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POST OCCUPANCY EVALUATION: A MORE EFFECTIVE CASE STUDY METHOD

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KEYWORDS

Key words: Architecture, Case Study, Post Occupancy-Evaluation, Survey;

ABSTRACT

Aim of Study: Exploring the high points of Post Occupancy Evaluation as a method of case studies and proposing it as an interesting and more-effective method of performing case studies in the practice of Architecture is the foremost aim of this study.

Methodology: This study involved an investigation carried out using web-based questionnaires randomly distributed to Architects with different years of experience to ascertain their perception of case studies and the extent to which they apply it in actual practice of architecture. It also involved desktop research done for more insight on the subject matter.

Results: A total of 77 Nigerian Architects responded to the online survey. 7.89% have 0-5 years of experience, 27.63% have 5-10 years, 31.58% have 10-15 years, 10.53% have 15-20 years and 22.37% have above 20 years of experience. These all affirmed that case studies have been helpful in numerous ways in cause of their practice of architecture and highlighted their various perceptions of case studies. Results also revealed that most of their case study activities unceremoniously express Post Occupancy Evaluation which entails walk-through and observation and also getting feedback from occupants of the building.

Observation: Generally, case studies are approached with some reluctance and with an approach that is not consciously planned. As a result, the knowledge sought while performing a case study is very often inadequate and sometimes distorted.

Recommendation: If the relevance of Case studies especially with the Post-Occupancy Evaluation approach is consciously inculcated in the study and practice of architecture, the knowledge and deliberate practice would yield better results like better comprehension of the evaluated building, an assortment of lessons learnt and a more practicable approach to architectural designs.

1. Introduction

The regular architect or architecture student surfs websites to study drawings and notes about existing buildings similar to their proposed projects. Some move a step further to look for reviews by other architects or people with an interest in the building. A few architects may visit the buildings to conscientiously carry out physical study taking pictures and notes on their experience. Clearly, case study methodologies differ from one case study to another depending on the extent of information required by the architect. This thereby reveals the extensiveness and unavoidability of case studies in the study and practice of architecture. [1]

Definition of Case Study

Architecture Students' Chronicles defined case study as "an in-depth investigation". It is also described as "the particular case that is similar to your design topic" [1]. It can be said that performing a case study is particularly beneficial to the architect as it helps knowledge expansion in various aspects to be considered when planning a design project. Some approaches to case studies include experiments, surveys, or analysis of archived information. [1]

Definition of Post Occupancy Evaluation

Prieser defined Post occupancy evaluation, also known as POE as 'the process of evaluating a building in a systematic and rigorous manner after they have been occupied for some time' [2]. Jacqueline, in her journal article 'A Multifaceted Tool for Building Improvement' elucidated that "POE involves activities initiated from an interest in learning how a building performs soon as it is built and occupied and also to ascertain whether or not its expectations were met. [3]. Furthermore, the RIBA Research Steering Group defined POE as "a methodical study of occupied buildings to provide architects with information about the performance of their designs and building owners and occupants with guidelines to achieve the best out of what they already have" [4]. These definitions present post-occupancy evaluation as a tool that is basically used to assess building performance and also to develop guidelines for similar future buildings. [5] Also, it is defined as a systematic evaluation of opinion about buildings in use, from the perspective of the people who use them. These evaluations are generally aimed at conveying the highpoints of buildings that work well and also at focusing on the ones that should not be repeated in future building designs. Post Occupancy Evaluation can be viewed as a forward-thinking case study method because it involves acquiring pertinent information of a building. It is more defined and executed in an extremely coordinated manner that can cover virtually all aspects of the study object.

A survey carried out on 77 architects with different years of experience reveals that architects see case studies as imperative and are involved in case studies however, not as intensely and rigorously as could engender substantial information. Below is a summary of responses from architects when asked of their understanding of case studies.

