



PERIODICITY OF MAINTENANCE: A PREDICTOR OF PHYSICAL CONDITIONS OF BUILDINGS IN PUBLIC SECONDARY SCHOOLS, ONITSHA, ANAMBRA STATE, NIGERIA

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Abstract

Improved conditions of school buildings play a vital role in achieving the educational goals of every society. There is a growing awareness that the conditions of buildings in public secondary schools in Nigeria are in a deplorable state of infrastructural decay due to poor maintenance practices. However, only a few studies have been done on the most appropriate maintenance approaches to adopt to improve the conditions of buildings in public secondary schools in Onitsha, Nigeria. This study, therefore, sought to to examine the relationship between the periodicity of maintenance and the physical conditions of buildings in the public secondary schools in Onitsha, Nigeria to provide feedback for improved building maintenance operations in the area. The research design for this study is a survey design. Data were obtained through both quantitative and qualitative research methods. Quantitative data were collected from the academic and non-academic staff and the school maintenance managers through structured questionnaires. The study focused on seven (7) schools chosen from the twenty-three (23) public secondary schools in the study area based on a simple random sampling method. Categorisation s the schools based on ownership structure before the government takeover into church, private and government was the basis for the first stage of stratification. Following the stratification, random sampling by balloting within the different strata was done to obtain the study sample. In the second stage, the number of staff of the selected schools was obtained and sampling size formulae were applied to obtain the number of respondents. Periodicity of maintenance and the physical conditions of buildings were interval scale variables, therefore, the Pearson Product Moment correlation tool was used to test the significance of the relationship. It was established that there is a significant relationship between the periodicity of maintenance and the physical conditions of buildings in the public secondary schools in Onitsha. This shows that the physical conditions of buildings are largely influenced by the periodicity of maintenance operations in the schools. This suggests that an increase in maintenance operations could result in improved condition of buildings in the schools. The study therefore concluded that the Anambra State Government should formulate maintenance policy and strategy and also develop minimum maintenance standards for efficient maintenance operations in public secondary school buildings in the state.

Keywords: Building maintenance, Periodicity, Public Secondary Schools, Physical conditions

INTRODUCTION

Buildings are often designed to retain the function and aesthetic values for which they were built (Ofide & Jimoh, 2016). They are essentially required to provide a safe and enabling environment to support several types of human activities. The condition and quality of buildings where people live and perform their daily activities reflect the well-being of the nation. According to Lyons (2001), most buildings start to show signs of deterioration as they age, although at different proportions which is dependent upon the design, quality of construction materials, and usage. Therefore, as the components of a building begin to demonstrate signs of deterioration, it becomes pertinent that adequate steps are taken to ensure that the desired features of the buildings are secured through adequate maintenance. However, this situation is not the case in Nigeria as studies on school buildings showed that many public secondary schools face the combined challenges of deterioration and pressures from usage (Ayeni & Adelabu, 2012). The study pointed out that the combined deficiencies in building conditions impact teaching, students' learning abilities, and curriculum delivery as well as also threaten the well-being of the users.

Building maintenance as an essential area in building management has been a neglected activity (Seeley, 2012). It also noted that building maintenance neglect is associated with the rapid increase in decay of the building fabrics and surfaces with damaging effects on the materials and users. It is noteworthy, that the essence of maintenance is to return or keep buildings or infrastructure in a functioning or operational condition, and that the culture of adequate maintenance enhances the life span of items (Umeora, Maduka, & Ngobili, 2023). However, the habit of keeping things available for normal use in their designed life span is greatly lacking in Nigeria, hence the poor state of infrastructure. Similarly, Izobo-Martins, Ekhaese, and Adewale (2015) remarked that constant neglect of buildings in the learning environments accumulates tremendous maintenance bills for the future and also has serious effects on the value of users' output.

