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EVALUATION OF THE EFFECTIVENESS AND ADEQUACY OF EXISTING FIRE SAFETY MEASURES IN FUTMINNA STUDENTS' HOSTELS

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ABSTRACT
Fire safety measures are of utmost importance in the design of any building, particularly in high occupancy structures such as student hostels. This paper is aimed at evaluating the adequacy of fire safety measures across the six hostels located at the Federal University of Technology Minna (FUTMINNA) Gidan kwano campus. The research methodology adopted in the study was the mixed method approach employing a structured questionnaire, and physical inspection/observation. To determine the adequacy of the existing fire safety systems in the students' hostels, a multi-attribute evaluation approach was employed which facilitated the classification of fire safety systems into five categories: non-existence, non-fulfillment, low-fulfillment, High fulfilment and Full fufillment of the assessment criteria in the checklist. Descriptive statistics was adopted to analyse the data obtained from the survey questionnaires, while mean score was used to analyse the data collected by observation. The study reveals that, the existing fire safety measures in FUTMINNA students' hostels is effective however, there are some others measures that are not provided such as fire stoppers on doors, windows and compartmentalization of spaces. Conclusively, the findings will be of relevance to other hostels within and around the campuses of other universities in Nigeria serving as guidelines and reference. The study recommends that, adequate attention should be paid to existing fire safety measures in students hostels while due consideration be given to the provision of fire safety measures and systems right from the design stage.

INTRODUCTION
Globally, enrolment of students in tertiary education is growing fast and as a result, student housing has become one of the major problems faced by higher institutions especially in developing country (Nimako & Bondinuba, 2013). Nigeria as a country has not been exempted from this explosion in growth. The past few decades have witnessed tremendous increase in student's population at the Federal University of Technology, Minna (FUTMINNA). Statistics indicates that the entire student population had increased by over 35% from 16,239 in the 2012/2013 session to over 22,000 student in the 2022/2023 session (Adeleke *et al*., 2016), which has put pressure on facilities on the campus including accommodation. And the recent merger of the two campuses – Bosso and Gidan Kwano, has also been an addition to the intense pressure on accommodation at the Gidan Kwano campus.

Kofi Agyekum *et al*., (2016) stated that increased population comes with its associated challenges, one of which is increased fire risk. Fire outbreaks at university hostels have of recent become a matter of urgent attention because of the frequency of fire outbreaks in several student hostels around Nigeria. Nwabueze (2012), also stated that there has been lot of incidence of fire in hostels, where student has lost their lives and valuable properties. The most recent fire outbreak was in the Bayelsa State Medical University female hostel in Yenegoa, which was reported that the fire was caused by an electric spark when a student was trying to iron her clothes (Daily Trust, 2023). Other recent reported fire incidences includes: University of Benin Female hostel in April 18th 2023 caused by a power surge in one of the rooms (Channels, 2023); Federal Polytechnic Ede, Osun State Female Hostel in January 30th 2020 which cause is unknown (Bamigbola, 2020); University of Nasarawa Keffi, Boys Hostel February 8th 2023 which cause is also unknown; and many others that are littered over the university campuses where valuable properties of student have been lost and the building itself has been rendered obsolete due to fire outbreak. When fire is not effectively controlled, people may suffer injuries and at times death. There is also destruction of properties, temporary or permanent closure of buildings, among other things. Therefore, it is imperative that proper fire safety measures are set in place to control the situation of fire outbreaks that has become a constant occurrence in student hostels. Therefore, immediate attention should be given to the issue of fire safety measures in hostels around university campuses especially as there is a demand for more students housing globally. So new buildings would be able to incorporate fire safety measures to keep the student safe and provide them with shelter and a conducive environment for learning.

STATEMENT OF THE RESEARCH PROBLEM
There have been records from various Nigeria higher institution hostels that have encountered various fire challenges. Seven rooms were reportedly destroyed by fire over a four week period at the University of Maiduguri in 2021, having five female students that were hurt and others having second and third degree burns. It was reported

by Bitrus (2021) to be caused by the failure of staff and regulatory organizations to provide alternative cooking areas and firefighting equipment. Similar cases have been reported by Asare (2022) and Oyekola (2021) to have happened at the University of Calabar and the Offa Grammar school in kwara state respectively. Therefore, due to the prevalence of fire in the hostels of higher institutions, there exists a need to evaluate the effectiveness of the fire safety measures that has been employed in building these existing hostel structures using the hostels at the Federal University of Technology, Minna (FUTMINNA) as a study focus. The existing fire safety measures implemented in these hostels require comprehensive evaluation to ensure the protection of lives and property. While it is true that regulations and guidelines exist, it is crucial to assess their practical implementation and compliance within the context of students' hostels.

AIM

The aim of this study is to evaluate the effectiveness of the available fire safety measures in the students' hostels located at the Federal University of Technology Minna (FUTMINNA) Gidan kwano campus, Niger State.

