



EVALUATING THE MEAN TIME BETWEEN FAILURE (MTBF) OF CRITICAL BUILDING SYSTEMS IN STUDENTS' HOSTEL BUILDINGS WITHIN LAGOS METROPOLIS

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ABSTRACT

Student hostel buildings in Lagos Metropolis, Nigeria, serve as essential infrastructure for higher education, yet they face significant maintenance challenges that impact functionality, safety, and student comfort. This study evaluates the Mean Time Between Failures (MTBF) for critical building systems in students' hostels across four types of institutions. Using purposive sampling approach, data were collected from 56 maintenance staff and porters. The data were analysed using mean, relative influence index, Mann-Whitney U test and Kruskal-Wallis test as descriptive and inferential statistical tools, respectively. The results show that MTBF is highest for foundation issues (MTBF = 17182.7 hours) and lowest for wiring systems (MTBF = 1304.9 hours), while budget constraints (RII = 0.79), inadequate monitoring systems (RII = 0.77), spare parts availability (RII = 0.76), and poor maintenance documentation (RII = 0.76) are the topmost factors influencing MTBF in hostel buildings. The study concludes that structural and foundational elements are the most reliable systems in students' hostels with rare occurrences of failures; while wiring systems, lighting bulbs and water pipes are vulnerable systems with relatively low reliability. The study recommends improved budget allocation and technology integration as strategic interventions for enhancing system reliability and students' satisfaction in hostel buildings.



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I. INTRODUCTION

Student accommodation in higher institutions plays a pivotal role in supporting academic performance, health, and overall well-being. In Lagos Metropolis, Nigeria's economic and educational hub, the demand for quality hostel facilities has surged with increasing student populations. Yet, maintenance management remains inadequate, leading to frequent system failures and reduced functionality [1], [2]. Maintenance performance indicators, such as Mean Time Between Failures (MTBF), are essential for quantifying system reliability and guiding resource allocation in educational infrastructure [3], [4]. MTBF measures the average time a system operates before failure, providing insights into durability and maintenance needs. In the context of student hostels, critical building systems - such as electrical, plumbing, structural, fire safety, waste disposal, sewage, solid waste management, CCTV, internet/Wi-Fi, and lightning protection - must function reliably to ensure safety and comfort [5], [6]. However, studies highlight persistent issues like reactive maintenance, budget constraints, and a lack of standardized metrics in Nigerian hostels, resulting in extended downtimes and health risks [7], [8]. This study addresses a key gap by measuring average MTBF values for critical building systems across Lagos hostels. The objectives of the study are:

- To evaluate the mean time between failure of critical systems in students' hostel ;
- To assess factors influencing mean time between failure of critical systems in students' hostel.

The research hypotheses formulated for the study are:

- Ho1: There is no statistical difference in the perception of maintenance staff and porters on the factors influencing failure of critical building systems in students' hostels.
- Ho2: There is no statistical difference in the factors influencing failure of critical building systems in students' hostels across the various types of institutions.

By focusing on MTBF, the study contributes to evidence-based guidelines for improving maintenance in educational facilities, aligning with global calls for sustainable infrastructure [9], [10].

II. THEORETICAL REFERENCE

II.1 MAINTENANCE PERFORMANCE INDICATORS IN BUILDINGS

Maintenance performance indicators (KPIs) are metrics used to evaluate the effectiveness and efficiency of maintenance operations in buildings [3]. These indicators help facility managers assess system reliability, optimize resource use, and reduce costs. Key KPIs include Mean Time Between Failures (MTBF), Mean Time To Repair (MTTR), and Overall Equipment Effectiveness (OEE) [11]. In educational facilities like student hostels, these metrics are crucial for ensuring the continuous operation of critical systems, which directly impacts student well-being and academic performance [12], [5]. Literature emphasizes the role of KPIs in transitioning from reactive to preventive maintenance. Reactive approaches, common in Nigerian hostels, lead to high costs and downtimes [13], [14]. Preventive strategies, guided by KPIs, can extend system life and improve safety [15]. For instance, MTBF helps predict failure patterns, allowing timely interventions [16].