Given the essential role education plays in society, adequate maintenance attention has become a vital tool in the management of public secondary school buildings. Ofide and Jimoh, (2016) agrees that the need to keep school buildings in good condition necessitates that maintenance of the facilities be considered at all times. This is to sustain their performance and functionality and to minimize maintenance problems that commence immediately after buildings are completed whether occupied or not. Izobo-Martins, Olotuah, and Adeyemi (2015), similarly averred that maintenance plays a crucial role in public secondary school buildings and their conditions can influence the academic attainments of students. Ayeni and Adelabu (2012) also remarked that a good school setting offers education as a lasting endeavour that empowers students to discern the ideal value structure for self-awareness and development. The study further noted that the deteriorating effects on building conditions in schools where effective maintenance is lacking threaten the overall school management and academic activities in the schools.

The situation in Onitsha, Anambra State, Nigeria, is not different from the general scenario in Nigeria as a pilot survey for this study confirmed overwhelming evidence of the appalling

conditions of buildings in public secondary schools in the area. A careful observation of the conditions of buildings in public secondary schools in Onitsha, Nigeria is a clear suggestion of a fundamental problem with maintenance operations in these schools. Some of the building fabrics often demonstrate evidence of inadequate maintenance and repair since they were built, some even dating back to the colonial period. Since many attempts have not been made to examine the state of the buildings and maintenance operations in the public secondary schools in the study area to see how the maintenance issues could be ameliorated, this research, therefore, sought to explore the phenomenon. This study was part of a wider research that sought to assess of physical conditions of buildings for maintenance operations in public secondary schools in Onitsha, Anambra state, Nigeria. The objective of the study is to examine the relationship between the periodicity of maintenance and the physical conditions of buildings in the public secondary schools in Onitsha, Nigeria. This is to provide feedback for improved building maintenance operations in the area.

Study Area

The study area is Onitsha in Anambra State, Nigeria. Anambra State is one of the 36 states in Nigeria and one of the five (5) states in the southeast geo-political zone of the country. Onitsha is located in the western part of the State and on the eastern bank of the River Niger. It lies within latitudes 6°8'N and 28° 7'N and longitudes 6°47' and 8°48' E with an estimated land area of 104sq.km (UN-Habitat, 2012). It has two Local Government Areas, Onitsha North and South as shown in Figure 1. Onitsha North Local Government Area had a population of 121,157 and 125,918 in 1991 and 2006 respectively, while Onitsha South Local Government Area had 92,716 and 137,191 also in 1991 and 2006 National Population Census (National Population Commission, 2006). It is bordered by Idemili North Local Government Area to the East, the River Niger and Delta State to the West, Oyi Local Government Area and Ogbaru Local Government Area to the North and South respectively. It is a bridge town between Eastern Nigeria and Western Nigeria and between the densely settled Igbo hinterland and the oil-rich creeks of the Niger Delta. Onitsha is strategically positioned as a regional hub for trade and logistics in Eastern Nigeria (UN-Habitat, 2012). There are twenty-three (23) public secondary schools in Onitsha. The details of the location map showing the major layouts and the street guide of the schools are indicated in Figure 2.

