construction Sites in Nairobi City Region*, Kenya university of nairobi].

Ogochukwu, S. A., Oduduabasi, E. I., & Anake, U. C. (2019). Analysis of fire disaster preparedness among Secondary schools in Port Harcourt metropolis, Rivers State / Nigeria. Global Scientific Journal, 7(10), 474–525. Retrieved from www.globalscientificjournal.com

Ouache, R., Nahiduzzaman, K. M., Hewage, K., & Sadiq, R. (2021). Performance investigation of fire protection and intervention strategies: Artificial neural network-based assessment framework. *Journal of Building Engineering,* 42(March): 102439. https://doi.org/10.1016/j.jobe.2021.102439

Pescaroli, G., & Alexander, D. (2016). Critical infrastructure, panarchies and the vulnerability paths of cascading disasters. *Natural Hazards,* 82(1): 175-192. https://doi.org/https://doi.org/10.1007/s11069-016-2186-3

Poliakova, T., & Grigoryan, M. (2018). Fire safety issues in the design and construction of high-rise buildings. *MATEC Web of Conferences,* 196(02014): 1–4. https://doi.org/10.1051/matecconf/201819602014

Ronchi, E., & Nilsson, D. (2013). Fire evacuation in high-rise buildings: A review of human behaviour and modelling research. *Fire Science Reviews*, 2(1): 7. https://doi.org/10.1186/2193-0414-2-7

Roslan, R., & Said, S. Y. (2017). Fire safety management system for heritage buildings in Malaysia. *Environment-Behaviour Proceedings Journal,* 2(6): 221–226. https://doi.org/10.21834/e-bpj.v2i6.961

Salazar, L. G. F., Romão, X., & Paupério, E. (2021). Review of vulnerability indicators for fire risk assessment in cultural heritage. *International Journal of Disaster Risk Reduction,* 60(December 2020): 1-15. https://doi.org/10.1016/j.ijdrr.2021.102286

Samson, D., & Terziovski, M. (1999). The relationship between total quality management practices and operational performance. *Journal of operations management,* 17(4): 393-409. https://doi.org/https://doi.org/10.1016/S0272-6963(98)00046-1

Sari, A. A., Rafrita, F. K., Rahayuningsih, T., & Alfianto, I. (2019). The role of the fire safety management in providing a guarantee of a fire protection: The case of Graha Rektorat building of State University of Malang. *IOP Conference Series: Materials Science and Engineering*, 669: 1–7. https://doi.org/10.1088/1757-899X/669/1/012058

Shariff, G. N., Yong, J. C. E., Salleh, N., & Siow, C. L. (2019). Risk assessment of building fire evacuation with stochastic obstructed emergency exit. *International Conference and Workshops on Recent Advances and Innovations in Engineering,* 2019(November): 27–29. https://doi.org/10.1109/ICRAIE47735.2019.9037753

Smith, T. D. (2010). Development and test of a firefighter safety climate model uga].

Smith, T. D., & DeJoy, D. M. (2014). Safety climate, safety behaviors and line-of-duty injuries in the fire service. *International Journal of Emergency Services.* 3(1): 49-64. https://doi.org/https://doi.org/10.1108/IJES-04-2013-0010

Sun, X. Q., & Luo, M. C. (2014). Fire risk assessment for super high-rise buildings. *Procedia Engineering*, 71: 492–501. https://doi.org/10.1016/j.proeng.2014.04.071

Tuhul, H. S., El-Hamouz, A., Hasan, A. R., & Jafar, H. A. (2021). Development of a conceptual framework for occupational safety and health in Palestinian manufacturing industries. *International Journal of Environmental Research and Public Health,* 18(3): 1338. https://doi.org/https://doi.org/10.3390/ijerph18031338

Wang, L., Li, W., Feng, W., & Yang, R. (2021). Fire risk assessment for building operation and maintenance based on BIM technology. *Building and Environment,* 205(April): 108188. https://doi.org/10.1016/j.buildenv.2021.108188

Wood, R. C. (2017). Housekeeping and related accommodation services. In *Hotel Accommodation Management*. 70-82. Routledge.

Zekri, M. K. S. (2013). Construction safety and health performance in Dubai. Unpublished thesis). Heriot Watt University, Dubai.