

COMPARATIVE ANALYSIS OF FUNCTIONAL COMPATIBILITY OF SELECTED PUBLIC BUILDINGS IN KHYBER PAKHTUNKHWA THROUGH “POST-OCCUPANCY EVALUATION” PROCESS MODEL

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ABSTRACT

The prime purpose of a building is to provide structurally stable shelter for occupants while maintaining a harmonious balance between outdoor and indoor environmental conditions. Buildings must not only serve their intended function but also cater to the diverse and evolving needs of their users. In the course of time, the dire necessity is to understand the growing complexities of the dynamic interplay of human needs with built environment. The study aims to highlight the challenges and shortcomings encountered in the planning and execution of government buildings in Khyber Pakhtunkhwa by conducting a probed process of Post-occupancy evaluation. Taking occupants as a benchmark, the satisfaction of the users measured in terms of building performance and user's satisfaction. The study reveals a positive correlation between the Satisfaction Score and Building Performance value in both buildings. Building A rates lower for natural light, form and spatial configuration but higher in circulation compare to building B, whereas the safety shared same values.

Keywords: Post-occupancy evaluation, Buildings Performance, Satisfaction score, Spatial configuration

INTRODUCTION

A huge part of the Khyber Pakhtunkhwa provincial assets has been diverted towards the development budget, to upgrade the infrastructure of the province. An aggregate of PKR 923 billion budget has been endorsed for the financial year 2020-21 out of which PKR 317.8 billion reserved for the annual development program (34.4% of the general budget) (2020-21, n.d.). Similarly, the budget document presented in the provincial assembly of Khyber Pakhtunkhwa for the fiscal year 2021-22 has a total expenditure of PKR 1.18 trillion, of which PKR 919 billion has been earmarked for settled districts and PKR 199 billion for merged districts. The development outlay has earmarked PKR 270 billion for settled districts and PKR 100 billion for merged districts (36.3% of the total budget) (Ali, 2021). The

annual development program (ADP) is the instrument through which the government of Khyber Pakhtunkhwa designs, executes and monitors a huge amount of developmental spending in the province (RESILIENT KHYBER PAKHTUNKHWA A Citizen 's Guide to Budget 2020-21, 2020). The annual development program of the provincial government of Khyber Pakhtunkhwa incorporates transportation infrastructure, government administrative buildings for ministries, directorates, attached departments, local authorities, colleges, hospitals and so forth. The ADP must be an impression of the transient vision and priorities of the government of Khyber Pakhtunkhwa. In its definition, it should help accomplish the objectives and goals of the provincial government (RESILIENT

KHYBER PAKHTUNKHWA A Citizen's Guide to Budget 2020-21, 2020). Along with the accomplishment of such goals, the government needs to formulate a sustainable built infrastructure which shouldn't only fulfill the needs of today but also to be efficient and productive in terms of socio-economic sustainability. However, the loudest question here is how to maintain the built environment improved and efficient?

For the last three decades, in the developed world, when a proposal is under consideration, the efficiency is the prime aspect to be considered. How building will perform in practice? How comfortable it will be for its occupants? How the facilities and services of the building can be improved and how well the building can be responded in certain environmental conditions.

In practice many buildings perform poorly so people feel embarrassed to publish the facts and figures so as a result, the building practitioners do not learn from the past experiences (Leaman et al., 2010). The occupant's satisfaction is the foremost priority of a building. Regular maintenance program is conducted to ensure that the building services and facilities are performing well after being occupied by the tenants at all times. By conducting such programs, the habitants been able to utilize the facility of the buildings to the best of its potential (Nawawi & Khalil, 2008). To sum it up, the building should perform its function in the best possible way and also fit for the purpose of the users. The building once constructed and occupied should be at least investigated once in its life time. POE is the assessment of building performance as it provides mechanism for evaluating the mutual interaction between users and building attributes, as a result it recommends guidelines for the improvement of existing building infrastructure.