- A critical evaluation of existing designs against certain parameters so as to aid the architect in his eventual design.
- A basic and necessary guide to a great design.
- A critical study of an existing project or condition as to improve its performance in subsequent the architects proposed work.
- An investigation into an existing scenario to get relevant information.
- A method for data collection and for familiarization with a new architectural theme.
- A study carried out to have better understanding of intended projects and for referencing.
- A study that gives the architect ideas on how to prepare and improve on similar project.
- Vital bricks which help to build a design process from conception to the finish process.
- In-depth study of architectural examples.
- Supports to elicit, define and express the primary parameters to consider in a specific design project.
- Evaluation of existing structure
- Help in understanding different building type

- As regards architecture, a study of how people use and experience the built environment for the purpose gathering information for future application. For example, how do physically challenged persons use elevators and bathrooms? This example will be called "A case study of the use of elevators and bathrooms by the physically challenged.
- A qualitative research method employed to have a full grasp of an existing situation which is related to your study.
- An avenue to highlight the needs of the client and examine and adopt the ideas exhumed from existing schemes.

In the study and practice of architecture, case studies are virtually indispensable. In trying to develop guidelines for the new buildings, case studies are very often conducted to gain insight on projects similar to the proposed projects. POE, which is in actual fact a more intense case study method is hardly deliberately employed. It is good enough to have all the drawings of an existing structure thoroughly studied, the building visited and studied physically but what about how the building users feel about the building particularly users from a relatively long period of time. This study unveils the relevance of post occupancy evaluation as a more effective case study approach. Buildings are designed and built for people hence if the people are not actively involved in giving feedback from their experience from years of occupancy, then the information may be termed half-finished. Post occupancy evaluation, when properly done can produce more detailed information that can enhance the architect's design process as well as report on the evaluated building's performance.

2. Statement of the problem

As relevant as case studies are in the practice of architecture, how is it possible that architects conduct peripheral case studies and this occurs and re-occurs in the private practice of an appreciable number of architects as well as students of architecture. Some circumvent the case study aspect of their project design process with the justification that the project is familiar and needs be done in the 'nick of time. Is it possible that emphasis on the relevance of in-depth case studies is insufficiently communicated to the students that they grow in the profession neglecting its inevitability? Can POE be better understood amidst practising architect as a more effective way of performing case studies?

3. Literature Review

Case studies are designed to flow from one stage to another. Figure 1. as put forward by Cosmos Cooperation depicts that case studies are in three sections.

- **Define and Design Section:** Case studies are consciously defined and designed. The proper approach is to define the scope of study and the volume of information required. Afterwards, there's a need to design the case study highlighting all the very important aspects that require responses. The approach to the case study; use of questionnaires, interviews with individuals or focus groups, physical observation etc.
- **Prepare, Collect and Analyse Section:** The preparation for case study, collection and analyses is the section where the location of study, the collection of relevant information and the analysis of such collected information.
- **Analyse and Conclude Section:** These sections make up a complete case study and cuts across every field requiring a case study.

