

# Exploring Post Occupancy Evaluation as a Sustainable Tool for Assessing Building Performance in Developing Countries

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**Edidiong Ukpong**

Department of Architecture, University of Nigeria, Nsukka, Nigeria

**Aniebietabasi Ackley\***

School of Architecture, Victoria University of Wellington, New Zealand

\*Corresponding author: [aniebietabasi.ackley@vuw.ac.nz](mailto:aniebietabasi.ackley@vuw.ac.nz)

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In recent years, the concept of using Post Occupancy Evaluation (POE) for building performance assessment has attracted much attention globally because of its benefits in enhancing future design decisions. However, developing countries give little or no concern to the practice of improving design outcomes using POEs. In Nigeria, buildings are rarely evaluated once they are handed over to the clients. This study explored the use of POE as a sustainable tool to assess building performance in developing countries with Nigeria as a case study. The method of data collection was firstly through a systematic literature review where existing and current conceptual body of knowledge in peer-reviewed journals, electronic databases (Science Direct and Google Scholar), conference proceedings, and published articles were appraised; with a specific focus on key issues of POE, such as: its definition, evolution, phases, levels, dimensions, benefits and application as a sustainable tool for building performance. The findings from the literature informed the use of interviews to gather the perception of building professionals on the use of POE for building performance assessment. A total of 117 building professionals including architects, engineers, planners and surveyors were interviewed. The data analysis involved descriptive and inferential statistics (frequency count and simple percentages). The study findings revealed that building occupants are a valuable source of information on building performance and that POE methods should be simple and building typology specific. The interviewees suggested that POEs could provide useful benchmarking data to establish best practices for delivering sustainable building developments in Nigeria. It is expected that the findings of this study will encourage policy makers to consider regulations that will enhance the use of POEs for building performance analyses to feed forward the positive and negative lessons learned to improve the design of current and future building developments in developing countries.

**Keywords:** assessment, developing countries, performance of building, post occupancy evaluation (POE), sustainability.



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## Introduction

Building users desire buildings to support their yearnings and meet their expectations in accessibility, productivity, health, comfort and satisfaction (Akpan-Iodiok and Ackley, 2017; Ackley et al., 2018). This is crucial since people spend up to 90% of their time inside buildings where they work, study or live in (Ferreira and Cardoso, 2014; Nathanson as cited in El-sharkawy, 2014; Ackley et al., 2017). The idea of sustainability, green buildings, and energy efficiency has made the construction industry and owners to be concerned about how their buildings perform. Building performance can be defined as the degree to which a building can meet any or all these expectations. Several tools and theories have been developed to appraise a building from environmental compliance to energy performance. Post Occupancy Evaluation (POE) is one of the existing tool (Aliyu et al., 2016; Sanni-anibire and Hassanain, 2016). POE is the process of evaluating the building in a systematic and rigorous way after it has been occupied.

In Nigeria, buildings are rarely evaluated once they are handed over to the clients. This lack of appraisal brings about repetition of design mistakes and even when some reassessments are done; it is usually done in a non-systematic manner. The absence of regularized feedback from performance to planning and construction phases becomes ever more relevant under the current conditions which include (Meir, 2008 as cited in Meir et al., 2009): (1) continuous rise in the consumption of energy, both per capita and in absolute terms; (2) the realization that fossil fuels are being depleted and that their use has adverse environmental, health, social, political and security implications; and (3) people spending 80–90 per cent of their lives in buildings, which means that the indoor conditions should have positive imprint on well-being, health and productivity (El Asmar et al., 2014; Jurado et al., 2014; Marchetti et al., 2015; Radwan, 2014; Rovelli et al., 2014; Thornes et al., 2016; Tofful and Perrino, 2015).

POE offers a sustainable building performance tool to create a balance for the increasingly stringent environmental constraints and occupant comfort and satisfaction in buildings. Greater attention has been given to POE studies but majorly in America, Europe and Asia (Leaman et al., 2016; Mallory-Hill et al., 2012; Morrison, 2008; Preiser and Nasar, 2008; Tookaloo and Smith, 2015). However, less attention is given to POE in Nigeria and the few POEs carried out are focused on subjective assessment of buildings (Adedayo and Zubairu, 2013; Ibem et al., 2015; Ilesanmi, 2010; Lawrence, 2012; Nwankwo et al., 2014). This paper focuses on exploring POE as a sustainable tool for building performance in Nigeria, aimed at improving the knowledge of POE in developing countries.