Zimring categorized POE as a procedure to investigate the exact requirement of space characteristics. Vischer concluded that POE is used not only to examine the functionality of the building associated with user's satisfaction but it can conclude recommendation of highlighting the building merits and demerits, construction criteria, understanding use of the materials and other related performance criteria (Nawawi & Khalil, 2008). POE is the investigative approach to work out the best possible solutions to enhance the efficiency of building

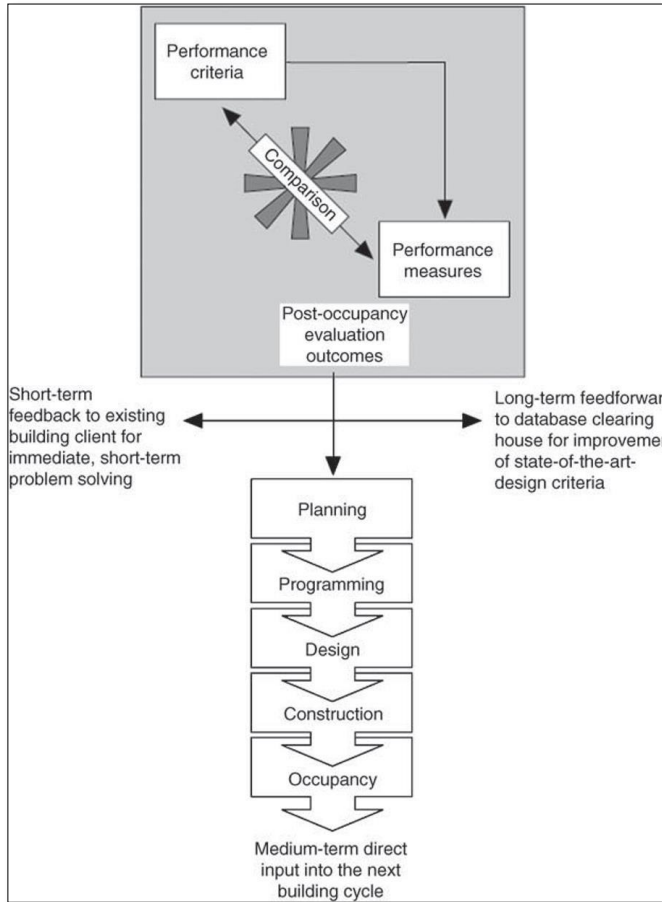
design (THEORETICAL AND CONCEPTUAL ISSUES IN BUILDING POST-OCCUPANCY THEORETICAL AND CONCEPTUAL ISSUES IN BUILDING POST-OCCUPANCY EVALUATION Stephen Ikpendu Nwankwo , PhD, 2019).

In view of the above literature, this study has the potential to evaluate the government buildings of KP on the basis of POE guidelines. Considering the existing situation, POE study of two (02) different government buildings carried out regarding building performance and the satisfaction of building users. In broader spectrum the overall process elaborates larger picture of defects and deficiencies along with successful design features in government buildings of KP.

LITERATURE REVIEW

It is an understood phenomenon that human learning history consists of a sequence of matters that repeatedly happened and occupy space in human's mind. Preiser narrated that historically, building performance was evaluated in an informal manner with no standard procedure and the results from the experience were applied in the next building cycle. As the evolution process of building learning procedures are very slow therefore, the knowledge about the building formation is passed by generation to generation. It is quite obvious that the informal subjective evaluation of built environment have been conducted over a long period of time but the systematic evaluation with the performance measure is of recent origin (Ilesanmi, 2010). To explain the idea of building performance using post occupancy evaluation technique, Preiser described the performance procedure in the building delivery process, as shown in figure 1 (Nawawi & Khalil, 2008).