LITERATURE REVIEW

Fire Safety Measures

Hazards of any kind require global safety standards to ensure the safety of human activities (Olarenwaju & Adebiyi, 2017). According to Findik (2022), fire is a chemical event that occurs as a result of the combination of matter with heat and oxygen. Fire safety measures are a set of practices aimed at minimizing the destruction caused by fire. These measures include those that are intended to prevent the ignition of an uncontrolled fire and those that are used to minimize the reaction of products and materials to fire after it starts (Na'inna & Bature, 2023). In addition, the fire safety measures include those that are planned for buildings from their design, construction, and occupation to their maintenance, as well as for the inhabitants of such buildings. Fire safety is an essential aspect of building design and management, aimed at reducing the potential for harm to life and property in case of a fire outbreak.

According to Hopkin (2017), fire safety measures are intended to minimize the risk of fire outbreak to the greatest extent possible. However, Chow (2004) opined that the possibility of being killed or injured in a fire cannot be get rid of totally. This implies that while fire safety measures can reduce the risk of fire outbreak, they cannot eliminate the risk entirely. Meanwhile, Huo *et al.* (2016) recommended that building design features such as fire-resistant materials, fire-rated doors, and fire suppression systems could be used to minimize the risk of fire outbreak in high-rise buildings. The study also emphasized the importance of regular maintenance of fire safety systems to ensure their effectiveness.

Buchanan and Abu (2017) argued that, architects play a crucial role in ensuring fire safety in buildings by designing structures that minimize the risk of fire outbreak and facilitate safe evacuation in case of a fire. The authors also highlighted the importance of considering fire safety in the early stages of building design and the need for architects to work closely with fire safety engineers to ensure that the building design meets fire safety standards. The authors further emphasized the importance of designing, constructing, equipping, maintaining, and operating structures with the intention to save the life and property of its occupants. Consequently, fire safety measures are crucial in ensuring the safety of occupants in students' hostels. While building design features can minimize the risk of fire outbreak, it is essential to consider the occupants' perspectives in implementing fire safety measures. Building management should have fire safety policies in place, and occupants should be educated on these policies (Osunsanmi *et al.*, 2020).

Fire Safety in Tertiary Institution Hostels in Nigeria

Umar *et al.* (2014) asserts that, ensuring fire safety in university students' hostels is a crucial responsibility of the university administration. A fire in a hostel can have devastating effects, resulting in loss of lives and properties. Although such occurrences are not frequent, they require continuous attention and devotion from both the university community and administration. Therefore, it is of utmost importance to employ appropriate measures to achieve an acceptable level of fire safety in students' hostels. According to Shittu *et al.* (2016), most windows in tertiary institution hostels are equipped with security bars to keep the hostels safe from intruders. However, these bars can also trap students in case of a fire outbreak. As such the authors recommend that, the tertiary institutions' administration should install quick release devices on windows and doors with security bars to enable easy opening in an emergency. Furthermore, Adama *et al.* (2019) suggests that providing adequate and well-maintained student accommodation facilities can contribute to improved academic performance. This implies that ensuring proper fire safety measures in students' hostels can have a positive impact on students' academic achievements.

Age	18-24	307	88.2	93.7
	25-34	21	6.0	99.7
	Above 34	1	0.3	100.0
	Total	348	100.0	
Disability or special needs	Yes	13	3.7	3.7
	No	335	96.3	100.0
	Total	348	100.0	

(Source: Field Work, 2023)

Evaluating the Effectiveness and Adequacy of Existing Fire Safety Measures in Students' Hostels

The effectiveness of existing fire safety measures was evaluated by asking the respondents to rate the statement shown in Table 5 below. With a WMS of 3.4540 the respondents indicate fire safety measures are available in the hostel followed by electrical distribution board been well taken care of as 2nd with a WMS of 3.1523, the use of fire safety systems been maintained by qualified professionals ranked 3rd with 3.1178, the respondents indicated cooking is mostly done in the kitchen with a WMS of 2.9914 which ranked 4th and the proper ventilation of the kitchen ranked 5th with a WMS of 2.9856. This indicated that the respondents were neutral with all the statements except for the availability of fire safety measures in the hostel which indicated were agreed on by majority.

Table 5: Fire safety measures in the building

Statements	Weighting Scale					WMS	Rank
	5	4	3	2	1		
There are available fire safety measures in the hostel	74	119	76	49	30	3.4540	1st
Fire safety systems (extinguishers, escape doors) are regularly maintained by qualified professionals	52	101	81	64	50	3.1178	3rd
Electricity distribution boards are well taken care of	38	112	99	63	36	3.1523	2nd
Cooking is mostly done in the kitchen	55	113	92	50	38	2.9914	4th
The kitchens are properly well ventilated	60	8	67	59	76	2.9856	5th

(Source: Field Work, 2023)

Fire incidents in the hostel

As shown in Table 6 below, 2 (0.6%) of the respondents indicated fire occurs very frequently, 1 (0.3%) indicated fire occurs frequently, 26 (7.5%) indicated fire occurs occasionally, 180 (51.7%) indicated it occurs rarely and 139 (39.9%) indicated it has never occurred. Majority of the respondents indicated fire incidents rarely occur.