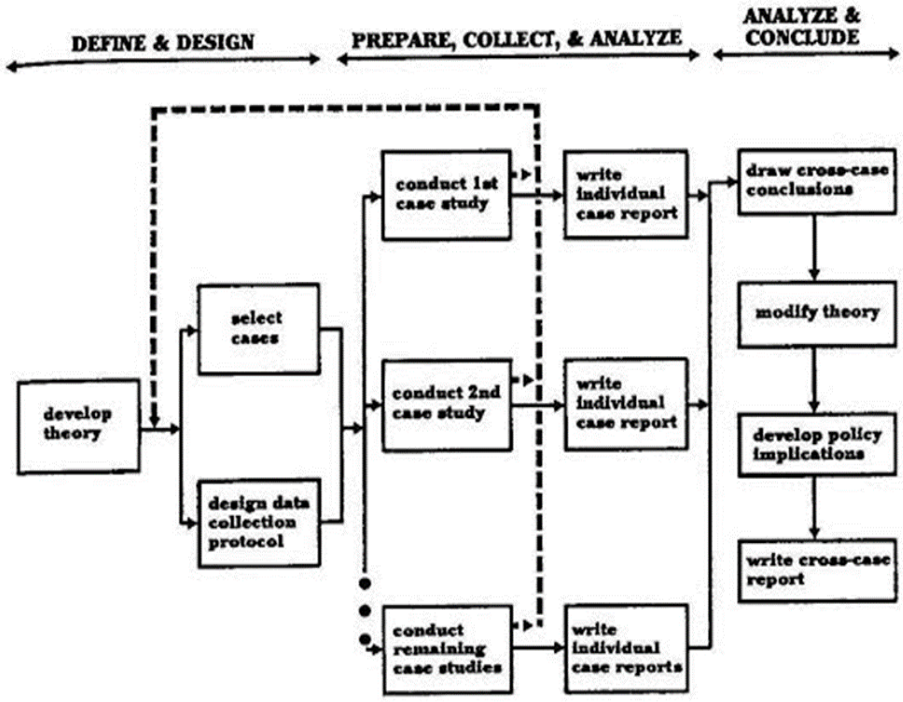


Figure 1 CASE STUDY FLOW DIAGRAM

Source: Cosmos Cooperation

Origin OF Post Occupancy Evaluation

POE has its origin from United Kingdom where the British Ministry of Education in conjunction with local governments first undertook evaluations of building in after the Second World War [2] POE has been supposedly used by number of researchers over the years as a tool for documenting, evaluating and improving a building as well as environmental condition. [6]

POE was derived from the "occupancy permit", a document that is issued once the building has been inspected and is declared free from all defects and ready for occupation. [7]. The idea of POE was established following the challenges emanating from the building industry, particularly in the facilities such as psychiatric hospital, nursing homes, school residence and correctional services [7]. The speedy development of buildings in the Second world war led to the adoption of POE in the built environment. Due to the urban renewal projects, many houses which were built in Northern America, has forced the designers to accommodate the need of the lifestyle of the occupants [7]. Having POE as a measuring tool in any building will be able to detect which elements in building performs or which elements in building underperforms and affecting the worker satisfaction and productivity as noted by Schwede&Davies [8]

As described by Kirk and Stirrett, POE of a building is a formal study, that tests whether the building has met goals and objectives set forth in the original programme. [9]. This means that, after a period of time within which the building has been occupied, the POE will be carried out to ascertain that the project brief has been met. The building is an immovable asset, and it is affected by external factors such as exposure to the climate, which leads to the necessity for periodic maintenance [10]

Evaluation Techniques in POE

A range of techniques can be used to carry out an evaluation. The relevance of a technique depends on the

- The level of detail required
- The level of information available

- The resource available in terms of time and money
- How quickly the study is to be carried out
- The skill levels of those who will be undertaking the study
- The extent to which a problem has already been identified

The most accurate evaluation can usually be gained from employing a combination of techniques, e.g. a widely circulated questionnaire with a focus group to examine in more detail any major problem identified by the questionnaire survey.

- Walk Through and Observation which basically involves 'reflecting on how space is performing' and 'informal discussions with users. Few staff resources are required and it can be done without involving end users. Quantitative data can be accessed if it is well planned and when users are involved, the observer gets unbiased views although this may be quite tasking and also, an observer may experience difficulty when during evaluation except he has a methodology to apply.
- Interviews with individuals are also very useful in trying to get very specific, detailed information and developing a deeper understanding of particular problems. They are best facilitated by a professional who is able to be objective about a given matter. Interviews provide a detailed exploration of issues, hit target issues and are mostly easy to set up. Although individual views do not always embody broad views and a strong possibility of a biased response however
- The use of questionnaires is a way of collecting useful data from a large group of people. Standard questionnaires offer the advantage of being able to gather consistent data across your facilities. The benefit of this is that you can benchmark buildings, or parts of buildings against each other. Tailored questionnaires enable examination of issues specific to the building or institution. However, it is possible to combine the two approaches and use a standard questionnaire with a section that is specific to your circumstances. There are web-based questionnaires are dispersed and completed and submitted via web technology which is generally convenient and cost effective. The responses are analysed very easily via software linked to the database. On the contrary, hard copy questionnaires are printed on paper and distributed to individuals mostly randomly. When using the hard copy questionnaires, it is needful to give careful direction to ensure sincere response, allow requires adequate time to complete and requires skills to analyse and interpret responses.

Levels of investigation

Also referred to as types of POE, Chikezie in his journal paper 'An Exploratory Literature Review of Post Occupancy Evaluation' stated and explained briefly, the three types of POE. [11]. The 'Guide to 'Post Occupancy Evaluation' [12] however, similarly explained the three levels of POEstating that it is possible to define three levels of investigation moving from a quick, surface review to a more in-depth investigative analysis, to a diagnostic review correlating physical and occupant perceptions. We have an indicative review, an investigative review and a deeper diagnostic review. They are

Indicative POE: This type of POE gives an indication of the success or failure of the overall building performance. By applying this method, it is easy to collect the data, as one can quickly interview few occupants who will quickly give the results that one wants [13].