Figure 1
 The performance concept in the building delivery process (Abdou, 2016)



POE originates from the architectural assessment techniques of the late 1950s and early 1960s (THEORETICAL AND CONCEPTUAL ISSUES IN BUILDING POST-OCCUPANCY EVALUATION Stephen Ikpendu Nwankwo , PhD, 2019). POE conducted in 1960s and 1970s were individual case studies of public and student (Hostels, Dormitory) in UK, Canada, France and USA. The POE assessment mainly involved process of collecting information from users and buildings through questionnaires, site visits and interviews. The circle of POE is widen thereafter to other facilities such as military installations, health care, prisons and hospitals. By observing the advantages and positive results from POE by the mid of 1980s, it was later spread over to real estate and office buildings.

POE process can be conducted from 4 to 24 months after the occupancy of a new or renovated structure and is conducted only one time for an individual building. However, Watson opposed this statement and stated that POE can be conducted any time with no limit of time and no specific duration of occupancy is required for such evaluation (Buildings et al., 2009). Post-occupancy evaluations in architecture are concerned with the performance satisfaction of building and is more related to function of the building with less concern with outlook and aesthetic. Various variables such as service performance, accessibility, way finding, safety and security may be considered. Such kind of investigations are conducted by single person or by a team, with set of formulated questions which ranges from a simple to complex set of investigation. Performance assessment is typically done on three aspects i-e technical, functional and behavioral.

The history of Post-occupancy evaluations has a length of approximate 30 years. Initially the practice of POEs emerges in educational institutions where the academics researchers investigated small scale issues for example Wheeler’s studies of social interaction in college dormitories. This influences such kind of studies for future decision making principles. In 1970’s the frequency, nature, scale and approach for POE started to increase suddenly. Most of the contracts were government funded at that time and it has emphasized that institutional based multi methods approached can only award such huge projects and it bridges the built environment with behavioral sciences for example, a link between certain environmental features and increased crime rates which were demonstrated by Newman in 1972. In 1970s the POE methodology was established such a way that the practitioners also got inspired by the building’s assessment technique. By the start of 1980’s, the POE establishment was strengthened in a way that most of the government bodies and authorities started to adopt on huge scale and the private sector also got its attention. The main source of such attraction were economic reasons behind POE’s success. Thus POE focuses on the issues raised during the process of its assessment and provides viable solutions which makes it an essential part of building formulation process (Cooper et al., 1991).

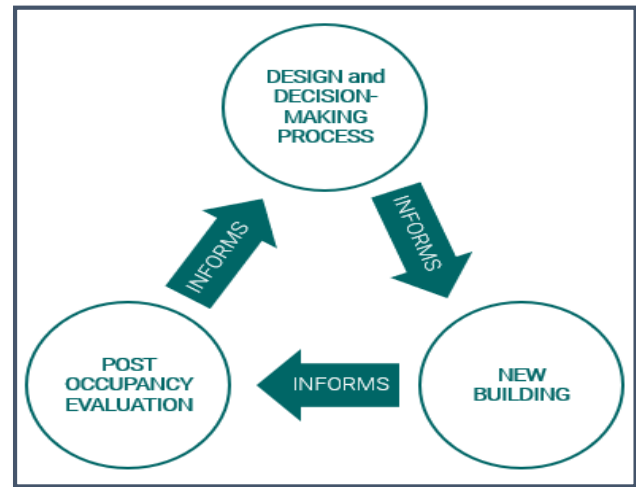
Post-Occupancy Evaluation (An Over View)

POE is the systematic process for assessment of building performance after occupied by the users for a period of time. This type of building's evaluation is different from other performance evaluation as it covers the basic functional needs of the users along with security, health, convenience and suitability (Abdou, 2016). Watson defined that POE is a systematic evaluation and perspective of users about the space they used. The process of data collection in POE consist of actual ground data rather than laboratories using different investigative approaches (Khalil & Nawawi, 2009). The terms building appraisal, building evaluation, building assessment, post-occupancy evaluation are that type of building studies which can be applied on completed building projects and the buildings can also be in use of the occupants for a certain period of time.