Building performance and its evaluation (using POE) have received increased attention in recent years, particularly with respect to residential and commercial buildings (Brown, 2009; Huat and Bin Akasah, 2011; Olubunmi, 2013; Tanyer and Pembegül, 2010). However, in developing countries; little concern is shown in the practice of building performance evaluation (Agyekum et al., 2016; Olatunji, 2013). Leaman (2004) as cited in Olatunji (2013) stated that building performance is yet to be taken as an area of legitimate interest in the academics, thereby calling for further studies to elucidate POE as a sustainable tool in that direction. Nigeria is yet to be in the fore front of bringing the knowledge and practice of POE as a sustainable tool to bear (Jiboye, 2012). This study explores the benefits of POE as a sustainable tool for building performance in developing countries with a case study of Nigeria.

### Building Performance

Building performance is the behaviour of a product in use in BS5240. It denotes the physical performance characteristics of a building as a whole and/or its parts (Clift, 1995 as cited in Jiun, 2005). It is the capacity of a building to meet its expectation and desired intention. Building occupants' interactions with the physical, business and work environments of a building defines the performance of the building. This performance approach involves the definition of user requirements and performance criteria to be used in a systematic appraisal for predicted or actual

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## Literature Review and Theoretical Framework

performance throughout the entire building life cycle (Gajendran, 1998 as cited in Jiun, 2005). There are specialised tools that can be used in measuring building performance and they include; Post Occupancy Evaluation, Building In Use, Concept of Total Building Performance and Building Diagnostics, Building Quality Assessments, ORBIT and BREEAM (Jiun, 2005), Elsaay and Othman (2013) included Building Quality assessment (BQA) and Serviceability tools and methods (STM).

### Post Occupancy Evaluation (POE) and its Evolution

POE is an examination of the effectiveness of occupied built environments for human users that focuses on the assessment of occupant satisfaction and functionality of a space; where effectiveness corresponds to the achievement of personal and organizational goals by the enhancement of physical and organizational factors (Turpin-Brooks and Viccars 2006; Zimmerman and Martin, 2001). "POE is the measurement of building performance throughout the life cycle of a building from initial concept through occupancy such that the information gathered is used to improve future building designs" (Vischer 2001; Zimmerman and Martin, 2001)

The roots of POE are based in academia in the mid-1960s; however POE is based on a much older idea known as the 'performance concept' of building, which dates back to the Code of Hammurabi (1800 BC)(Mallory-Hill et al., 2012). Interesting account of the evolution of POE are recorded in Cooper (2001) and Preiser and Nasar (2008) specifically in the UK. In 1960, Sim van der Rijn and Victor Hsia carried out evaluation case studies of university dormitories even though not called POEs, these evaluations were among the first systematic attempts at assessing building performance from the building users' point of view (Preiser and Nasar, 2008).

In the 80s, lots of POE activity were carried out in the UK, Canada, New Zealand, Australia, and the US on public works projects, government buildings, airports, etc., resulting in very sizeable and significant POE studies. And the first textbook on POE was written by Preiser, Rabinowitz and White in 1988 (Preiser and Nasar, 2008), and since then several terms have been suggested to POE by academics and others working in the industry such as; environmental design evaluation, building in use assessment, facility assessment and post-construction evaluation have been used to depict POE in an attempt to better reflect on its aims and objectives (Council, 2002).