Investigative POE: The investigation starts by find out what the problems are for this type of Post Occupancy Evaluation. once the problem has been identified, the process has been completed, the data will be presented for a solution. The 'Guide to 'Post Occupancy Evaluation' [12] suggests that investigative POE uses more rigorous research techniques to produce full-bodied data.

Diagnostic POE: In the aspect of diagnostic POE, at this level, the evaluation will be focusing on the critical elements of the building such as the safety of the staircases, quality of lighting within spaces and overcrowding in the building, HVAC concerns, etc. This type is a more all-inclusive investigation that is done with care. After conducting this kind of POE, it may take some time to formulate and conclude its findings, probably months or years. The findings revealed by the evaluation will improve the performance of the building. **A** deeper diagnostic review is a very exhaustive analysis which links physical performance data to occupant responses. In this type of review, the evaluators carry out analysis of the

building's environmental systems. Generically, this comprises: air-handling, illumination, energy use, heating, measuring ventilation rates, temperature, lighting levels, energy use, CO^2 emissions and acoustic performance.

Furthermore, the three levels are each divided into three phases, namely

- Planning
- Conducting
- Evaluation

Planning Phase: This phase of POE attempts to discover the extent of evaluation to be done. Once that is resolved, the evaluator checks the feasibility study and creates a plan to work with. The project brief and plan are developed in this phase. If the evaluation was requested for by the building manager or owner, it must be planned such that, delegates be nominated amongst the building users and the viability of the study may be determined based on the challenges prevalent in the building.[14]. The challenging aspect of completing this phase is dependent on the resources made available by the client and cooperation is very vital at this stage to ensure that challenges may be addressed and resolved. [15]. An imperative aspect of this phase is the performance criteria where the evaluator needs to identify the methods of data collection. It is needful to must identify and assess the building's performance, so that the strengths and weaknesses of the project may be chronicled. Building performance elements such as health, safety, security, efficiency and cultural performance must be prioritised. A consensus between the evaluator and the building owner or manager will engender unabridged access to the design guidelines of the building concerned [15]

Executing Phase: This phase of POE, the evaluator finds out which data gathering tool is most pertinent to each specified evaluation. In most cases, the use of questionnaires is said to be suitable when carrying out the POE. In the case where data gathering tools are limited, the evaluator becomes proactive in finding a way of interacting with building users. The evaluator identifies the building users and gives an early notice that POE will take place. This will give the evaluator skilfully collects data and analyses it. The real evaluation starts during this phase, when data collection must be monitored and managed. The data collection has to be monitored so that genuine results of the evaluation may originate. Valuable and astute findings will be helpful to the purpose for the evaluation. [15]

Applying Phase: As soon as the data has been analysed, the evaluator has to assembles feedback, this will make up part of the source from which necessary actions can be taken subsequently. The reports can be in various formats either a presentation or a written and printed document. Once the findings have been presented, necessary actions concerning next step in terms of development and implementation can be decided on. The review of the results can now be executed for enhancement of the building's performance [15]

4. Methodology

Preliminary literature review was done extensively on materials containing information on Post Occupancy Evaluation. The purpose of this was to provide in-depth understanding of what Post Occupancy Evaluation is all about and what needs to be known about case studies.

Desk Research

This research involved the identification and deduction of information on post occupancy evaluation and libraries generally from published material from universities, research institutes and sponsored entities. These materials included books, book sections, journal article, reports, conference proceedings and documents from websites. Also, extraction and analyses of responses from semiformal conversations and questionnaires.

Field Research

This research was carried out in the following ways

Observatory Method: This method also referred to as field observation engaged the physical observation mode. It involved a walk-through technique, through all the floors, the spaces designated for reading, circulation and official activities.

Case Study Method: This entailed the in-depth study of existing university libraries which lead to a premise birthed by

the synthesis of analysed data.

Data Collection

Primary Data Collection: The primary data collection sources for this research included;

- The use of purpose-invented hard copy and we-based questionnaires.
- Walk-through-observation of the library especially when it is in use and interactions with random persons
- Live-site surveying through visitation, observation and documentation of existing site conditions and features.

The local case study was the Central Library of Rivers State University, Port Harcourt where POE was carried out extensively.