II.2 MTBF IN HOSTEL BUILDINGS

Mean Time Between Failures (MTBF) is defined as the average operational time between failures, calculated as total uptime divided by the number of failures [17]. It serves as a reliability metric, with higher values indicating more durable systems. In building maintenance, MTBF is applied to systems like electrical wiring, plumbing, and structural elements to assess performance [18], [19]. In student hostels, MTBF is particularly relevant due to high usage and limited budgets. Studies show low MTBF for electrical systems due to overloads and poor wiring, leading to frequent outages [20]. Structural systems, like foundations, typically have higher MTBF as they are less prone to daily wear [21]. In Nigerian contexts, MTBF is often low in public institutions due to inadequate monitoring and funding [9], [22]. Research gaps include limited empirical data on MTBF in Lagos hostels and comparisons across institution types [23]. Table 1 summarizes recent literature on MTBF in building maintenance.

Table 1: Summary of recent literature on MTBF in building maintenance.

Authors	Focus	Methods	Limitations
[17]	Explanation and standards for MTBF in equipment reliability.	Review	Focused on general building equipment and not specific to students' hostels.
[4]	Analysis of downtime and reliability in hostel building maintenance.	Case study	Limited to one institution and did not provide for institutional comparisons.
[18]	Quality control analysis of downtime and MTBF for water supply pipes.	Analysis	The study was restricted to plumbing systems.
[19]	Implementation of MTBF in logistical support for operations.	Case study	The study was not specific to education institutional buildings.
[3]	KPIs including MTBF for maintenance operations.	Review	The study provided broad Key Performance Indicators for maintenance and was not focused on student hostel buildings.

Source: Authors (2026).

From Table 1, existing literature on MTBF applications are limited in scope, with few studies on educational facilities. This study addresses this by measuring MTBF across critical systems in various types of tertiary institutional students' hostels.

II.3 CHALLENGES IN MEASURING MTBF IN EDUCATIONAL FACILITIES

Measuring MTBF in a hostel faces challenges like data inaccuracy, lack of reporting systems, and resource constraints [24]. In Nigeria, reactive maintenance hinders accurate failure tracking [7]. Institutional disparities, with private universities having better data systems, affect MTBF calculations [25].

III. MATERIALS AND METHODS

This study was conducted in Lagos, targeting student hostels in four institution types: Federal University, Federal Polytechnic, Private University, and Federal College of Education. A mixed-methods approach was used, with quantitative data from questionnaires focused on MTBF. The population comprised maintenance staff and porters responsible for the daily operations and maintenance of systems and services in students' hostel buildings. Purposive sampling selected 56 respondents with direct experience. Questionnaire was the instrument used in collecting primary data for the study with a section of the questionnaire eliciting information on the number of failures for critical systems (e.g., wiring repairs, foundation issues) in the last one year. MTBF was calculated as:

MTBF = Total Operational Time / Number of Failures
Assuming 24/7 operation.

Data were analyzed using descriptive statistics (means, frequencies) in SPSS. Comparisons across institutions used Mann-Whitney U test to test the hypothesis of no significant difference in perceptions. Validity was ensured through pilot testing and expert review; reliability via Cronbach's Alpha (>0.7).

IV. RESULTS AND DISCUSSIONS

This section presents the findings of the study, organized into four subsections: respondent demographics, MTBF for critical building systems, factors influencing failures of building systems, statistical comparisons between institutions, and a thematic discussion of the results. The analysis draws from quantitative data collected through structured questionnaires distributed to maintenance staff and porters in maintenance management at students' hostels. Both descriptive and inferential statistical techniques were employed to identify key constraints affecting MTBF of critical systems and to determine whether significant differences exist between institutional contexts.