### Phases of POE

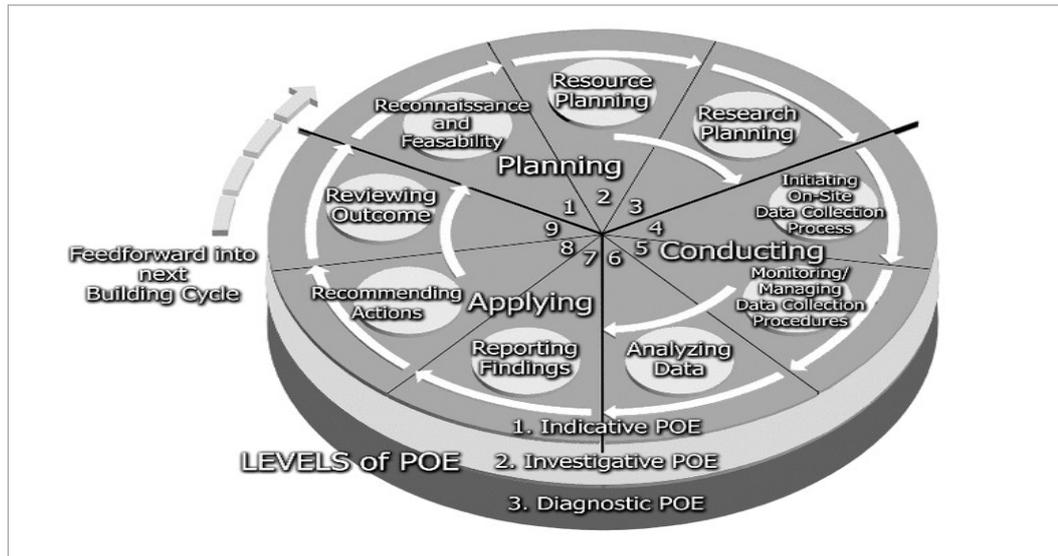
Figure 1.0 identifies 3 phases and 9 sub phases in a POE process (Council, 2002).

- The 1st phase: **Planning** involves review for (1) reconnaissance and feasibility, (2) planning for the resources and (3) the research planning that may be needed for a particular level of POE. Schedule, cost, and human resources are determined; and plans for data collection procedures, time and amounts are the parameters laid out.
- The 2nd phase: **Conducting** starts with (4) initiating on-site data collection process (5) monitoring and management of data collection procedures, and (6) data analysis.
- The 3rd phase: **Applying** involves (7) reporting findings, (8) recommending actions and (9) reviewing outcome. This is the most tedious part from the client's view since actions are supposed to be taken at this stage based on the recommendations made. The feed-forward arrow into next building cycle is vital as the best application of POE is its use as a factor in pre-design phases of the building delivery cycle.

POE assesses several aspects of the occupied buildings' functional and technical performance, both chemo-physical (indoor environment quality (IEQ), indoor air quality (IAQ) and thermal performance, acoustic and visual quality), as well as more subjective and interactional (space use, user satisfaction, etc.). POE draws on an extensive quantitative and qualitative toolkit: measurements and monitoring, and methods such as walk-throughs, observations and user satisfaction questionnaires and semi-structured and structured interviews (Meir et al., 2009).

Fig. 1

Post Occupancy  
Evaluation:  
evolving  
Performance  
criteria  
(Council, 2002)



### Levels (Types) and Dimensions Of POE

Most of the literature submitted to these three levels to POE and are summarised as: Indicative, Investigative and Diagnostic POE (Aliyu et al., 2016; Eke et al., 2013; Elsaay and Othman, 2013; Hadjri et al., 2009).

1. **Indicative POEs** involves quick (two or three hours to one or two days) archival, walkthrough and document evaluations involving structured interviews with key personnel, group meetings with end users as well as inspections. The aim is to highlight major strengths and weaknesses.
2. **Investigative POEs** are more in-depth analyses, utilising interviews and questionnaires, focus group reviews usually across many buildings of the same or similar type to produce more robust data. This could take a week to several months.
3. **Diagnostic POEs** are regarded as being the most sophisticated of the methodologies. This takes several months to years. They tend to have a broad system wide focus on many comparable facility types, focusing on a broad range of technological and anthropological areas of research. They produce high validity and generalizability of data collected with the potential of being transformed into guidelines for use in the public realm. Generally, this includes: air-handling, heating, measuring ventilation rates, lighting levels, energy and water usage, CO2 emissions, thermal, air and visual quality and acoustic performance.

Zimring and Reizenstein in 1980 (as cited in Bhawani, 2015), summarised three **dimensions** of POE and they include: (1) **Generality and Specificity** determines the nature of the POE data collected. For example, a study based on impact of floor-plan configurations on users is driven by generic data collection, whereas a study based on specific apartment complex for students is targeted towards specific settings. (2) **Breadth of Focus** covers the extent of review during an evaluation. The focus of review can be a single physical characteristic of a single setting versus multiple settings. It can also be evaluation of holistic systems such as the social and physical workings of a combination of settings or influence of social trends on the organizational structure that operates in those settings. (3) **Timing of application** which suggested that while some studies can be conducted on a short-term basis to inform design and planning decisions, some may be conducted on a longer term to develop heuristics and facilitate future planning. Although most POEs have a primary goal, a single study may have multiple goals or multiple studies may have a common goal.