Secondary Data Collection: The secondary data collection sources for this study included literature reviews on POE from published material from universities, research institutes and sponsored entities. The materials included books, book sections, journal article, reports, conference proceedings and documents from websites.

5. Results

A total number of 77 architects participated in the survey. 92.2% practice architecture actively while 7.8% practice passively.

The 77 architects have various years of experience within 0 years to above 20years of experience as illustrated in the figure 2.

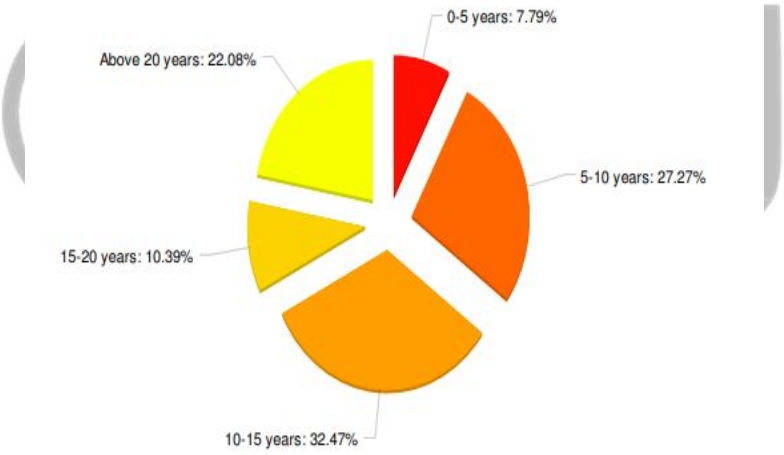


Figure 2 CHART SHOWING THE DIFFERENT YEARS OF EXPERIENCE OF 77 ARCHITECTS

96.10% of architects affirmed that they carry out case studies before commencing their designs while 3.90% do not bother about case studies. The possibility that there is no absolute grasp of the relevance of case studies may be evident in the 3.90% of these architects or they may not have been tasked with a case-study-demanding design project. However, most architects carry out case studies either online or physically before commencing their design projects. This reveals that they view case studies as a relevant aspect of a design process.

From the 77 architects, 37.7 percent of them study only drawings. 53.2% try to go the extra mile by experiencing the building to have direct user experience probably by being in the building and partaking in the experiences related to the building for example, an architect may visit a shopping mall, do some window shoping or do actual shopping just for the purpose of observing the flow of activities and analysing space flow. Almost similar to that, about 59.7% of the architects interact with other users to get feedback on their experience of the building while 62.3% of the 77 architects carry out a physical study on the building. Now all case study patterns are useful however, some methods provide much more

astute data for the success of a proposed project for the improvement of the evaluated building. Amonst the four methods listed which are studing the building's drawings only,Visit the building for physical study, having my own experience within the building and visiting the building and interact with users randomly, 54.5% of the 77 architects affirmed that they found visiting the building and interacting with the users most effective for their individual projects. From the survey, 92.4% of 66 architects, when responding to their perception of evaluation that involved interacting with building users, affirmed that interacting with building users is very effective as a result of the first hand information acquired from such interaction. 7.6% of the 66 architects who responded to the question said otherwise.

SN	**CASE STUDY EXTENTS**	**INEFFECTIVE (%)**	**EFFECTIVE (%)**	**VERY EFFECTIVE (%)**
1	Study the building's drawings.	11.69	66.23	22.08
2	Physical study of the build-ing.	-	44.16	55.84
3	Experience the building personally	3.90	37.66	58.44
4	Interact with users of the building	2.67	49.33	48.00

The table shows that architects may study drawings of buildings and the buildings peripherally, nevertheless, they would rather experience the building and interact with the building users. The last two are the forthright definition of POE where a building is experienced by an observer and his perspective of the building documented alongside information accrued from the users of the building. Architects were asked to comment about case studies and its concerns from their perspective. Outlined below are their various responses

- Case studies are simply indispensable and involve spending time to understand the building flow in terms of functionality and user experience.
- Case studies are important to have a previous knowledge of anything you want to do.
- Experiencing the building and interacting with the users are relevant.
- To achieve an all-round functionally effective design; aStudy the building's drawings. Furthermore, all four(4) methods of case studies are very essential. Information at your disposal is key in Architecture.
- Designing for man (client/user) requires understanding the psychology of the man i.e. taste, behaviour, comfort zones as it relates to colour, size and shape; the man in the environment and the environment to create functional habitable spaces.
- Case studies go along way to help identify the merits and demerits in the building. It provides guidance on inputs to make in the design process.