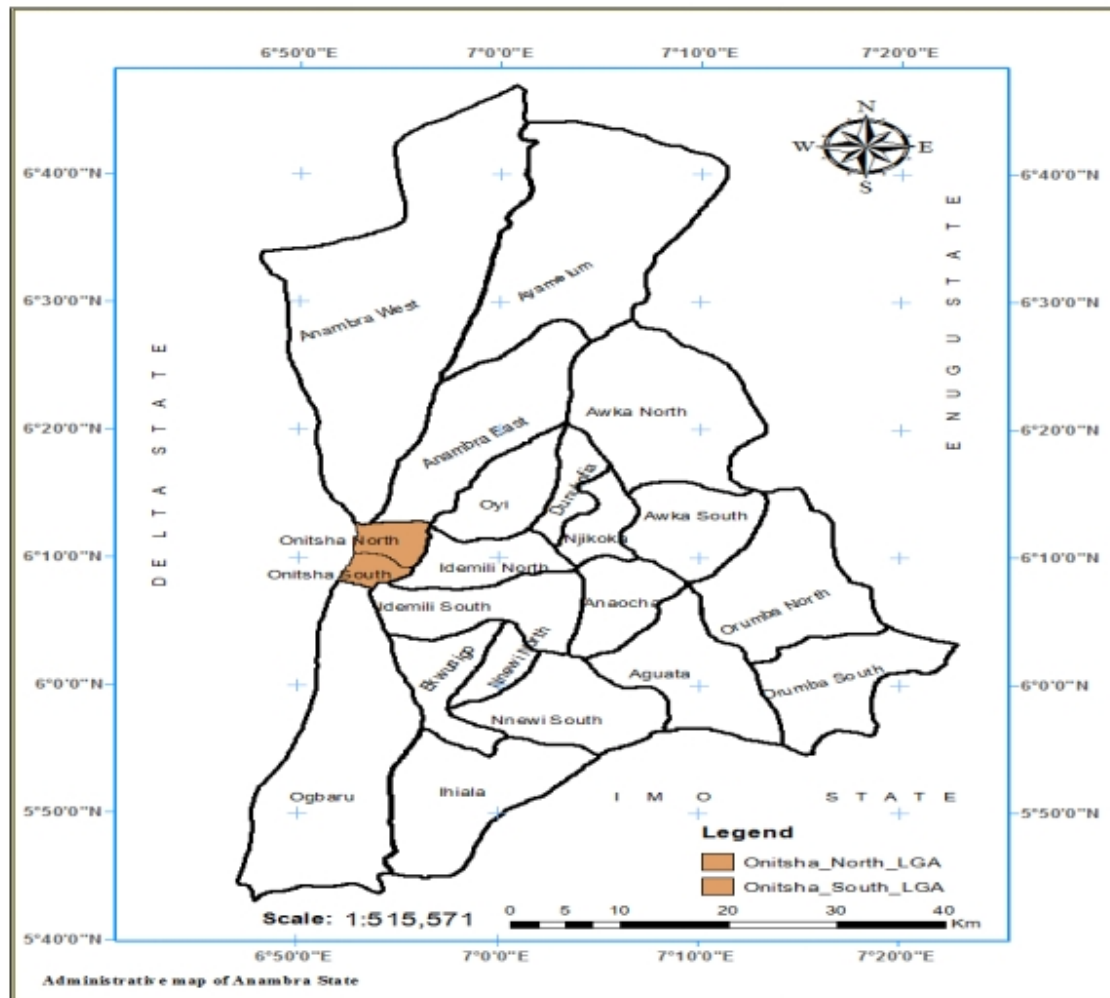


Figure 1: Map of Anambra State showing Onitsha North and South Local Government Areas

Source: Department of Environmental Management, COOU, (2017)