This research focused on making a case for POE as a sustainable tool for building performance in Nigeria, which gives the focus of this POE specific in terms of the first two dimensions. And for the third dimension, this study is intended to help Nigeria gain from the short and long-term benefits of POE.

### **Building Performance Assessment Using POE: The Global Case**

A study by Dahlan et al. (2009) focussed on naturally ventilated student housing with ceiling fans and deduced that occupants' perception of indoor thermal comfort was affected by outdoor conditions in agreement with previous research by De Dear and Brager, (2002). Brown and Cole (2009) examined the influence of knowledge on occupant behaviour studying green and non-green academic (departmental) buildings in a university campus. Through the use of POE tools they found that sub-optimal comfort conditions were caused by (Hadjri and Crozier, 2009) absence of timely feedback and poor comprehension. Preiser (2002) highlighted the need for continual building performance evaluation and indicated that POEs are different from other evaluation methods. POEs focus on technical and non-technical parameters providing a holistic performance picture; this was also posited by (Hadjri and Crozier, 2009). Augenbroe and Park (2005) reinforces the importance of measuring building performance addressing key performance aspects such as: energy, lighting, thermal comfort, maintenance and indoor air quality.

Fowler et al. (2005) emphasized that the lack of performance measured data hampered the adoption of sustainable design and construction. This minimizes the savings realized, as stakeholders are simply unaware of the information. Turpin-Brooks and Viccars (2006) discussed the importance of developing robust and effective POEs as part of a sustainable approach to workplaces. They stated that POEs are effective in addressing client satisfaction, and user needs as part of sustainability assessments. Bordass et al. (2009) affirmed Turpin-Brooks and Viccars (2006)'s position.

A study of US data on residential energy consumption, Steemers and Yun (2009)) found that occupant behaviour and socio-economic parameters were also important components in the equation of energy consumption and sustainability demanding POE to salvage the situation. This findings is in agreement with a study carried out by Brown et al. (2010) and Meir et al. (2009). Another study by Guerra-Santin and Itard, (2010) used surveys and questionnaires to discuss the influence of occupants on energy consumption. They studied a residential application in Netherlands and showed that the type of heating/cooling system selected had an influence on occupant consumption behaviour.

The importance of tracking, measurement and on-going building performance awareness was a finding in Masoso (2010) study on waste energy consumption during non-occupied periods of six buildings. The suggested that building performance awareness is the key to reducing energy consumption in buildings and promoting sustainability. This implies that occupants could have a great impact in reducing energy consumption in buildings. POE studies have been carried out worldwide in both the private and public sector, but have rarely led to 'lessons learned' and design changes (Ornstein and Ono, 2010) and the lack of systematic POE use by professionals has led to a situation where mistakes are repeated and every building is a prototype. The impact of occupant behaviour on building energy consumption was studied by Yu et al. (2011). Their findings indicated occupant behaviour as the lead factor influencing building energy consumption.

A study (Martani et al., 2012) carried out on two non-domestic buildings on the MIT campus showing operation of heating, ventilation and air conditioning systems suggested other factors other than occupancy. These factors were closely related to external temperature, however there was a significant correlation between occupancy and electricity consumption. Toftum et al. (2009) studied the energy consumption in two different types of buildings in Singapore one with active cooling and one with passive strategies. They found no significant energy consumption or significant com-

plaints by those who experienced higher temperatures in the passive building, even though the differential between the two were vastly different. Berker et al. (2011) carried out a study on the user evaluation of sustainable buildings looking at parameters such as indoor climate, mechanical operation, user attitudes and general satisfaction. They highlighted ultimate performance of a building is reliant on users. A study (Yang and Wang, 2013) similar to a study by Klein et al. (2012) focused on the creation of a multi-agent intelligent control system to interact with occupants by responding to their requests and obtaining feedback based on their behaviours.