IV.1 RESPONDENTS' PROFILE

Understanding the background of the respondents provides critical context for interpreting the results. Table 2 summarizes the 56 respondents: 71.4% male, 28.6% female; roles: 53.6% maintenance staff, 46.4% porters; experience: over 10 years (32.1%), 7-10 years (25%). Institutions: Federal University (35.7%), Federal Polytechnic (28.6%), Private University (21.4%), Federal College of Education (14.3%).

Table 2: Demographic profile of respondents.

Profile	N	Percent	Cumulative Percent
Gender			
Male	31	55.4	55.4
Female	25	44.6	100
Role			
Maintenance Staff	27	48.2	48.2
Porter	29	51.8	100
Age Group			
16-24 years	0	0	0
25-34 years	5	8.9	8.9
35-44 years	24	42.9	51.8
45-54 years	23	41.1	92.9
55+ years	4	7.1	100
Experience			
Less than 1 year	0	0	0
1-3 years	13	23.2	23.2
4-6 years	30	53.6	76.8
7-10 years	12	21.4	98.2
Over 10 years	1	1.8	100
Institution Type			
Federal University	21	37.5	37.5
Federal Polytechnic	10	17.9	55.4
Private University	15	26.8	82.2
Federal College of Education	10	17.9	100
Duration of Working			
Less than 6 months	0	0	0
6-12 months	2	3.6	3.6
1-2 years	18	32.1	35.7
3-5 years	18	32.1	67.8
Over 5 years	18	32.1	100

Source: Authors (2026).

The gender distribution shows that 55.4% of the respondents were male, while 44.6% were female. This shows that the distribution gives an adequate representation of male and female respondents. Regarding role type, the table shows that about 51.8% of the respondents were porters, while about 48.2% were maintenance staff. This shows that the distribution was evenly shared amongst the respondents. In terms of age category, 42.9% of maintenance staff/porter respondents fall within the age range of 35-44 years, and 41.1% of the respondents fall within the range of 45-54 years. Only a few numbers of respondents, representing 8.9% fall within the range 25-34 years. 53.6% of the respondents have a working experience of 4-6 years in hostel maintenance/management, and about 23.2% and 21.4% of the respondents have a working experience of 1-3 years and 7-10 years, respectively, in hostel maintenance. Regarding institutional affiliation, 37.5% of the respondents were from Federal University, 26.8% of the respondents from Private University, and 17.9% of the respondents from both Federal Polytechnic and Federal College of Education. In terms of how long the respondents have spent working in the hostel, 32.1% of the respondents have spent between 1 and 2 years, 3-5 years, and over 5 years in the hostel, respectively, which shows an even distribution of experience by the respondents. Only a few numbers of respondents representing 3.6% have worked in the hostel for less than 6 - 12 months.

IV.2 MTBF VALUES FOR CRITICAL BUILDING SYSTEMS IN STUDENTS' HOSTEL BUILDINGS

Following the demographic overview, this subsection presents the MTBF values for critical building systems in students' hostel buildings. Drawing responses from 4 institutions, the data highlight the MTBF values of critical systems in students' hostel. Table 3 presents a ranked list of MTBF values of various critical systems in students' hostels.

Table 3: MTBF values for critical building systems in students' hostel buildings.