- Case studies are important for reviews and lessons from previous similar works.
- A physical study of the building will help to choose best fit materials that are most sustainable in a particular terrain, how functional spaces interact with respect to sound and traffic analysis and also methods used for the construction
- Case studies should be a daily affair for an Architect and it does not have to wait till there is a project to execute.
- Visiting the building and studying the drawings are the most effective case study methods.
- Case Study is an essential part of the design process and as such should be taken very seriously to avoid previous mistakes from similar design projects.
- Taking pictures is also very effective
- Interactions with building users can reveal their experiences that may be contrary to the designer's intent.
- Other options like (visiting the designer if possible) or reading up the designers perspectives, concepts, and views on intended building performance would help strengthen building understanding.
- Studies should be for buildings with similar physical, social, economic and environmental conditions
- Architects do not frequently get challenging projects that would require case studied. The ones that do may only carry out a physical study or empirical study of existing data on drawings and pictures.
- Case study helps especially for brand new projects
- Users are very effective for case studies because they have good knowledge of the subject matter, relating with the subject more frequently than the researcher.
- Case study should be carried out with occupants experience
- Knowledge of the past and present will always make considerable contributions to the sustainable forecasting and design considerations of the future. Consideration must be made of the way of life of the people and their experience as well as the impact of climate and the environment and available technology.
- Case study is a necessary tool for effective, functional and efficient design in the architecture world.
- Case study should enhance creativity and must be adopted all the time so as to take care of any challenges previous projects experienced and corrected as such.
- Case study of buildings is usually overlooked as most architects rarely get challenged with tasking designs. When they do; there are some setbacks like restricted entry, building owners not willing to support when architects need to view or tour complexes or facilities. Furthermore, the lack of examplary buildings as case study reference can sometimes be challenging. Things like this a lot more create bottle necks for architects to effectively perform case studies and proffer good solutions to buildings.

6. Discussion

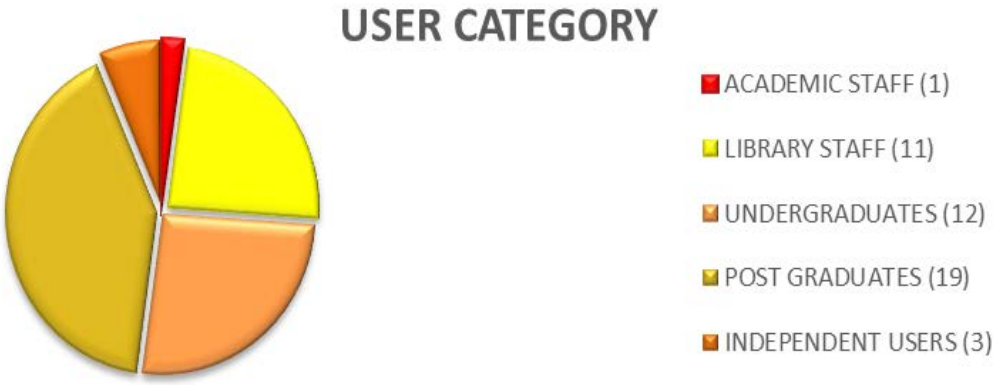
A review of the results of the survey carried out on the 77 architects reveals that the architects are well aware of the importance of case studies in the practice of architecture however, case studies are very often approached lightly and not as rigorously as would yield sufficient results.

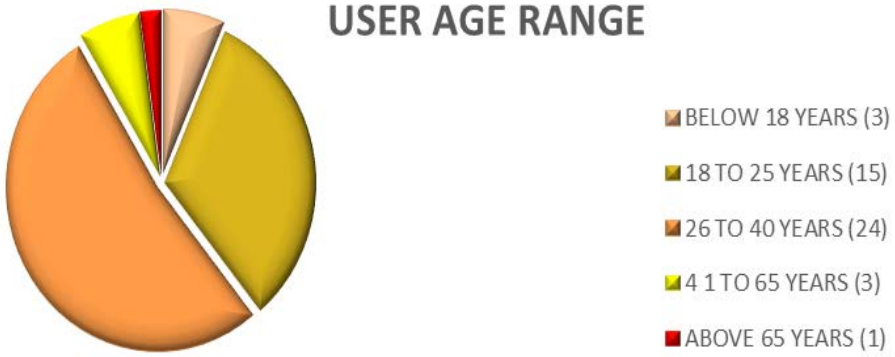
A percentage of the architects would rather study facades and floorplans via websites of buildings similar to their proposed design projects. As a result, the aspect of users' perspective is virtually excluded.