### Post Occupancy Evaluation: The Nigerian Case

Given the rising cases of building collapse in Nigeria and the poor maintenance of institutional buildings, it is apparent that POE is not well explored in Nigeria. This assertion is supported by Olatunji, (2013) who states that POE is not carried out in most institution buildings in Nigeria (Olatunji, 2013). This has resulted in institutional buildings being regarded as inadequate and deplorable with low occupants' satisfaction (Adamu and Shakantu, 2016; Aluko, 2011; Ojogwu and Alutu, 2009; Ojo et al., 2013; Ubong, 2007). Government office buildings in Nigeria are generally faced with premature but steady and rapid deterioration, decay and dilapidation due to lack of maintenance (Olagunju et al., 2013). A POE carried out in a school building in Nigeria suggested that the negative experiences expressed by the study participants point to the need for building performance evaluation (Olatunji, 2013).

Another study observed that POE as a systematic method of collecting data on buildings in-use has not found wide usage for housing in Nigeria (Jiboye, 2012; Nwankwo et al., 2014). Olatubara and Fatoye (2006) and Olatubara (2008) were cited to have observed that unfortunately most State governments in Nigeria provide housing estates and do not regard building evaluation of these housing estates as an area of legitimate interest (Olubunmi, 2013). There is little factual evidence to ascertain the key problems and the specific factors of 'inadequacy' or 'non-satisfaction' in existing public housing estates (Ilesanmi, 2010), making a call for POEs.

Users of public buildings are generally not satisfied with the building design and design decisions taken with implications that the building has failed to meet the majority of the needs and aspirations of the user of the public buildings in the selected cities in Nigeria (Adedayo and Ayuba, 2013). Motor parks have not met the needs of their users in Minna because they are inadequate and require major transformation (Adedayo and Zubairu, 2013). Another study by Adeniran and Akinlabi, (2012) suggested that because of the form adopted in the architectural design of the Senate Building under study, satisfactory levels of indoor environmental comfort was not achieved and appeared to have been sacrificed for the high aesthetic value achieved.

### Benefits of POE as a Sustainable Tool for Building Performance in Nigeria

Brundtland Commission (1987), defined Sustainable development to be a development that "meets the needs of the present without compromising the ability of future generations to meet their own needs" (Ijatuyi Olufunto and Olatunde, 2013). Under the mounting pressure of energy shortage, one approach to minimize the contradiction of the increasing demand for comfort in buildings and the need to decrease the use of energy is to design sustainable buildings in an informed and responsive way (Meir et al., 2009; Zeiler and Boxem, 2008; Zeiler et al., 2007). As a result, integration between end-user needs and building performance is indispensable. POE makes a case in this stand and its **short-term benefits** include obtaining users' feedback on problems in buildings and the identification of solutions; **medium-term benefits** include feed-forward of the positive and negative lessons learned into the next building cycle; **long-term benefits** aim at the creation of databases and the update, upgrade and generation of planning and design protocols and paradigms.

Exploratory research is an examination into a subject to gain further insight identifying issues that could be the focus of future research. The methodology used in this study was firstly a systematic

literature review which focused on appraising existing and current conceptual body of knowledge, previous published studies bringing to the fore the key issues of POE- its evolution, phases, methods, levels, application as a sustainable tool for building performance and its benefits. Peer-reviewed journals, electronic databases (Science Direct and Google Scholar), and conference proceedings where direct sources of the body of literature. The study reviewed and analysed literature on post occupancy evaluation (POE) and building performance bringing out germane points on POE concept.

The second method used to gather data was through interviewing building professionals to gather their perception on the use of POEs for building performance analyses in Nigeria. Interviews can be defined as a qualitative research technique which involve social interaction with participants to explore their perspectives on an idea (Groat and Wang, 2004). Interviews help to collate the story behind a participant experiences and pursue in-depth information around a topic (McNamara, 1999). Based on the response of the respondents, interviews are completed by the interviewer. In this study, an informal conversational, semi structured face to face interview with predetermined questions were used to gather the perspective of 117 building professionals on the use of POEs for building performance analyses in Nigeria. The data analysis involved descriptive and inferential statistics (frequency count and simple percentages).

Between 16<sup>th</sup> and 31<sup>st</sup> November 2018, informal conversational, semi structured face to face interview was carried out with 117 interviewees. The interview allowed each interviewee to express their perspective about POE in Nigeria. The charts and tables below present the responses collated from interviewees.

As shown in Table 1, many interviewees were males 61.5% (n=72), between the ages of 26 to 35 years 43.6% (n=51). Majority of interviewees were architects 41.0% (n=48) and 40.2% (n=47) attained a master's degree tertiary education level.