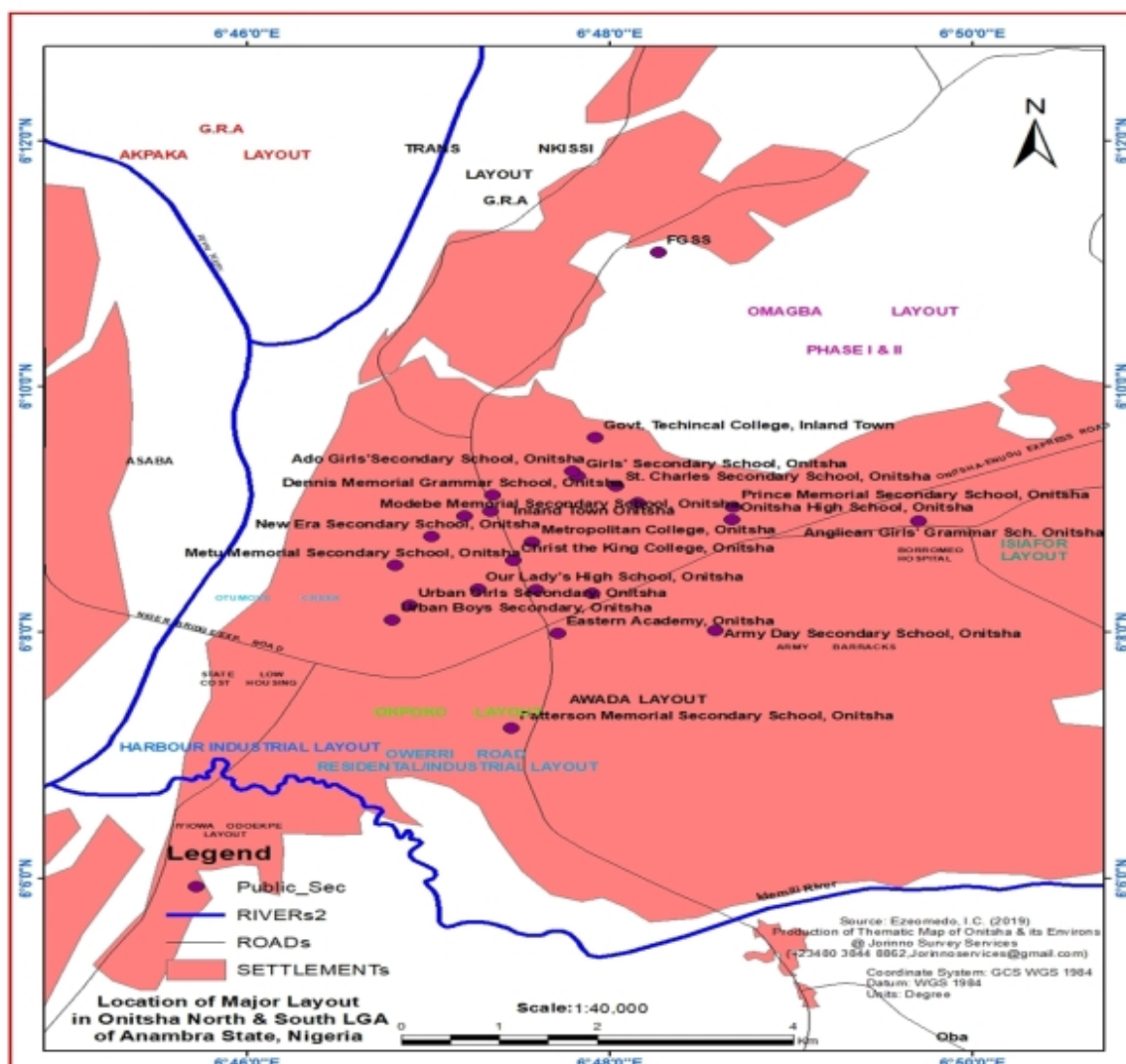


Figure 2: Location map of major layouts showing the public secondary schools in Onitsha
Source: Department of Environmental Management, COOU, (2019)

LITERATURE REVIEW

The life of living and non-living things necessary for life sustenance call for regular maintenance to sustain their usefulness (Uma, Obidike & Ihezukwu, 2014). Okoye, Olotuah, and Ezeji (2021), also noted that the study of maintenance conditions of buildings stemmed from the need to document the problems in the buildings, proffer solutions as well as put forward outlines for future building maintenance programmes. Maintenance, therefore, sums up positive efforts and activities aimed at the sustainability of the life of any structure. The healthy existence and use of these structures (public secondary schools inclusive) is a requirement for improving the well-being of any nation.