Post Occupancy evaluation seeks to promote the aspect of user involvement in evaluating a building's performance.

Furthermore, to buttress the relevance of this study, an evaluation was carried out on the Rivers State University's Central Library, Port Harcourt to know how the users feel about the facility generally and what improvements may be required. This study was carried out using basically primary data obtained through the following ways

- Distribution of questionnaires
- Interview with library personnel carried out through during walk-through method of observation
- Actual observation of the facility





The users of the library put into view a number of noteworthy suggestions to enhance the functionality of the library as well as make every category of library user comfortable at all times. Such views cut across various aspects of the library: Security, Interior space zoning, accessibility and circulation, furnishing, ventilation, more spaces that would be helpful for library users, lighting, collection, maintenance, conveniences and refreshment areas etc.

The observer carried out a walk-through and observation and was able, through the help of a guide to navigate the entire facility and made noteworthy observations just about all the issues highlighted by the library users but with a more professional approach.

As a result of the interaction with users and walk-through and observation, substantial information was collated. This information was found very helpful to enhance the existing situation of the library as well develop premise for the design of a new library. The users' expression of their experience within a building however affirms the extent to which the design brief was met. The observer may engage in his observatory activities though.

The users and the observer, at the conclusion of the survey were able to make extensive and pertinent recommendations concerning entrance area and security, air conditioning, navigation through the library, first users guide, conveniences, seating, space articulation, space enhancement, wall openings (windows), roofing system, courtyard enhancement, library collection, orientation of library personnel on library ethics, treatment of expansion joint, access to internet. Etc.

Why is Post Occupancy evaluation as a more effective architectural case study method?

Post Occupancy Evaluation is purported to be a more effective architectural case study method since the architect has the leverage of discovering how similar buildings performs once they are in use, policy creators can apply it to help in refining the existing architectural programmes. Post Occupancy Evaluation is an invaluable tool for appraising building quality. The architects and building developers, owners and even the government, in the case of government sponsored buildings are held accountable for the success or failure of the building and policies creating the buildings.

According to Darkwa [16], Post Occupancy Evaluation basically does the following;

- It identifies ways people can make use buildings and equipment more efficiently and more cost-effectively.
- It eliminates dysfunctional and seldom-used areas in a building.
- It presents opportunities for mistakes to be corrected in future design and building policies.

The greatest benefits from Post Occupancy Evaluation are determined when the information covers a wider spectrum of listeners as possible. Information from Post Occupancy Evaluation can provide not only insights into problem resolution but also provide useful benchmarking data to which other people projects can be compared.

From the perspective of Whyte and Gann, [17], a number of remarkable benefits from conducting a Post Occupancy Evaluation are given thus;

- Post Occupancy Evaluation helps in the development of design skills as a result of the lessons learned from previous works.
- Conducting a Post Occupancy Evaluation brings about the advancement of contracting processes as more details of a given facility are exposed and the functions of a facility are highlighted from the point view of the users of the facility.
- Improving user requirements
- The Improvement of management procedures which are often developed based on the outcome of analysed and fine-tuned feedback from Post Occupancy Evaluation processed.
- Providing knowledge for design guides and regulatory processes
- Targeting of refurbishment where it is needed

There are temporary, intermediate and permanent benefitsof Post Occupancy Evaluation as captured in 'Learning from our buildings' [18] outlined below.

Temporary Benefits

- Building challenges are identified and tackled accordingly.
- Practicable building supervision amenable with building user ideals.
- Improved space exploitation and feedback on performance of building.
- Better-quality attitude of building users through active participation in the evaluation procedures.
- Understanding of the building performance insinuations of variations dictated by budget cuts.
- Better-informed design decision-making and understanding of the consequences of design.