The scope and study of building performance evaluation has widen by Preiser and Schramm and proposed a procedure to evaluate user and aesthetic aspects with technical and financial aspects. The idea has further ripen by Watt who used the terminology of 'Building pathology' to explain that procedure of building assessment is mainly concerned with defects and remedial responses. Furthermore Duffy suggests that these are only terminologies overlapping dilemma, otherwise all of these concepts aim at assessment of completed buildings, determining possible improvements, mistakes or omissions and collecting information for future references and design considerations. However, Preiser and Vischer considered POE to be the most commonly used terminology for the assessment of already built and occupied buildings. Considering users/occupants as a benchmark in the evaluation study, POE has enormous potential for improving the performance of a building as shown in figure 2 (Ilesanmi, 2010). The evaluation is basically constituted by the gap between on ground performance of the building and the stated performance claimed at time of planning.

Figure 2

Process of efficient building delivery (Nejati, n.d.)



The RIBA (Royal Institute of British Architects) defined POE as POE is basically the study of completed buildings to provide valuable information to architects, building owners and to propose best guidelines out of what already existed (Bakens et al., 2005). The Method of POE is re-emerged in United Kingdom because of rethinking the construction strategies which involved a lot of finances. Wauters confirms the value of "user satisfaction surveys" as a procedure of benchmarking the needs of the users and fulfilling it by identifying the misfits and mistakes during design of a project. The authors claimed that such assessments can be measured in more depth by conducting an individual case study approach. Indeed, POE itself concerns about the highlighting of issues and measuring the data with set criteria during the process of data collection. However, such data collection methods would definitely need a review of professionals and other stakeholders as it cannot be finalized holistically by a single individual with the user's interpretation. Indeed, POE's main purpose of understanding and satisfaction of building users' needs is primarily important for the environment (Turpin-Brooks & Viccars, 2006). It is important to mention that the perceptions of the occupants must not be neglected at any stage and correlate their input with the efficiency of space as determined by POE guidelines (THEORETICAL AND CONCEPTUAL ISSUES IN BUILDING POST-OCCUPANCY EVALUATION)

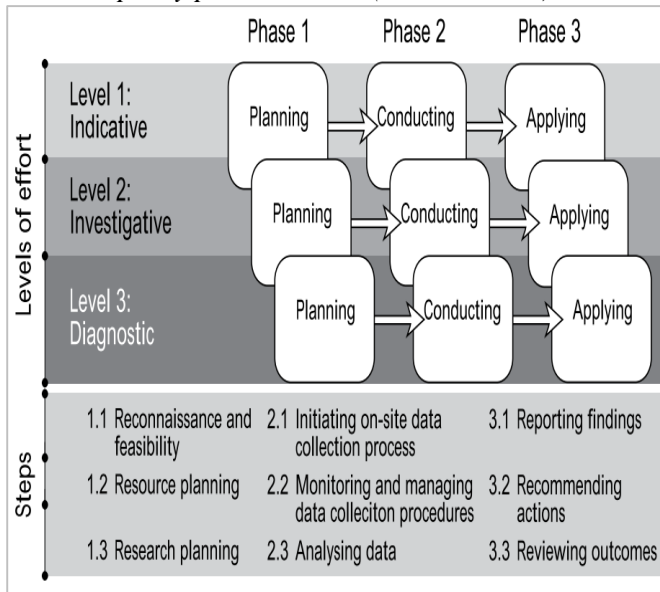
Stephen Ikpendu Nwankwo , PhD, 2019). In the process of building procurement, POE is the not the end phase rather it is the integral part of building delivery cycle(Evaluation, n.d.).

Post-Occupancy Evaluation Process Model

POE process model is developed by the researchers which is categorized in three phases and six steps. In addition, three different levels at which POEs can be conducted is shown in figure 3.