Table 6: Frequency of fire incident in the hostel

Frequency	Percent	Valid percent	Cumulative percent
Very frequently	2	0.6	0.6
Frequently	1	0.3	0.3
Occasionally	26	7.5	7.5
Rarely	180	51.7	51.7
Never	139	39.9	39.9
Total	348	100.0	100.0

(Source: Field Work, 2023)

Observation Schedule

An observation checklist was formulated using three (3) criteria to evaluate the effectiveness and adequacy of existing fire safety measures in students' hostels at the FUTMINNA. The criteria are; Means of escape, Active Fire protection system, Fire safety construction (Asigiri *et al.*2021). The rating scale used is shown in Table 7 below:

Table 7: Observation Assessment Grading (Adopted from Umar et al, 2014)

Assessment Grade	Corresponding point	Interpretation
1	0	Non-existence of fire safety attribute
2	0.25	Non fulfillment of the assessment criteria in the checklist
3	0.5	Low fulfillment of the assessment criteria in the checklist

4	0.75	High fulfillment of the assessment criteria in the checklist
5	1.0	Full fulfillment of the assessment criteria in the check list

Criteria One: Means of escape

Attributes	Standard	Male hostel (a&b)	Male hostel (new)	Female hostel (shehu aliyu)	Female hostel (new)	Female hostel (old)	Mean
Number of exits	2 exits shall be provided for occupant load 1- 500	0.75	1	1	1	1	0.95
Width of exit routes	1001-1500 = 1350mm	0.25	0.75	1	0.75	1	0.75
Maximum travel distance	61m for non sprinklered and 45m for sprinklered	1	1	1	1	1	1
Corridor Width	Shall be 1118mm or more and 9mm or more within a sleeping unit	1	0.5	1	1	1	0.9
Number of stairs	Based on occupancy 4-500 = 2, 501-1000 = 3, 1001-2000=4 (Baiche and Walliman, 2002)	1	1	1	1	____	1
Riser to tread ratio	150-175mm for riser and 225-300mm for tread (Cheung, 2008)	0.5	1	1	1	____	0.88
Access to staircase	Staircase should be approached from different directions and at least 50% of its perimeter should be opened to external air	0.75	1	0.25	1	____	0.75

(Source: Field Work, 2023)

Overall, the means of escape system is well-implemented in most areas, with a mean score ranging from 0.75 -1. Areas that may need attention include the "Width of Exit Routes" in the Male Hostel (a&b) and the Female Hostel (new), as well as the "Access to Staircase" in the Female Hostel (Shehu Aliyu). The "Number of Exits," "Maximum Travel Distance," "Number of Stairs," and "Corridor Width" generally show full or high fulfillment across all the selected hostels.

Criteria Two: Active Protection System

Attributes	Standard	Male hostel (a&b)	Male hostel (new)	Female hostel (shehu aliyu)	Female hostel (new)	Female hostel (old)	Mean
Width of access road to building	Should not be less than 3.7m (Baiche and Walliman, 2002)	1	1	1	1	1	1
Width of entrance to premises	Should not be less than 3.1m (Baiche and Walliman, 2002).	1	1	0.5	1	1	0.9
Space for movement of fire engines and pitching ladders	Adequate space around the building with a turning circle	1	1	0.5	1	1	0.9

The fire safety construction attributes, particularly "Fire Stopping to Openings for Pipes, Ducts, and Shafts," "Subdivision of Concealed Spaces with Cavity Barrier," and "Fire Separation Walls," all have a score of 0, indicating non-existence. This shows that these specific fire safety construction features were not implemented in all of the hostels.

CONCLUSION

Conclusively, the evaluation of fire safety measures in students' hostels has been a subject of considerable scholarly interest because the issue of fire safety in hostels is very paramount in students' hostel buildings. Extensive literature on this topic reveals a critical need for comprehensive assessments and improvements in fire safety infrastructure within educational facilities especially in the students' accommodation areas which is prone to fire because of the availability of flammable materials. Furthermore, the necessity for the university administration to prioritize the implementation of up-to-date fire safety regulations and standards was another factor presented in some studies. Recommendations from the literature stress the importance of regular inspections, maintenance of fire safety equipment, and the establishment of effective communication channels to disseminate emergency information promptly. Research has also explored the potential integration of advanced technologies, such as smart fire detection systems, to enhance the efficiency of fire prevention and response measures in the context of student hostels. In conclusion, the literature on the evaluation of fire safety measures in students' hostels, emphasize the urgency for proactive and comprehensive measures. The findings call for immediate attention to addressing infrastructural deficiencies, improving fire safety education, and fostering collaboration between stakeholders to create a safer living environment for the university's student population.

RECOMMENDATION

The study highly recommends that, designers, government, building regulatory agencies and other relevant stake holders should take into consideration the viability, efficiency and effectiveness of existing fire safety measures in other students hostels across the nation while ensuring that provision be made for unavailable fire safety systems. Furthermore, architects and other relevant professionals should make use of the findings of this research as it provides guidelines and will aid in providing needed fire safety measures not available currently in the existing students hostels in case of construction in the nearest future. Finally, the school authorities and other relevant stakeholders should recognize the significant roles of fire safety measures in ensuring students safety and its impact on academic performance and overall productivity.

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