Intermediate Benefits

- Built-in capacity for facility adaptation to organizational change and growth over time, including recycling of facilities into new uses
- Significant cost savings in the building process and throughout the life cycle of a building
- Accountability for building performance by design professionals and owners.

Permanent Benefits

- Long lasting improvements in the performance of the building.
- Upgrading of design standards, databases, criteria and guidance literature.

Improved measurement of building performance through quantification.

7. Conclusion

Post Occupancy Evaluation is a more in-depth form of case study and it will be of great relevance if architects who actively practice architecture are involved. POE not only assists with new designs but also rates a previous work and give the architect an insight on how well his building performs from the perspective of the users.

8. References

[1] "Architecture Student Chronicles," 21 December 2011. [Online]. Available: http://www.architecture-student.com/case-studies/how-to-conduct-a-case-study.

[2] W. F. E. Preiser, H. Z. Rabinowitz and E. T. White, Post-Occupancy Evaluation, Cincinnati.: Van Nostrand Reinhold, 1988.

[3] J. Vischer, "Post-Occupancy Evaluation: A Multifaceted Tool for Building Improvement," 2001.

[4] RIBA, R.S.G., "A Research Report for the Architectural Profession," *Architectural Knowledge: The Idea of a Profession,* 1991.

[5] A. H. Nawawi and N. Khalil, "Post-occupancy evaluation correlated with building occupants' satisfaction: An approach to performance evaluation of government and public buildings," *Journal of Building Appraisal,* vol. Volume 4, no. Issue 2, p. pp 59–69, June 2008.

[6] A. Rubin and B. L. Collins, "Evaluation of the working environment at selected U.S. Army field stations: Suggestions for improvement.," National Bureau of Standards, Gaithersburg, 1986.

[7] M. Riley, N. Kokkarinen and M. Pitt, "Assessing Post Occupancy Evaluation in Higher Education Facilities.," *Journal of Facilities Management, Vol 8,* pp. 202-213, 2010.

[8] D. Schwede and H. Davies, Occupant Satisfaction with workplace design in new and old environments, Facilities, 2008.

[9] Kirk, S.J. &Stirrett, C.M., "Post-occupancy Evaluation for Added Value at Trail's End in," *Lean Construction Institute of Michigan, Michigan State University,* pp. 1-17, 2011.

[10] K. Konara and Y. Sandanayake, "Building Occupancy Evaluation Framework: Department of Building Economics, University of Moratuwa," pp. 218-228, 2010.

[11] E. Chikezie, A. Clinton and T. Wellington, "An Exploratory Literature Review of Post Occupancy Evaluation," in *International Conference on Civil and Environmental Engineering (CEE'2013)*, Johannesburg (South Africa), 2013.

[12] B. Alastair, G. Anthony and B. Mel, "Guide to Post-occupancy Evaluation," HEFCE, Westminster, 2006.

[13] P. Palm, "Closing the Loop: The use of Post Occupancy Evaluation in Real Estate Management.," *Licentiate Thesis. Stockholm: Kungliga TekniskaHogskolan.,* 2007.

[14] W. Preiser and J. Nasar, "Assessing Building Performance: Its Evolution from Post-Occupancy Evaluation," *International Journal of Architectural Research,* pp. 84-99, 2008.

[15] N. Khalil and H. Husin, "Post Occupancy Evaluation towards Indoor Environment Improvement in Malaysia's Office Buildings," *Journal for Sustainable Development, Vol 2(1),* pp. 187-191, 2009.

[16] I. Darkwa, "Post-occupancy evaluation of State-subsidized housing units in Kayamadi, Stellenbosch," *Masters in consumer Science (Housing), University of Stellenbosch.,* 2006.

[17] J. Whyte and D. Gann, "Closing The Loop Between Design and Use: Post-Occupancy Evaluation," *Building Research and Information Vol. 29 No 6.,* pp. 460-462, 2001.

[18] "Learning From Our Buildings: A State-of-the-Practice Summary of Post-occupancy Evaluation," Federal Facilities Council Technical Report No. 145, Washington, D.C, 2002.

[19] F. M. Saiyed, A. H. Makwana, J. Pitroda and C. M. Vyas, "EXPANSION JOINT TREATMENT: MATERIAL & Techniques," in *"Trends and Challenges of Civil Engineering in Today's Transforming World"*, Umrakh, 2014