- a) Indicative POE
- b) Investigative POE
- c) Diagnostic POE

Figure 3
 Post occupancy process model (Preiser, 2006)



RESEARCH METHODOLOGY

This section is designed to target the most relevant procedures and set of data to investigate the effectiveness of design features used in two selected public buildings. Based on the established POE guidelines the building performance in term of efficiency was investigated. Similarly the satisfaction level of the users has also been formulated in form of a questionnaire survey. The two sets of data derived from the building performance and satisfaction score is correlated in the final stage of research to evaluate the effectiveness of design features and to highlight the demerits of buildings. Different softwares which

were used in the formation of data, images and diagrams are:

- a) Autodesk autocad 2023
- b) Statistical package for social science (Statistics 27)
- c) Origin Pro (2023 b)
- d) Microsoft excel (2013)

Poe Process Model Detail

The POE procedure adopted for building evaluation consists of five steps.

Step 1: Buildings Detail and Information:

Step 2: Objective analysis:

Step3: Planning & conducting:

Step 4: Applying:

Step 5: Action:

Step 1 Building/S Detail and Information

As mentioned in the introduction part of the study, the two different government buildings are selected for POE assessment. The criteria set for building selection was, these are standard design buildings and were approved by the competent authority (Central Design Office of C&W approved) for construction in other districts as well. It means that the government of Khyber Pakhtunkhwa has approved the same building design to be constructed in other districts and both the buildings have different architectural style and spatial configuration. The two buildings selected for POE study are:

- a) C&W secretariat and training center at Police-line road, Peshawar / (Building A)
- b) Abdul Wali Khan Multiplex Block B at Police-line road, Peshawar / (Building B)

The C&W building has concentric planning with corridors serving circulation and the Abdul Wali Khan Multiplex Block B has linear geometry with verandas for circulation.

Communication & Works Secretariat and Training Center at Police-Line Road, Peshawar / (Building A)

C&W secretariat & training center is located at the Police line road linked with Khyber road, Peshawar cantonment area. The building is located at Coordinates 34°00'51"N 71°33'24"E and has been under the use of C&W department and food safety & halal food authority since 2016 with approximate cost of 615 million PKR. The area of the project is

25,500 Sft (4.7 kanals). The architectural layout plan is given in figure 4. Other necessary detail of the building is mentioned as:

- a) No of Stories: 02 Basements+Upper Ground floor+ First Floor+ Second Floor
- b) Area per floor: 23,741 Sft
- c) Total covered area: 118,705 Sft
- d) Car parking Floors: 2 + Half Floor with Total number of Cars= 160 Cars.

Figure 4
 Building plan of Communication & Works (Building A) Source: Author



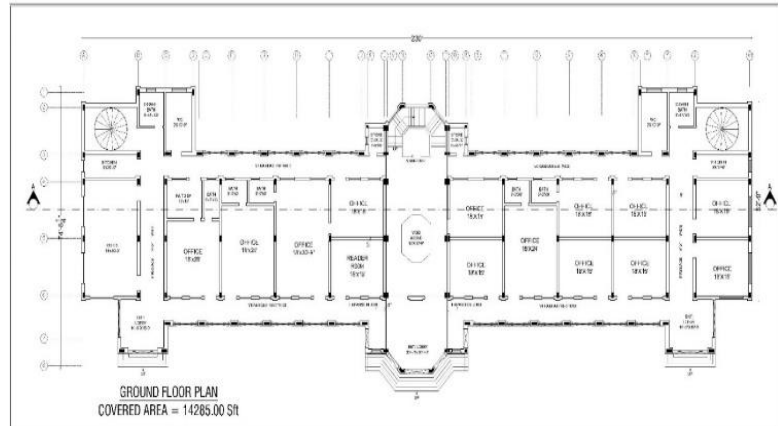
Abdul Wali Khan Multiplex Block B at Police-Line Road, Peshawar /Building (B)

Abdul Wali Khan Multiplex Block B is located at the Police line road at Peshawar secretariat linked with Khyber road, Peshawar cantonment area. The building is located at Coordinates 34°00'36"N 71°33'29"E and has been under the use of KP secretariat (Administration department) with approximate cost of 750 million PKR. The area of the project is 14,285 Sft (2.6 kanals). The architectural layout plan is given in figure 5. Other necessary detail of the building is mentioned as:

- a) No of Stories: 01 Basements + Upper Ground floor+ First Floor+ Second Floor

- b) Area per floor: 14,285 Sft
- c) Total covered area: 57,140 Sft
- d) Car parking Floors: Nil

Figure 5
 Building plan of Abdul Wali Khan Multiplex, block B (Building B) Source: Author



Step 2: Objective Analysis

In this step the focus was on the strategies to achieve the research objective to address the research problem at large. The study of the base plan analysis of both building plans is to analyze the spatial configuration. For this approach the physical survey of the buildings was conducted. The physical survey visits were planned in different times of the day to check the maximum threshold at peak hours and the questionnaire was also distributed to the visitors to record their responses. The site pictures were also taken as evidence and record the overall scenario of building/s at different times. The data once recorded was compiled and is used at later stage of the research.

Step 3: Planning & Conducting

This is the major part of the methodology as it consists of all the phases of data processing techniques. It is clear that extensive field and table work is involved in the formulation of research data so the emphasis was on the reliability of sourced information.

Identifying The Building's Parameters for Poe Study

This section of the study consists of methodology for identification of key variables to examine the research questions, engaging the users and major stakeholders. Various studies have been conducted to investigate the level of satisfaction with different facilitates/services of buildings. To narrow down the domain of the research, a pilot study is conducted.

Pilot Study and Formulation of Composite Variable

A pilot study is conducted to shortlist the most relevant variable and its applicability. The questionnaire contains the pertinent questions about the respondent's background to make sure that the right target audience is reached. The same questionnaire is shared with stakeholders, professional and experts for further improvement. The purpose of this pilot study was to target the most relevant variables. Thus, the Relative Satisfaction Index (RSI) of the survey and supportive literature will utilize to conclude the most relevant and effective parameters of the building to be examined for POE study. The variables derived from the pilot study of questionnaire are:

- a) Spatial Configuration(Agyekum, 2016)
- b) Accessibility and circulation(Anjum & Hameed, 2013)
- c) Building form and Orientation(Nawawi & Khalil, 2008) (Azhar & Sattineni, 2010)
- d) Natural lighting(Yun et al., 2014)(Fasi & Budaiwi, 2015)
- e) Safety & security(Abdou, 2016)

Formulation of Questionnaire

In the light of the pilot study the major part of the questionnaire was finalized. Furthermore, the qualitative approach was adopted for new information, to draw in-depth implications and relevancy between respective variable of the building relevant to stakeholders. These building parameters are selected, based on the pilot study questionnaire, literature review and the relevancy to the functional compatibility of buildings. The questionnaire is proposed with open end questions and the responses are with options along with open suggestion that can be part of questionnaire at stage of reliability test. As adopted in the similar studies (Heungsoon Kim) the

sample size was 15% of the major stakeholders and total residents of the selected buildings(Kim, 2007).

Reliability Test of Questionnaire

The reliability test of the questionnaire was conducted using SPSS (Statistical package for social sciences). The questionnaire was filled with 40 number of total responses. The data of all questions has been put in SPSS and the run the reliability test as per procedure of SPSS. The desired value of Cronbach's Alpha 0.71 was achieved after rigorous scrutiny of all questions. Thus we conclude that the proposed questionnaire was valid and relevant inquiry questions for data collection was included.

SAMPLE SIZE

For Sample size, the data was recorded from the daily entry register of visitors placed at the gate of the both buildings and the number of employees working in the buildings.

By taking population size, with 95% of confidence level, 5% of error margin and response distribution of 25% (as per procedure of Heungsoon Kim the sample size is 15%) (Kim, 2007), the sample size of C&W secretariat and training center (Building A) was 126 persons and Abdul Wali Khan (Building B) was 78 persons.

SAMPLING TECHNIQUE

The stratified sampling technique was adopted as a sampling procedure as the population consisted of heterogeneous group of people. The survey questionnaire has pertinent questions on the basis of which the stratification of population has been distributed. Hence the data can be selected or classified as simple random sample from mutually exclusive strata.

