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POTENTIAL BENEFITS FOR ADOPTING POST OCCUPANCY EVALUATION (POE) AS MAINTAINABILITY TOOL FOR NIGERIAN PUBLIC SCHOOL BUILDINGS

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ABSTRACT:

Post occupancy evaluation as a well-established building performance evaluation tool, attempts to provide a link between building design and the operation and maintenance stages, using occupants' feedback mechanism. It provides acceptable balance between aesthetics and functionality of the building. This paper examines the potential benefits of carrying out POE in school buildings in Nigeria and how it contributes to maintainability. The study draws data from an earlier research carried out by the authors using semi-structured one-on-one interview questionnaire. 27 Respondents drawn from the management cadre of Rivers State Ministry of Education spread through 12 selected schools in 6 local government areas of River State, . The data was qualitatively analyzed using simple percentages with thematic analysis. Findings showed that over 70% of respondents admitted that there are potential benefits derived from adopting POE which include planning and budgeting for improving, replacing buildings and its facilities; operation and maintenance to address short-comings, incorporating future maintenance plan and management standards with proffered solutions to government. The study thus recommends the use of POE information to quantify performances to compare with best practices.

Keywords: Building Performance, Maintainability, POE, Potential Benefits, School Buildings.

1.0 INTRODUCTION AND BACKGROUND STUDIES

Building professionals; researchers and practitioners have continued to explore the benefits of Post Occupancy Evaluation (POE) to ensure that buildings are designed and managed to ensure sustainability. POE aims at assessing the performance level of buildings after it had been occupied; providing a mechanism for understanding the mutual interaction process between buildings and occupants satisfaction and recommending improvements for future similar buildings (Nawawi and Khalil, 2008). Vischer (2002), added that POE is also used to determining building defects, support design and construction criteria. It also supports performance measures for asset and facility management, identify design errors that could lead to increased maintenance and operating cost, clarifying design objectives and improving general building performance.

According to Nkpite and Wokekoro (2017), the actual functioning of school buildings and end-users satisfaction are very rarely revisited and assessed, once they are handed over to the users. It is expected that government, who is rightly the proprietor of public schools should be responsible to ensuring that school buildings are cared for; ensuring that they are safe, secure sustainable, accessible, cost effective to operate and maintain (Preiser, 2002). Although the Rivers State Government Model Primary School Buildings are relatively new, but are visibly deteriorating, decaying and dilapidating due to poor maintenance management (Nkpite, 2017).

This paper x-rays the potential strategy government could adopt in ensuring that current and future school buildings are maintainable long into the future. The scope is limited to the educational buildings, particularly, the newly built prototype Rivers State Government Model Primary School Buildings in all the 23 Local Government Areas of the State as a test case for public primary schools in Nigeria. The schools were constructed at different start dates across the state; from 2007 to 2010, and occupied from 2011 to 2015.

2.0 BACKGROUND INFORMATION

2.1 Understanding the Concept of Maintainability

Maintainability is described by the US Institute of Technology and Science as; "*a characteristic of design and installation, expressed as the probability that an item will be retained in or restored to a specified condition within a given period of time, when the maintenance is performed in accordance with prescribed procedures and resources*" (ITS, 1996). BusinessDictionary.com (2010) defines it as a *"Characteristic of design and installation which determines the probability that a failed equipment, machine, or system can be restored to its normal operable state within a given timeframe, using the prescribed practices and procedures"* (Businessdictionary.com, 2010). Blanchard and Lowery (1969) makes it more explicit; positing that *"Maintainability is a characteristic of equipment design and installation which is expressed in terms of ease and economy of maintenance, availability of the equipment, safety, and accuracy in the performance of maintenance actions."*

In concluding, and deducing from the above definitions, maintainability in the context of this paper is seen as 'a design characteristic; qualifying a design with respect to ease, safety and cost that will be involved in maintaining the designed building, after it has been built'. This is to say that, *'maintainability in building design'* mean 'a design that is conscious of the ease, safety and cost of maintenance, not compromising standards and quality, but ensures that building elements and components are kept in their continued good appearance and functional state, through the building life-cycle'. The outcome of maintainability will be a maintainable design.