Critical systems in hostels	FU (N=21)		FP (N=10)		PU (N=15)		FCE (N=10)		Total (N=56)	
	MTBF	Rank	MTBF	Rank	MTBF	Rank	MTBF	Rank	MTBF	Rank
Wiring systems	1303.7	1	1619.2	3	1247.0	2	1080.1	1	1304.9	1
Lighting systems (bulbs)	1335.0	2	1598.7	2	1228.9	1	1228.5	3	1334.7	2
Water pipes	1457.4	3	1461.0	1	1338.1	3	1126.3	2	1366.9	3
Sockets and switches	1659.6	4	1648.8	4	1546.2	5	1322.3	4	1567.3	4
Shower/bathing facility	1732.1	5	1739.5	5	1699.2	7	1435.0	5	1671.6	5
Drainage	1836.4	6	2555.0	8	1485.7	4	1581.0	7	1825.2	6
Toilet/bathroom fixtures	1937.4	7	2000.2	6	1717.9	8	1649.8	8	1838.5	7
Power distribution panels	2044.0	8	2803.2	9	1613.0	6	1437.1	6	1955.7	8
Door/window frames	2217.8	9	2175.4	7	2423.6	9	1839.6	9	2197.8	9
Backup power systems	2753.1	10	3124.4	10	2550.1	10	1912.6	10	2615.0	10
Walls	3476.2	11	3577.0	11	3212.0	11	2482.0	11	3245.9	11
Floor finishes	3476.2	12	3825.2	12	3260.7	12	2847.0	12	3368.4	12
Staircase and railing	4588.6	13	4701.2	13	3990.7	13	3942.0	13	4333.1	13
Roofs	5318.6	14	6307.2	14	5256.0	14	5256.0	14	5467.2	14
Water heaters	7230.5	15	8059.2	16	5548.0	15	7884.0	16	7044.5	15
Building foundation	17647.6	16	17519.0	15	16132.0	16	17446.0	15	17182.7	16

NOTE: FU is Federal University, FP is Federal Polytechnic, PU is Private University, FCE is Federal College of Education.

Source: Authors (2026).

The result shows that the Mean Time Between Failure (MTBF) values for critical building systems in students' hostels across the four higher institutions in Lagos Metropolis varies in reliability. Wiring systems ranks 1st with the lowest overall MTBF of 1304.9 hours and, indicating that it is the least reliable in the systems category with the most frequent failures. The frequent failure of wiring systems could potentially be due to electrical overloads from multiple devices, substandard wiring materials, or unstable power supply, which could lead to safety hazards like fire outbreak or supply outages affecting students' comfort and productivity. Lighting systems (bulbs) ranks 2nd with a MTBF of 1334.7 hours, indicating frequent bulb failures. This could be as a result of voltage fluctuations, poor quality lamps, or excessive demand in communal areas, underscoring the need for energy-efficient upgrades to ensure consistent lighting for study and navigation in the hostels. Water pipes rank 3rd with a MTBF of 1366.9 hours, highlighting recurrent plumbing leaks as a major issue and plumbing pipes as a key vulnerable system for failure, sockets/switches rank 4th with a MTBF of 1567.3 hours, suggesting moderate reliability for electrical sockets and switches, with failures often linked to wear and tear from frequent use, misuse and poor handling by the students.

The result also shows that systems with lower failure rates include; water heaters, which rank 15th with a MTBF of 7044.5 hours, demonstrating high reliability, possibly due to infrequent use or the unavailability of the system in most hostel buildings. Foundation issues rank 16th with the highest overall MTBF of 17182.7 hours, indicating that the foundations of hostel buildings rarely exhibit any form of failure due to their engineered stability as any issue could have severe implications in terms of building stability and safety. Comparatively, the result shows that in the Federal University, wiring systems has the lowest MTBF of 1303.7 hours, revealing that electrical repairs is a primary concern in the students' hostels. Other systems in the Federal University students' hostels having low reliability include; lighting systems (MTBF = 1353.0 hours), water pipe leaks (MTBF = 1457.4 hours), Sockets and switches (MTBF = 1659.6 hours), Shower/bathing facility (MTBF = 1732.1 hours), In the Federal Polytechnic however, systems with low reliability include; water pipe leaks (MTBF = 1461.0 hours), lighting systems (MTBF = 1598.7 hours), wiring systems (MTBF = 1619.2 hours), and socketets and switches (MTBF = 1649.8 hours).