Segun and Onovughakpor (2014) defined School building maintenance as a continuous operation carried out to retain the school buildings, furniture, and equipment in the best form for regular activities. It is a daily activity of the institution and constitutes an important factor in the delivery of education in every society. These definitions imply that school building maintenance involves all the activities undertaken to keep the school in working condition to achieve educational goals. Maduka, (2021) noted that the periodicity of the maintenance activities is very essential in determining the physical conditions of buildings in schools. However, it is important to note that, a school that is properly maintained, safeguards the health and well-being of the occupants. The maintenance theory jungle was adopted as the theoretical framework in this study

Maintenance theory jungle which guides building assessment and maintenance was adopted for this study. The concept of a 'Management Theory Jungle' was introduced by Harold Koontz (Deryk, 2015). It is argued that there are similarities between the characteristics of the 'management jungle' proposed by Koontz and the state of maintenance management theory. These similarities are concerned with the environmental and contextual characteristics of the 'jungles'. These interactions relate to environmental and contextual features of the 'jungles' which led to the proposal that a related jungle of theories or approaches to maintenance and maintenance management existed. It is, therefore, proposed that there is a similar jungle of approaches to maintenance and maintenance management. This is referred to as 'The Maintenance Theory Jungle' (Deryk, 2015).

The Condition Based School of Thought approach (which is one of the six identified schools of maintenance theory) to maintenance management was adopted to undergird this study. It focuses on the identification and measurement of parameters that can be used to identify or predict the onset of failures in buildings. The study adopted this focus to ensure optimum performance for buildings in public secondary schools in Onitsha, Nigeria. The Condition Based School includes reference to Condition Monitoring, Predictive Maintenance, or "Just-In-Time" Maintenance. The Condition Based School gives insight into the actual condition of the component of the building assessed. The school is concerned with the identification and measurement of parameters that can be used to identify or predict the onset of building failure. This is used to correct the condition of the building before or after the failure occurs.

Categories of maintenance

- a. Predictable maintenance - This is regular periodic work that is essential to preserve the performance features of a facility including all that is vital to substitute or restore the facility after it has attained a suitable lifecycle.
- b. Avoidable maintenance- This work is essential to repair dilapidations resulting from faulty design, improper construction, or the use of poor-quality building materials.

It has also been noted in the literature that, in Nigeria, most buildings, whether privately or publicly owned or rented, were very poorly maintained, mainly due to poor preventive methods, poor building maintenance culture, and fairly high cost of maintenance (Usman, Gambo & Chen,

2012). Similarly, Waziri and Vanduhe (2013) identified some factors that led to poor maintenance conditions in buildings and facilities as follows; aging of the buildings, use of substandard materials for maintenance works, moisture problems leading to leakages, lack of trained/skilled maintenance team, poor communication in maintenance process and poor preventive methods, among others.

METHODOLOGY

The research design adopted for this study was a survey method; this was done through the use of a questionnaire, personal observations, and an interview guide to obtain data from respondents in the area of study. The data was obtained on the conditions of the physical elements of the buildings in public secondary schools in Onitsha, Nigeria. The research population in this study were all the classroom blocks, libraries, laboratories, and toilet units in public secondary schools in Onitsha, Anambra State, Nigeria. The target population was the total population of the Principals or Vice-Principals (the maintenance managers), and academic and non-academic staff from the selected schools.

A multi-stage stratified random sampling method was adopted for the study. This is to offer each item of the population an equal chance of being included in the sample. In the first stage, stratification of the public secondary schools in Onitsha based on the ownership structure of the schools before government take-over in 1970 was done. The adoption of this method was particularly important because of the possible effects ownership may have on maintenance funding and management. This is following observations from closer interaction with some of the Principals during a pilot survey of the study that schools originally owned by the church exhibited qualities of better maintenance than others. The stratification is shown in Table 1.

Table 1: Categorisation of Schools according to ownership structure

S/N	Church	Private	Government
1	Dennis Memorial Grammar School, Onitsha.	Eastern Academy, Onitsha.	Girls' Secondary School, Onitsha.
2	Queen of Holy Rosary College, Onitsha.	Washington Memorial Secondary School, Onitsha.	Ado Girls' Secondary School, Onitsha.
3	St. Charles Secondary School, Onitsha.	Patterson Memorial Secondary School, Onitsha.	New Era Girls' Secondary School, Onitsha.
4	Anglican Girls' Grammar School, Onitsha	Prince Memorial Secondary School, Onitsha.	Inland Girls' Secondary School, Onitsha.
5	Christ The King College, Onitsha.	Metropolitan College, Onitsha.	Army Day Secondary School, Onitsha.
6		Modebe Memorial Secondary School, Onitsha.	Govt. Technical College, Inland Town.
7		Metu Memorial Secondary School, Onitsha.	Onitsha High School, Onitsha.
8		Our Lady's High School, Onitsha.	Urban Girls Secondary School, Onitsha.
9			Urban Boys Secondary School, Onitsha.
10			Special Sec. Sch. (Deaf And Dumb) Odoakpu, Onitsha.