2.2 POE as a Building Assessment Tool

Post Occupancy Evaluation (POE), sometimes also referred to as Building Performance Evaluation (BPE) (BSRIA, n.d. in Frank, 2014). It involves a systematic evaluation of opinions about buildings in use, from the perspective of those who use them (Watson, 2003). It is intended to evaluate how well the building matches users' needs, and identifies ways to improve building design, performance and fitness for purpose (Frank, 2014). POE is used to evaluate new and old buildings when they are fully operational; preferably, not less than 12 – 15 months of occupancy, in which period users must have adequately experienced and adjusted to their new environment and also allows for a full circle of the climatic seasons (SGV, 2010). Watson (2003) argued that there is no industry's acceptable definition of POE to different professionals in different field of endeavour which is used by variety of industry professionals and owners as well as for a number of building types. However, it is generally believed that Post occupancy evaluation (POE) is the process of evaluating buildings in a systematic and rigorous manner after they have been built and occupied for sometimes (Preiser, 2002). According to Vischer (2001), POE is any and all activities that originate out of an interest in learning how a building performs once it is built, including if and how well it has meet design expectations. From facilities management's perspective, POE is a diagnostic tool and system which allows facility managers to identify and evaluate critical aspects of building performance systematically (Preiser, 1995).

2.3 Other Building Assessment Tools

Literature sources reveal a number of building assessment terminologies and protocols which differ slightly in themselves and with POE. It is therefore pertinent to identify their distinctions and what constitute the elements of such evaluation techniques.

2.3.1 Building Performance Evaluation (BPE)

Although Building Performance Evaluation (BPE) and POE are sometimes interchangeably used to mean the same thing, there still exist distinctions between both. Gale (2008) noted that whereas BPE encompasses POE, it focuses mainly on the assessment of building's success in supplying a healthy and usable environment to its occupants and users, as well as providing appraisals that are necessary component of the building Life Cycle Analysis. Zimring (2014) has identified the goals of BPE to include:

- To better understand the impact of early design delivery decisions on long-term efficiency and effectiveness of buildings and;

- To better understand the impact of building delivery processes and decisions on end-users response both initially and over the life cycle of the building.

BPE can also be described as the process of evaluating the performance of a building with POE; being one of its major parts which can be carried out on new, existing and refurbished domestic and non-domestic buildings (Nkpite 2017).

2.3.2 Building Condition Survey

Building Condition Survey is a survey of a building's physical elements and components, looking at structural issues as well as aesthetics. It deals with the state of repair of these components as discussed in section 2.21 of the 2006 edition of the Nigerian National Building Code. It is building specific. BRE Group, (2011) describes Building Condition Survey as an investigation and assessment of the constructional elements and their state of repair, which will normally include advice on overall value of the property. This, usually is incorporated in POE.

2.3.3 Spot Identification Assessment

Spot identification assessment in building involves identifying specific defects in buildings. It involves the process of reasonable practical steps focused on eliminating or minimizing defects or risks of any sort (Davis, 2001). This assessment may involve an assessment of the cause of any crack or damage in the masonry, the internal finishes or distortion in the floor and the walls, etc (Kampschroer and Heerwagen, 2004). Olanrewaju, Khamidi and Idrus (2010) opined that full inspection of building is carried out to spot and identify the damage with a view to providing a firm opinion on the cause of defects and the necessary remedial action. Spot identification assessment helps prevent incidents, injuries and illnesses through a critical examination of the building identifying and recording defects for corrective action (Gale, 2008).

2.4 Integration of POE Benefits in Public School Buildings

That the remarkable potential benefits of POE is serving as an integrator of occupant to the building and its component facilities, which work towards, to an extent, the path of greater maturity, acceptance, consistency and formalization with POE among stakeholders (Nkpite, 2017). According to Meir, Garb, Jiao and Cicelsky (2009), it is this integration role that sees POE as contributing to sustainability in a deeper sense. The authors also further posit that this integration means among others, the following:

- Integration between the pre-and post-handover phases in the building life cycle.
- Integration of various stakeholders in the building process, particularly the designer, owner, operator and occupants.
- Integration of the various building disciplines with one another;
- The merging of practice with research

- Integration of various tools and indeed, with the suites of quantitative and qualitative research traditions;
- Integration of subjective and objective dimensions of building use and experience, and their measurement;
- The ability to bridge the static performance conceived for the building versus the dynamic functioning when real users interact with and modify these static features;
- Bringing conceptions and aspirations closer to actual practices and performances.

These kinds of integration sketched above are no longer luxury, but imperative for survival of the built environment (Meir et al, 2009).