Furthermore, the result shows that systems with low reliability in Private University are; lighting system (MTBF = 1228.9 hours), wiring systems (MTBF = 1247.0 hours), water pipes (MTBF = 1247.0) and drainage (MTBF = 1485.7 hours) while the systems with low reliability in Federal College of Education are; wiring systems (MTBF = 1080.1 hours), water pipes (MTBF = 1126.3 hours), lighting systems (MTBF = 1228.5 hours) and sockets and switches (MTBF = 1323.2 hours). In general, public institutions such as Federal University and Federal Polytechnic exhibit higher MTBF in structural components, suggesting better long-term durability, while Private Universities and Federal Colleges of Education show more variability in systems reliability, with private institution underperforming in major structures and colleges in minor fixtures. The results highlight potential disparities in maintenance investment and usage patterns across institutional types. The findings show that the variability from low MTBF in electrical and plumbing related systems to high MTBF in structural systems align with usage intensity, suggesting a need for improved resource allocation for maintenance management activities aimed at enhancing reliability, reduced operational costs, and improve students' comfort and satisfaction in the hostels.

IV.3 FACTORS INFLUENCING FAILURE OF BUILDING SYSTEMS AND COMPONENTS IN STUDENTS' HOSTELS

The respondents were also asked to rate the extent to which they agree that the under-listed factors influence failures of building systems and components in students' hostels. Table 4 presents a ranked list of 15 identified factors, analyzed using the Relative Influence Index (RII) to assess the severity of each factor from the perspective of maintenance staff and porters across the four institutions.

Table 4: Factors influencing failures of critical building systems in students' hostels.

Factors influencing critical building systems failure	Maintenance Staff (N=27)			Porter (N=29)			Total (N=56)		
	RII	Rank	Remark	RII	Rank	Remark	RII	Rank	Remark
Budget constraints	0.76	4	EI	0.83	1	EI	0.79	1	EI
Inadequate monitoring systems	0.76	4	EI	0.78	2	EI	0.77	2	EI
Spare parts availability	0.75	7	I	0.77	3	EI	0.76	3	EI
Poor maintenance documentation	0.75	7	I	0.77	3	EI	0.76	3	EI
Poor installation quality	0.78	1	EI	0.73	6	I	0.75	5	I
Inadequate preventive maintenance	0.77	3	EI	0.72	8	I	0.75	5	I
Excessive user load and misuse	0.76	4	EI	0.7	10	I	0.73	7	I
Poor communication channels	0.78	1	EI	0.68	13	I	0.73	7	I
Lack of user education	0.73	9	I	0.72	8	I	0.73	7	I
Design inadequacy	0.70	11	I	0.77	3	EI	0.73	7	I
Building age and degradation	0.70	11	I	0.73	6	I	0.72	11	I
Climatic and environmental factor	0.73	9	I	0.70	10	I	0.71	12	I
Delayed response to repairs	0.67	14	I	0.68	13	I	0.68	13	I
Lack of skilled maintenance personnel	0.67	14	I	0.69	12	I	0.68	13	I
Overcrowding and capacity overload	0.68	13	I	0.68	13	I	0.68	13	I

NOTE: EI = Extremely Influential, I = Influential, ME = Moderately Influential.

Source: Authors (2026).

The findings show that overall, budget constraints rank highest (RII=0.79, Extremely Influential), followed by inadequate monitoring systems (RII=0.77, Extremely Influential), spare parts availability and poor maintenance documentation (both RII=0.76, Extremely Influential), implying funding, oversight, and logistics as primary drivers of system failures in the students' hostels. Poor installation quality and inadequate preventive maintenance tie for fifth overall (both RII=0.75, Influential), highlighting initial workmanship and routine upkeep as key influences. Excessive user load/misuse, poor communication channels, lack of user education, and design inadequacy tie for seventh overall (all RII=0.73, Influential), pointing to user behavior and design flaws as moderate contributors. The findings also show that building age/degradation ranks eleventh overall (RII=0.72, Influential), climatic/environmental factors twelfth (RII=0.71, Influential), and delayed repairs, lack of skilled personnel, and overcrowding tie for thirteenth (all RII=0.68, Influential), suggesting these as lower but still influential factors.