Step 4: Applying

In this part of research, the focus is on the process of data analysis and procedures of measuring and scaling. Application of feedback of findings, review outcomes, compilation of record and analysis is part of this section. The data was converted into a summarized form and the reports were concluded. The data obtained through user's responses was summarized in form of table, pie charts and other presentable formats. The importance of this section is that all the efforts made for months were

summarized into a short, understandable and presentable form for study of the fellow researchers. Furthermore, the recommendation plan of action has also been sorted out in this phase of the research.

Satisfaction Score of the Users and Building Performance

The questionnaire was formulated to record the response of the occupants on 04 parameters containing 40 questions. The responses were classified from 1 to 5 on likert scale where 1 donates strongly disagree and 5 donates strongly agree. The Satisfaction Score was calculated using the formula;

$$SS = \frac{RS [N5 + N4 + N3 + N2 + N1]}{FS [Total N5]}$$

Where, SS is the satisfaction score, RS is the relative score, FS is the full score, N is the no. of respondent/s(Nawawi & Khalil, 2008).

The Building performance was recorded based on comparative analysis of performance evaluation of composite variables from score 0.1 to 1.0, where 0.1 is the lowest and 1 is the highest value. The building performance value less than 0.4 is low and above 0.7 is considered high.

Table 1
 Satisfaction Score (SS) and Building Performance of Building A and B of each variable Source: Author

Composite variable	Q. No	Question detail	SS of C&W Block	BP of C&W Block	SS of AWK Block B	BP of AWK Block B
Spatial Configuration	01	Design of all building spaces	0.44	0.35	0.61	0.65
	02	Spaces arrangement/configuration	0.41	0.46	0.61	0.7
	03	User's needs & requirements	0.46	0.51	0.6	0.47
	04	Design of room/space	0.61	0.72	0.47	0.75
	05	Rooms facilities	0.50	0.53	0.45	0.4
	06	Provision of all building services	0.65	0.37	0.44	0.35
	07	Indoor air quality	0.60	0.7	0.73	0.45
	08	Humidity and dryness in rooms	0.55	0.46	0.78	0.55
	09	Cleanliness of building	0.66	0.35	0.72	0.35
	10	Noise control strategies	0.55	0.2	0.83	0.67
Accessibility & Circulation	11	Horizontal and vertical circulation	0.47	0.32	0.72	0.52
	12	Way finding and ease of movement	0.64	0.4	0.57	0.68
	13	Accessibility for differently abled persons	0.37	0.4	0.49	0.35

	14	Facilities for differently abled persons	0.43	0.45	0.33	0.32	
	15	Ease of movement from parking to office	0.62	0.6	0.43	0.38	
	16	Vehicular Circulation of building	0.66	0.7	0.46	0.33	
	17	Availability of parking space	0.68	0.5	0.5	0.25	
	18	Provision of elevators	0.82	0.7	0.84	0.9	
	19	Peak hours footfall	0.49	0.52	0.42	0.6	
Building form & Orientation	20	Walkways, corridors blockage in peak hours	0.43	0.45	0.42	0.46	
	21	Climate, sunlight based design	0.48	0.31	0.7	0.6	
	22	Intelligently used building material	0.65	0.5	0.76	0.7	
	23	Maintenance free building materials	0.49	0.41	0.73	0.9	
	24	Building material helps in normalize temp	0.48	0.37	0.44	0.8	
	25	Facade of Building	0.72	0.62	0.84	0.85	
Natural light & building's Light	26	Maintenance facility of building	0.64	0.48	0.5	0.35	
	27	Amount of natural light in room	0.48	0.73	0.71	0.75	
	28	Purpose built design for natural light	0.49	0.31	0.82	0.84	
	29	Natural light in building	0.36	0.23	0.83	0.78	
	30	Artificial light in building	0.57	0.43	0.56	0.45	
	31	Natural light in walkways & service area	0.46	0.18	0.64	0.7	
	32	Glare control strategies in building	0.42	0.16	0.86	0.93	
	33	Routine work in case of no artificial building	0.49	0.21	0.72	0.83	
	Safety Security &	34	Building safety in case of unforeseen	0.62	0.41	0.5	0.6
		35	Digital surveillance of building	0.50	0.79	0.65	0.67
36		Natural surveillance of building	0.47	0.37	0.61	0.76	
37		Building design Sustains any act of terrorism	0.55	0.41	0.53	0.36	
38		Evacuation in case of emergency	0.65	0.7	0.67	0.58	
39		Condition of emergency routes and exits	0.68	0.67	0.53	0.45	
40		Safety measures of building	0.51	0.6	0.53	0.48	