2.5 The Practices of POE as a Building Management Tool

Appraisal of buildings with POE is not new, it was initiated in the 1960s, however, what is new is the way in which POE is beginning to be viewed as a management tool and as a crucial building appraisal tool for property owners, managers and designers (Adewunmi, Omirin, Famuyiwa and Farinloye, 2010). Frank (2014) also posits that, in the UK building delivery protocol it has become a part of the architect's responsibilities to evaluate/review project performance in use as outlined in stage L3 of the RIBA Outline Plan of Work 2007; corroborated by BRE Group (2011).

This is in line with the philosophy of the need for property owners and managers to be aware of and concerned about the level satisfaction of the building occupants regarding the standards of management and maintenance of buildings. Hence, the potential benefits of POE seeks to create awareness for property or building managers, as to improve the quality of maintenance and management of buildings, and by extension promote sustainable built environment.

3.0 RESEARCH METHODOLOGY

The Investigative POE technique is identified to be most suitable for this study, particularly as it involves a number of prototype buildings. The technique entails a more in-depth exercise using interviews and survey questionnaires, in addition to photographic/video recordings, and physical measurements, they typically involve a number of buildings of the same type.

The study was conducted on 138 completed and functional Rivers State Government Model Primary Schools across the 23 local government areas of Rivers State, Nigeria. This study utilizes semi-structured one-on-one interview questions with key stakeholders from ministry of education. The study population consists of high ranking officials responsible for the management and maintenance of school buildings in the ministry, involving 27 key officers of the Rivers State Ministry of Education. It includes UBE Secretaries, Head teachers, Maintenance Officers, Directors of Project, Procurement and Primary School Services Departments.

Non-probability purposive sampling techniques was used to select 6 Universal Basic Education secretaries, 12 head teachers, 4 maintenance officers, 1 Procurement Director, 1 Project Director

and 1 Primary School Services Director; across 12 schools within 6 Local Government Areas (LGAs); taking 2 schools from each LGA as detailed in table 1.

Table 1: Characteristic of Interview Population

Occupation	Frequency	Percentage %
UBE Executive Secretary	6	22.2
Head Teachers	12	44.5
Director of Project	1	3.7
Director of Procurement	1	3.7
Director Primary Sch. Services	1	3.7
Chief Maintenance Officer	2	7.4
Maintenance officer	4	14.8
Total	**27**	**100**

Source: Authors' Field Survey, 2017

Excluding the Executive secretaries and the Head Teachers, most other respondents were building professionals made up of Architects, Estate Surveyors and Civil Engineers. They were persons who are well experienced in the built environment professions, so their opinions about the building and their workings could be counted reliable.

The Interviews were analysed using the Thematic Content Analysis Methodology; a process that is aimed at producing a detailed and systematic recording of the themes and issues addressed in the interviews and linking the themes and interviews together under a reasonably exhaustive category system (Burnard, 1991). The themes, also referred to as codes, are drawn from existing theoretical ideas that the researchers brought to the data (deductive coding) or from the raw data itself (inductive coding) Marks and Yardley (2004). This study employed both the inductive and deductive coding systems. On the other hand, the content analysis approach results is a numerical description of features of a given text or series of images, whereas, the thematic analysis emphasises the qualitative aspects of the material analysed (Marks and Yardley, 2004). Content system is seen as a partial quantitative method (Julien, 2008), and provides room for systematic qualitative analysis.

For this study, the Content and Thematic approaches were used in analysing the data gathered from all interviews. A system referred to in Burnard (1991) as 'Thematic Content Analysis'.

4.0 RESULTS AND DISCUSSION

4.1 Awareness of POE

It was necessary to measure the level of awareness of POE by the respondents. Table 2 showed that 70.4% (majority) of the respondents interviewed indicated that they are not aware of what is

called Post Occupancy Evaluation, while only 29.6% claimed to be aware of what is known as POE and that they know it as a tool used in verifying end-users' satisfaction in building.

Table 2: Attain Awareness of POE

Option	Frequency	Percentage %
Aware	8	29.6
Not Aware	19	70.4
Total	**27**	**100**

Authors' Field Survey, 2017

A Summary of the interviewees' opinions is that:

> "*POE is a veritable tool which built environment researchers could adopt for the improvement of building and its facilities, maintenance management been used for determining the performance and end-users' needs, expectations and satisfaction".*

4.2 Potential Derivable Benefit for Adopting POE in Public School Buildings

The respondents were asked to state from their opinions the potential benefits for adopting post-occupancy evaluation in public school buildings, haven been enlightened on what POE is all about. Table 3 showed that 70.4% of respondents agree that there are derivable benefits in adopting POE, while 14.8% disagree and 14.8% of the respondents are not sure of any benefits derived from POE.