Among maintenance staff (N=27), poor installation quality and poor communication tie for first (both RII=0.78, Extremely Influential), inadequate preventive maintenance third (RII=0.77, Extremely Influential), and budget constraints/excessive user load/inadequate monitoring tie for fourth (all RII=0.76, Extremely Influential), emphasizing technical and user issues. Spare parts availability/inadequate documentation tie for seventh among staff (both RII=0.75, Influential), climatic factors/lack of user education ninth (both RII=0.73, Influential), building age/design inadequacy eleventh (both RII 0.70, I), overcrowding thirteenth (RII=0.68, Influential), and delayed repairs/lack of skilled personnel fourteenth (both RII=0.67, Influential). Then, among porters (N=29), budget constraints rank first (RII=0.83, Extremely Influential), inadequate monitoring second (RII=0.78, Extremely Influential), and spare parts availability/inadequate documentation/design inadequacy tie for third (all RII=0.77, Extremely Influential), stressing financial and logistical barriers.

Building age/poor installation tie for sixth among porters (both RII=0.73, Influential), excessive user load tenth (RII=0.70, Influential), climatic factors tenth (RII=0.70, Influential), lack of user education/inadequate preventive maintenance eighth (both RII=0.72, Influential), and delayed repairs/lack of skilled personnel/overcrowding/poor communication tie for thirteenth (all RII=0.68, Influential). The Table shows that comparing groups, porters rank budget constraints higher (1st, RII 0.83 EI) than staff (4th, RII 0.76 EI), while staff prioritize poor installation (1st, RII=0.78 Extremely Influential) over porters (6th, RII=0.73 Influential), revealing role-specific emphases on funding vs. technical quality. Overall convergence on top factors like budget and monitoring suggests targeted interventions, with divergences (e.g., porters higher on design inadequacy, staff on user misuse) informing role-tailored strategies for hostel maintenance.

IV.4 TEST OF HYPOTHESIS

Two hypotheses were formulated for the study as follows:

Ho1: There is no statistical difference in the perception of maintenance staff and porters on the factors influencing failure of critical building systems in students' hostels.

Ho 2: There is no statistical difference in the factors influencing failure of critical building systems in students' hostels across the various types of institutions.

Mann-Whitney U test and Kruskal-Wallis test were used to analyze the hypotheses respectively. The Mann-Whitney U test evaluated the null hypothesis that there is no statistical difference in the perception of maintenance staff and porters on the factors influencing failure of building systems and components in students' hostels while the Kruskal-Wallis test evaluated the null hypothesis that there is no statistical difference in the factors influencing failure of building systems and components in students' hostels across the

various types of institutions. Table 5 presents the result for the first hypothesis indicating the mean rank scores, U-values, and *p*-values for both categories of respondents.

Table 5: Mann-Whitney U Test of difference in the perception of maintenance staff and porters on the factors influencing failure of critical building systems in students' hostels.

Factors influencing systems failure	Category of Respondents		U	Z	<i>p</i>	Remark
	Maintenance staff N=27	Porter N=29				
	Mean Rank (MR)	Mean Rank (MR)				
Budget constraints	25.43	31.36	308.500	-1.472	0.14	NS
Spare parts availability	26.80	30.09	345.500	-0.978	0.33	NS
Delayed response to repairs	28.13	28.84	381.500	-0.187	0.85	NS
Lack of skilled maintenance personnel	27.83	29.12	373.500	-0.322	0.75	NS
Overcrowding and capacity overload	28.67	28.34	387.000	-0.078	0.94	NS
Building age and degradation	26.83	30.05	346.500	-0.807	0.42	NS
Climatic and environmental factor	29.28	27.78	370.500	-0.370	0.71	NS
Poor installation quality	30.63	26.52	334.000	-1.015	0.31	NS
Excessive user load and misuse	31.02	26.16	323.500	-1.201	0.23	NS
Poor communication channels	34.44	22.97	231.000	-2.986	0.00	S
Lack of user education	28.81	28.21	383.000	-0.159	0.87	NS
Poor maintenance documentation	27.69	29.26	369.500	-0.389	0.70	NS
Design adequacy	24.93	31.83	295.000	-1.732	0.08	NS
Inadequate preventive maintenance	30.56	26.59	336.000	-0.990	0.32	NS
Inadequate monitoring systems	27.63	29.31	368.000	-0.440	0.66	NS

Significant level set at $p \leq 0.05$.
Source: Authors (2026).