Description		Frequency (n=117)	Percentage (%)
<b>Gender</b>	Male	72	61.5
	Female	45	38.5
<b>Age</b>	18-25	37	31.6
	26-35	51	43.6
	36-50	19	16.2
	Above 50	10	8.5
<b>Field of Practice</b>	Architect	48	41.0
	Engineer	31	26.5
	Planner	23	19.7
	Surveyor	15	12.8
<b>Qualification</b>	Diploma	29	24.8
	BSc	35	29.9
	MSc	47	40.2
	PhD	6	5.1
<b>Years in Practice</b>	0-1 years	7	6.0
	2-5 years	14	12.0
	6-10 years	30	25.6
	11-20 years	56	47.9
	Over 20 years	10	8.5

## Methodology

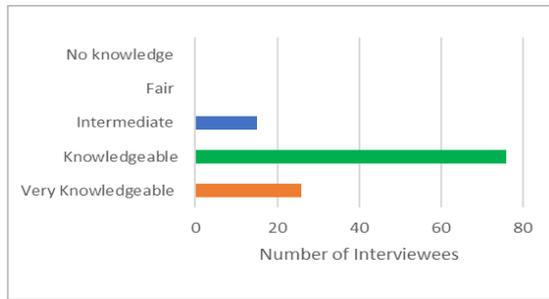
## Results

**Table 1**

Socio-demographic data of Interviewees n=117

Fig. 2

Respondents knowledge about building performance evaluation

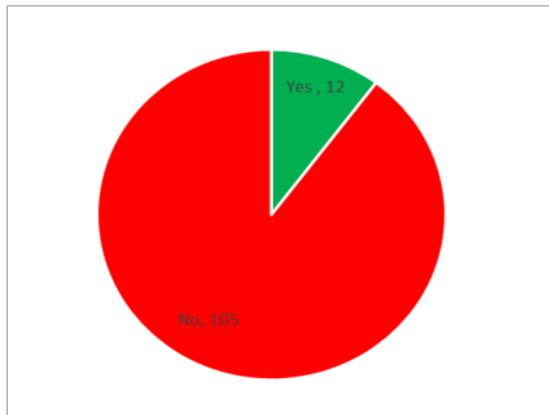


### Building Professionals Knowledge of Building Performance Analysis Using POEs in Nigeria

In Fig. 2, majority of interviewees (n=76) stated that they are knowledgeable about building performance evaluation. This could be because majority of interviewees had at least a first-degree qualification and above and are building professionals.

Fig. 3

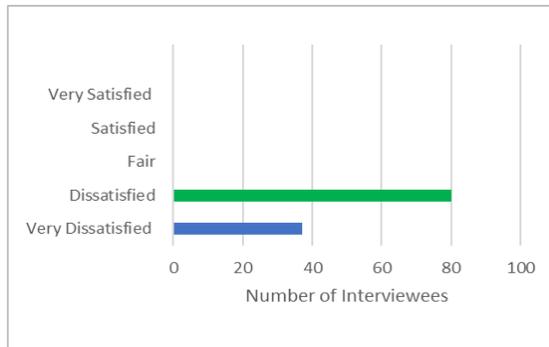
No of Interviewee that have carried out or been involved in building performance evaluation or research or published any article relating to building performance assessment.



In Fig. 3, majority of interviewees stated that they have not carried out or been involved in building performance evaluation, researched or published any article relating to building performance. The few interviewees who responded “yes” stated that they have been involved in POEs of student’s hostel accommodation, motor park facilities assessment, and in some selected building estates in the country. They opined that only few POEs seems to have been carried out in Nigeria. This is evident in Fig. 4 below were majority (n=80) of interviewees stated that they were dissatisfied with building performance assessment practice in Nigeria