Table 3: Derivable Benefits of POE

Option	Frequency	Percentage %
Yes	19	70.4
No	4	14.8
Unsure	4	14.8
Total	**27**	**100**

Authors' Field Survey, 2017

Majority of the respondents stated that the innovative tools used in carrying out Post Occupancy evaluation exercise are the same with social science research process (questionnaires, focus group, interviews, walkthrough, etc.) which is thus, empirical in nature, with a systematically laid down procedure in order to arrive at a reliable solution to identified social problem that involves series of steps.

Results of the interview further revealed that, the benefits of POE is the processes involved which include formulating and clarifying a problem to be solved (topic), reviewing previous exercises (data), deciding on the research approach and choosing a research strategy. Others are data collection, processing and analysis, drawing of relevant inferences and conclusions, formulation of laws and theories and writing of final report. The various stages established that POE is "an innovative tool in the built environment research; conceptualized on a set of systematically arranged steps which if rigorously followed leads to the production of valid and

reliable solutions to improve building maintenance management by the criteria which its truth is tested" (Nkpite, 2017).

The results also show that post occupancy evaluation has been identified as the maintenance management innovative tool which is in tandem with table 3 above that there are potential derivable benefit from adopting POE in public school buildings. From the results, the following opinions were deduced of what the potential benefits of POE are;

- *Contributing to improving the quality of building through building maintenance management delivery process*
- *Provides feedbacks on causes and effects of environmental issues related to buildings.*
- *Informing planning, programming and management through the building life cycle*
- *Culminating in the production of sustainable built environment*
- *Helping in understanding the actual performance of buildings meeting various users expectation*
- *Encouraging efficiency of building procurement process.*
- *Serving the different purpose (formulation and implementation of polices, development new innovative tools, dissemination of information) in the building industry as well as the public.*

4.3 POE as an Innovative Tool Useful for Participatory Maintenance Management

A number of innovative building assessment/evaluation approaches abound in literature as indicated in section 2 of this paper. Participants were asked to indicate which of the building assessment tools could best be used to inform maintainability and maintenance management. The results are presented on Table 4, which indicates 44.4% agreeing that POE is an innovative tool used for building assessment, while 29.6% had preference for Building Performance Evaluation. 14.8% went for Building Condition Survey and 11.2% for Spots Identification Assessment. It implies that POE can readily be acceptable as a maintenance management tool for the school buildings and can inform future design school buildings anywhere in Nigeria.

Table 4: Building Assessment Innovative Approaches

Innovative Approaches	Frequency	Percentage %
Building Condition Survey	4	14.8
Spot Identification Assessment	3	11.2
Building Performance Evaluation	8	29.6
Post Occupancy Evaluation	12	44.4
Total	**27**	**100**

Author's Field Survey, 2017

The principle motivation for a POE is most likely to be a "fine turning" of the building so that it operates as effectively as it can. It is likely that there will be a number of aspects where things have not turned out quite as well as hoped or expected, and there may be somewhere early

attention might be warranted which POE provides opportunity demonstrating where the management would be genuinely interested in.

5.0. CONCLUSION AND RECOMMENDATIONS

The study examined the potential benefits derived from adopting post occupancy evaluation (POE) of Rivers State Government Model Primary School Buildings in Rivers State, Nigeria. The study reveals that Building Performance Evaluation (BPE) is a form of Post-Occupancy Evaluation (POE) which can be used at any point in a building's life to assess energy performance and occupant control and to make comparisons with design targets. POE constitutes the activities of the BPE process once building is occupied and in used, focusing on the operational performance and the occupants of the building. It is important to note to what extent the building maintains its occupants satisfaction and perceived comfort in a systematic and structured way, POE can be employed as a major part of BPE involving the collection of feedbacks, which provide more information on what BPE is an how it should be implemented.

The study further showed that the potential benefits derivable from POE adoption will definitely spur policy makers in making certain actions that can ensure full attainment of the building's benefits. Emphasis has been more on POE, since it seeks to improve the quality of design, construction and management of buildings.

The study concludes that the potential benefits of POE cannot be overemphasized, since POE seeks to improve the quality of building design, construction, operation and management of building and by extension promotes sustainable built environment where building operation, maintenance and management will be given due attention.

The study therefore recommended that POE be part of research agenda of the built environment profession, and made accessible to designers of future buildings. Additionally, for any building to remain competitive and serve its purposes it must use POE information to evaluate its performance on end-users as to compare it with best practices.

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