The result in Table 5 shows that there is no significant difference in the perception of maintenance staff and porters on factors influencing failure of systems in students' hostels except for poor communication ($p=0.00$), hence, the null hypothesis was accepted for the factors the factors influencing failure of systems in students' hostels except for poor communication channels, for which the null hypothesis H_0 was rejected. Table 6 presents the result for the second hypothesis indicating the mean rank scores, degree of freedom (df), and *p*-values.

Table 6: Kruskal-Wallis Test of difference in the factors influencing failure of critical building systems in students' hostels across various types of institutions.

Factors influencing systems failure	FU (N=21)	FP (N=10)	PU (N=15)	FCE (N=10)	H (χ^2)	df	<i>p</i>	Remark
	Mean Rank	Mean Rank	Mean Rank	Mean Rank				
Budget constraints	34.64	37.30	20.23	19.20	15.195	3	0.00	S
Spare parts availability	30.90	23.20	28.60	28.60	2.543	3	0.47	NS
Delayed response to repairs	29.88	32.40	27.17	23.70	2.199	3	0.53	NS
Lack of skilled maintenance personnel	28.31	24.45	28.40	33.10	1.682	3	0.64	NS
Overcrowding and capacity overload	30.29	34.55	28.47	18.75	5.883	3	0.12	NS
Building age and degradation	26.07	35.90	25.03	31.40	4.208	3	0.24	NS
Climatic and environmental factor	25.31	29.60	32.10	28.70	1.822	3	0.61	NS
Poor installation quality	23.74	33.65	31.70	28.55	3.899	3	0.27	NS
Excessive user load and misuse	26.07	26.35	35.37	25.45	4.234	3	0.24	NS
Poor communication channels	27.14	25.90	32.53	27.90	1.712	3	0.63	NS
Lack of user education	25.55	30.10	32.43	27.20	2.229	3	0.53	NS
Poor maintenance documentation	30.17	30.75	27.33	24.50	1.265	3	0.74	NS
Design adequacy	26.95	27.90	29.10	31.45	0.659	3	0.88	NS
Inadequate preventive maintenance	33.14	27.75	22.53	28.45	4.417	3	0.22	NS
Inadequate monitoring systems	29.88	27.70	27.20	28.35	0.353	3	0.95	NS

NOTE: FU is Federal University, FP is Federal Polytechnic, PU is Private University, FCE is Federal College of Education, Significant level is at $p \leq 0.05$.
Source: Authors (2026).

The result in Table 6 shows that there is no statistical difference in the factors influencing failure of building systems in students' hostels across the various types of institutions except for budget constraints ($p=0.002$) hence, the null hypothesis H_{02} for all the factors was accepted, except for budget constraints for which the null hypothesis H_{02} was rejected. The result suggests that the Federal University and Federal Polytechnic experiences significantly higher budget constraints with Mean Ranks of 34.64 and 37.30 respectively as compared to the Private University and the Federal College of Education with Mean Ranks of 20.23 and 19.20 respectively.

IV.5 DISCUSSION OF FINDINGS

The results from this study provide valuable insights into the reliability of critical building systems in student hostels within Lagos Metropolis, highlighting variations in Mean Time Between Failures (MTBF) across different systems and institution categories.

From the analysis of data collected from maintenance staff and porters working in the students' hostels of the surveyed institutions, the study quantifies system performance, identifies key influencing factors, and tests for differences in responses through statistical methods.