Fig. 4

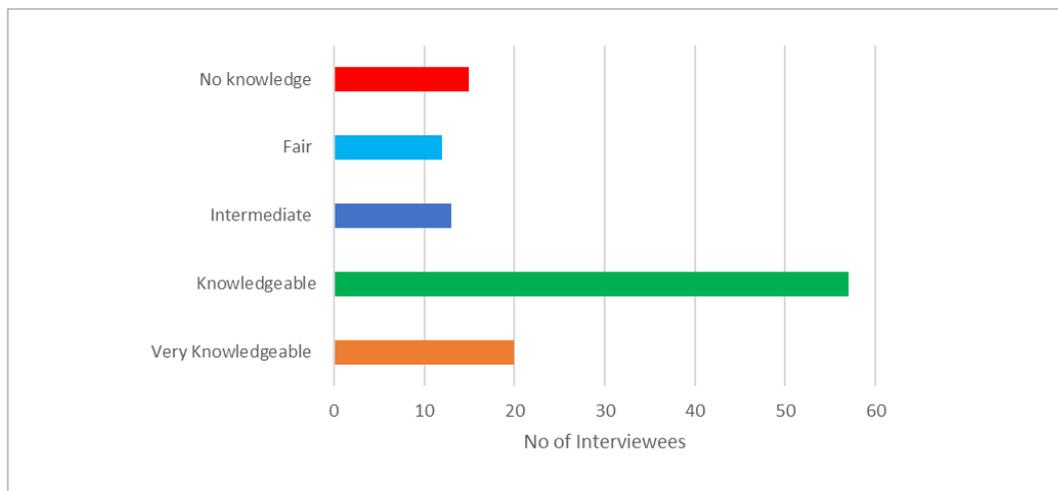
Satisfaction level of interviewees with the building performance assessment practice in Nigeria



In response to the benefits of using POE for building performance assessment, majority of interviewees stated that they were knowledgeable about the merits of using POE to assess a building’s performance. These gives concerns on why limited POEs have been carried out in Nigeria. Possible reasons are stated in Table 4.

Fig. 5

Interviewees knowledge about the merits of using POE in building performance assessment



## Building Professionals Perception of the Benefits of and Factors Affecting the Use of Building Performance Assessment in Nigeria

In Table 2, majority of interviewees stated that; improvement in building design following lessons learned from POEs (79.5%) and forestalling future building failures (77.8%) were the major benefits of consistent building performance assessments using POEs. This assertion is supported by the literature which suggested that POEs may be beneficial in ascertaining the various causes of building collapse in Nigeria.

Benefits of Building Performance Assessment	Frequency (n=117)	Percentage (%)
Improvement in building design following lessons learned	93	79.5
Forestalling future building failures	91	77.8
Enhancing building efficiency	38	32.5
Improved functionality of the buildings	53	45.3
Effective utilization of resources	57	48.7
Regulation of architectural practice	75	64.1
Expansion of knowledge base on building performance	69	59.0
Improved structural stability and safety features in buildings	71	60.7
Promote the review of building policies	46	39.3
Improvement in service delivery	44	37.6
Provision of new ways of solving building performance problems	34	29.1

**Table 2**

Interviewees perspective of the benefits of a consistent building performance assessment practice in Nigeria

In Table 3, lack of policies that encourage POEs, Poor building laws enforcement, high cost of consultancy and professional fees and lack of interest by building professionals were leading factors limiting the sustainable practice of building performance assessment in Nigeria.

Factors Affecting Building Performance Assessment	Frequency (n=117)	Percentage (%)
Lack of awareness of the benefits of POEs	7	6.0
Lack of policies that encourage POEs	80	68.4
Lack of interest by building professionals	55	47.0
High cost of consultancy and professional fees	69	59.0
Poor continuous professional development of professionals	46	39.3
Lack of database culture for archiving information	5	4.3
Poor commitment to sustainability	43	36.8
Poor clients and professionals relationship	47	40.2
Lack of adequate information	48	41.0
Lack of adequate experience in carrying out POEs	59	50.4
Non-involvement of building regulation authorities in construction	39	33.3
None usage of professionals in construction	37	31.6
Government policies	48	41.0
Poor building law enforcement	66	56.4
Ignorance in the part of professionals and professional negligence	26	22.2
Funds mismanagement	32	27.4

**Table 3**

Factors that could affect the sustainable practice of building performance assessment in Nigeria

All interviewees stated that they will recommend the use of POE as a sustainable tool for building performance practice in Nigeria because of the following reasons stated in Table 4.