Source: Anambra State Ministry of Education (2018)

Based on the stratification, the study sample was obtained through simple random sampling by balloting within the different categories. A sample of seven (7) schools was taken from a population of twenty-three (23) schools. Adopting a method of proportional allocation where the different groups were kept proportional to the ratio of their contribution to the population, the following schools were randomly selected to represent the various classifications of ownership before government takeover:

Church:

1. Christ the King College.
2. Dennis Memorial Grammar School.

Private:

1. Metu Memorial Secondary School
2. Modebe Memorial Secondary School, Onitsha.

Government:

1. Urban Boys Secondary School
2. Ado Girls' Secondary School
3. Govt. Technical College, Inland Town.

The data obtained from the staff population was then used to determine the respondents' size by applying the Cochran formula as stated below:

$$n = \frac{z^2 \times \sigma_p^2 \times N}{[N-1]e^2 + (z^2 \times \sigma_p^2)} \quad (\text{Kothari, 2004}) \text{----- (Equation 1)}$$

Where: n = size of sample for finite population, N = research population = 454 staff, σ_p = Assumed standard deviation of population = 0.5, e = significance level (precision/acceptable error) preferred = 0.05, Z = standard variate at a given confidence level = 1.96 for a 95% confidence level.

The results of the calculated sample sizes for the respondents drawn from each of the schools are shown in Table 2.

Table 2: Calculated respondents' population

S/n	Name of school	Number of existing staff	Sampled
1	Christ the King College.	112	52
2	Dennis Memorial Grammar School.	116	54
3	Metu Memorial Secondary School	35	17
4	Modebe Memorial Secondary School.	37	17
5	Urban Boys Secondary School	40	19
6	Ado Girls' Secondary School	64	30
7	Govt. Technical College, Inland Town.	50	23
	TOTAL	454	209

Source: Fieldwork (2019)

RESULTS AND DISCUSSION

Descriptive summary measures and frequency distribution for each of the variables studied were calculated. Pearson's Product Moment Correlation analysis was also conducted to test the significant relationship between the two interval variables selected from the research data using Statistical Package for Social Sciences.

Aggregated analysis of the Periodicity of building inspections

Responses from this investigation as obtainable in Figure 3 showed that the majority of the sampled schools (59%) carry out building inspections after 12 months while the rest (41%) carry out their own once in 12 months. This is expected because the school maintenance managers were not trained professionals in the building industry and were likely ignorant of the significance of regular building inspection.



Figure 3: Analysis of Periodicity of building inspections

Source: Fieldwork (2019)

Aggregated analysis of physical conditions of buildings

It is evident from investigation that the physical conditions of buildings in the majority of the schools were largely poor consequent upon some notable amount of damages to the building elements such as structural cracks, peelings, rising dampness, thermal expansion, structural inadequacies, temperature-induced defects, material degradation, blisters, efflorescence, discolourations, broken louvre blades, leaking and broken sanitary fixtures and rusting. Nevertheless, the result as presented in Figure 4 also alluded that some buildings at the sampled schools were in good condition owing to some pronounced features on the building elements while few were in a moderate state.