The findings of the study not only address the research objective of measuring average MTBF but also reveal institutional disparities and role-specific perceptions, contributing to a deeper understanding of maintenance challenges in educational infrastructure. The discussion is structured to explore the top five systems with critical MTBF values, linking empirical data to existing literature, and examining implications for practice. Among the critical building systems evaluated, foundation of the hostel buildings exhibits the highest MTBF values across the institutions, indicating high reliability and infrequent failures. This aligns with literature emphasizing the durability of foundations in most buildings, which are designed to withstand long-term loads and are less susceptible to daily wear and tear compared to mechanical systems [21]. In the context of students' hostel buildings in Lagos, where environmental factors like soil instability and high humidity could accelerate degradation, the high MTBF suggests appropriate choice of foundation design and generally, high quality of construction work when the hostel buildings were being constructed. Roofs, staircase and walls equally demonstrated high reliability with their respective high MTBF values, reflecting their robust performance in supporting the overall building framework.

This result concurs with [18] that structural components benefit from inherent resilience when properly maintained, reducing the frequency of failures [21]. It is also important to note that in student hostels, where occupancy is high and usage intense, this MTBF particularly in staircase components may be attributed to periodic maintenance inspections that prevent minor issues from escalating. The findings show that wiring systems, lighting systems and water pipes are the most frequently failing systems in students' hostels with relatively low MTBF values. Wiring systems failure in public buildings often arises from cable overheating and arcing fault as a result of overloaded circuits, loose connections, or improper cable use. This aligns with the position of [7,21] that public buildings are often challenged by maintenance demands relating to electrical systems. Furthermore, the findings revealed frequent light bulbs burn out in the students' hostels which could be due to poor quality of materials and parts or systemic electrical issues such as high voltage, poor or loose wiring, and voltage fluctuations. Other factors that could influence rapid failure of light bulbs include overheating from poor ventilation in the enclosed fixtures, incompatible switches and ratings, and physical damage from vibration or improper installation.

These findings highlight the need for standardized protocols in the procurement of quality materials and parts that could enhance systems and components longevity, particularly in resource-limited public settings. Water pipes failure, especially frequent plumbing pipes leakages in student hostels are often as a result of high-intensity use, poor maintenance, and aging infrastructure. This finding supports the position of [20, 21, 22] that plumbing systems in public buildings often suffer frequent defects including corrosion and blockages, but regular maintenance can improve their availability and extend operational periods [20]. Conclusively, the high MTBF values for structural elements such as foundations, walls and staircases illustrate areas of relative strength in Lagos hostel infrastructure while systems such as wiring systems, lighting bulbs and water pipes are exposed as being highly vulnerable to failure underscoring the need for improved attention, institutional funding and proactive maintenance approaches at improving their reliability. These findings portray the study's contribution to bridging research gaps in MTBF applications for educational facilities, advocating for targeted interventions to elevate system reliability and ultimately enhance student comfort and safety.

V. CONCLUSIONS

This study has illuminated the reliability of critical building systems in student hostels across Lagos Metropolis through MTBF analysis. The study concludes that structural and foundational elements are the most reliable with rare occurrence of failures in students' hostels while wiring systems, lighting bulbs and water pipes are frequently failing systems with relatively low reliability. The study also concludes that the reliability of systems in students' hostels are largely influenced by budget constraints, inadequate monitoring systems, spare parts unavailability and poor maintenance documentation. By quantifying failures and identifying influencing factors, the study addresses gaps in maintenance performance metrics for Nigerian educational infrastructure. To this end, the study recommends increasing budgetary allocations for operations and maintenance of infrastructure in tertiary institutions to enable preventive maintenance and technology driven maintenance implementation, such as computerized maintenance management systems (CMMS). It also recommends the implementation of regular staff training programs to improve skills in failure prediction and repair; development of standardized reporting protocols to enhance data accuracy and monitoring; promoting user education campaigns to reduce misuse and overload; and conducting longitudinal studies integrating MTTR for holistic key performance indicator frameworks. These measures can foster sustainable hostel management, boosting students' well-being and academic success.

VI. AUTHOR'S CONTRIBUTION

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