**Table 4**

Reasons for recommending the use of POE as a sustainable tool for building performance practice in Nigeria

Reasons for Recommending the use of POEs in Nigeria	Frequency	Percentage (%)
To ascertain if the users of the space are satisfied with the building after occupancy	82	70.1
Lessons learned would be useful in promoting design synergy in Nigeria	54	46.2
It will promote knowledge on the proper use of building materials	66	56.4
Improvement of POE know how	98	83.8
Check reoccurrence of building failures in Nigeria	102	87.2
It will create professional employment in the building sector	45	38.5
It will check professional negligence	92	78.6
It will check the possibility of building failure	102	87.2

## Discussion

From the systematic literature review, it is gathered that little or no attention is given to POE in Nigeria unlike the greater attention given to it as a tool for assessing building performance at the global stage. Highlighted were the definition, evolution, levels, dimensions, and benefits of POE as a sustainable tool for evaluating building performance by involving the owners, professionals, and occupants. POE serves the needs of the owners and it is critical that the building should be evaluated from time to time to ensure that it is serving its intended purposes. Researchers also cautioned that POE methods should be simple and building typology specific. Also highlighted was that industry split incentives, lack of supporting policies, and tools have inhibited adoption of POE processes especially in Nigeria.

From the interview responses, it is evident that building professionals in Nigeria are aware of the benefits of using POEs as a tool for assessing building performance. Interviewees suggested that these benefits include; the use of POE data to improve buildings occupant's health, safety, security, and functionality of a building. This indicates that interviewees understand that POE differs from other types of buildings' similar to the position of some authors (Jiboye, 2012; Nwankwo et al., 2014) performance evaluations.

However, majority (n=80) of interviewees were dissatisfied with building performance assessment practice in Nigeria and recommended the use of POEs as a sustainable tool for building performance analyses. Most interviewees suggested that lack of policies that encourage the use of POEs as well as possible high cost of engaging consultants are key factors that affect the sustainable practice of building performance assessment in Nigeria and in developing countries at large. Considering the frequency of building collapse in Nigeria, most interviewees suggested that consistent building performance assessment using POEs could be useful in providing evidence-based data that could help in the improvement of building design and policies to curb future building failures in Nigeria. Some interviewees also suggested that evidence-based data from POEs could promote the review of building policies and expand building professional's knowledge base on building performance analysis.

Furthermore, interviewees suggested that it will be useful to incorporate POEs in building certification process in Nigeria. Nonetheless, the study findings generally support the argument that POEs are important to improving user's satisfaction in buildings which is similar to the position in some studies (Adedayo and Zubairu, 2013; Olatunji, 2013), and establishing best practices and lessons learned in delivering building performance assessment in Nigeria.

## Conclusion

This study appraised the dimensions and benefits of POE application as a useful tool in building performance assessment. The systematic literature review and responses from interviewees revealed that little or no attention is given to POE in developing countries like Nigeria, unlike the greater attention given to it as a tool for assessing building performance at the global stage. The

results suggest that building occupants are a valuable source of information on building performance and that POE methods should be simple and building typology specific.

In the Nigerian context, the study findings suggest that the use of POEs in building performance assessment could provide data driven information's that would encourage guideline principles and design criteria to improve similar future projects to forestall building failures. Interviewees recommended the incorporation of POEs in building certification process in developing countries. The findings of this study are limited to 117 interviewees. Interviewing a larger number of respondents including clients and building regulators as well as using questionnaires to gather the perception of policy makers may provide more insights regarding the sustainable use of POEs for building performance assessment.

In summary, this study supports the argument that POEs are important to improving user's satisfaction in buildings, and establishing best practices and lessons learned in delivering building performance assessment in Nigeria. It is expected that the result of this study will encourage policy makers to consider regulations that enhances the uses of POEs for building performance assessment to feed forward the positive and negative lessons learned to improve the design of current and future building developments in Nigeria.

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## About the Authors

### **EDIDIONG UKPONG**

**Principal Architect, Directorate of Physical Planning**

University of Uyo, Akwa-Ibom State, Nigeria

#### **Main Research Area**

Lighting in Buildings, Indoor Environmental Quality, Post Occupancy Evaluation

#### **Address**

University of Uyo, Nigeria  
Tel.: +2348060061292  
Email: edidiongukpong1983@gmail.com

### **ANIEBIETABASI ACKLEY**

**PhD Researcher**

Faculty of Architecture and Design, School of Architecture, Victoria University of Wellington, New Zealand

#### **Main Research Area**

Sustainable Architecture, Building Performance Evaluation, Indoor Environmental Quality and Health Architecture

#### **Address**

139 Vivian Street, Te Aro Campus, Wellington  
Tel.: +642102850560  
Email: aniebietabasi.ackley@vuw.ac.nz