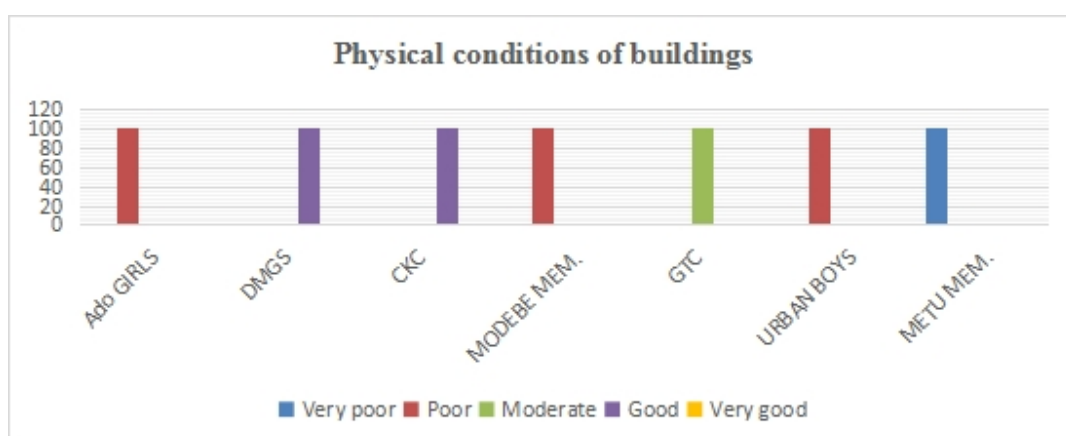


Figure 4: Analysis of physical conditions of buildings

Source: Fieldwork (2019)

Test of Hypotheses

The hypothesis “there is no significant relationship between Periodicity of maintenance (PM) and physical conditions of buildings (PCB) in public secondary schools in Onitsha” was tested. The two variables are of interval scales, therefore, the Pearson Product Moment Correlation test was used to test the significant relationship between them. The result of the analysis as shown in Table 3 revealed a correlation coefficient value of 0.313 with a probability value point of 0.000 at 5% (95% compliance). This indicates that the magnitude of the relationship is moderate but significant. The postulated null hypothesis is therefore rejected and the alternative one which states that ‘*there is a significant relationship between the periodicity of maintenance and the physical conditions of the buildings in public secondary schools in Onitsha, Nigeria,*’ accepted.

Table 3: Pearson's Product Moment Correlation result of the relationship between PM and PCB

Periodicity of maintenance	Physical Conditions of Buildings	
	Pearson Correlation	-.313**
	Sig. (2-tailed)	.000
N		158

Source: Fieldwork (2019)

From the results of the analysis of data gathered, it was established statistically that there is a significant relationship between the periodicity of maintenance and the physical conditions of the buildings in public secondary schools in Onitsha, Nigeria. This shows that the physical condition of buildings is largely influenced by the periodicity of maintenance operations in the schools which suggests that an increase in maintenance operations could result in improved condition of buildings in the schools. This was corroborated by the interviews conducted with the principal and vice principals of some of the schools who noted there was poor implementation of the existing maintenance practices and procedures that are in use at the public secondary schools in Onitsha, Nigeria. During the interview sessions, there was a unanimous position that if the periodicity of maintenance of the buildings got adequate attention, the conditions of the buildings would be in a good state.

CONCLUSION

The research has statistically proven that there is a significant relationship between the periodicity of maintenance and the physical conditions of the buildings in public secondary schools in Onitsha, Nigeria. From the examination of the variables, the study inferred that the

physical conditions of buildings in the sampled public secondary schools were largely influenced by a lack of effective maintenance policy, regulations guiding maintenance operations, negligence, absence of cognizance of the concepts of maintenance practices, poor maintenance culture and lack of documented standards for maintenance operations. There is therefore the need for the Anambra State Government should formulate a maintenance policy and strategy and also develop minimum maintenance standards for efficient maintenance operations in public secondary school buildings in the state. Concerted efforts should be made to develop a documented maintenance manual to guide maintenance operations as a substitute to the existing practices and procedures that are in use at the public secondary schools in Onitsha, Nigeria.

If implemented, this will serve as a veritable source of information guiding research in related fields and will contribute immensely to knowledge and enhance the value of the learning environment within the public secondary school buildings in Onitsha, Anambra State, and Nigeria in general.

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