Correlation and Interpretation of Data

After calculating the satisfaction score from the questionnaire and building performance value from detailed investigation of POE process model, the two sets of data from both the buildings were then ready for analysis interpretation. The analysis of the correlation is conducted using the Statistical Packages for the Social Sciences (SPSS). Kendall's tau- correlation is used for correlation analysis.

Table 2
Correlations between Satisfaction Score and Building Performance of C&W (Building A) Source: Author

			Satisfaction score C&W Block	Building performance C&W Block
Kendall's tau	Satisfaction score C&W Block	Correlation Coefficient	1.000	.320**
		Sig. (2-tailed)	.	.004
		N	40	40
	Building performance C&W Block	Correlation Coefficient	.320**	1.000
		Sig. (2-tailed)	.004	.
		N	40	40

**Correlation is significant at the 0.01 level (2-tailed)

Table 3
Correlations between Satisfaction Score and Building Performance of Abdul Wali Khan Block B (Building B) Source: Author

			Satisfaction Score AWK Block	Building Performance AWK Block
Kendall's tau	Satisfaction score AWK Block	Correlation Coefficient	1.000	.369**
		Sig. (2-tailed)	.	.001
		N	40	40
	Building performance AWK Block	Correlation Coefficient	.369**	1.000
		Sig. (2-tailed)	.001	.
		N	40	40

**Correlation is significant at the 0.01 level (2-tailed)

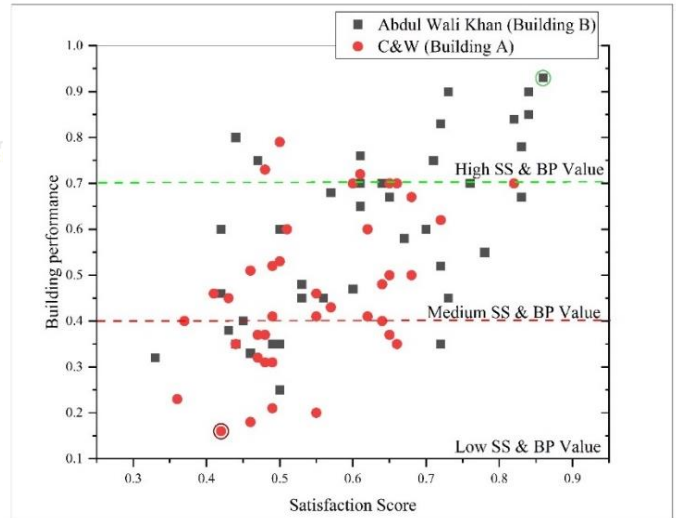
In the above tables the P-values were found associated with the Kendal's tau correlation. The hypothesis were statistically tested with a two-tailed alpha level of 0.05. The tables show that P-value/Sig.(2-tailed) of C&W (Building A) is .004 and the P-value/Sig.(2-tailed) of Abdul Wali Khan Block B (Building B) is .001. Both P-values are less than 0.05 which shows that there is strong correlation between both sets of data. However, the correlation of Abdul Wali Khan Block B (Building B) is more significant than that of C&W (Building A). Both the

data sets were statistically significant and were used for analysis, conclusions and recommendations based on satisfaction score and building performance of each building.

Step 5: Action

This is the most important part of the research in which action to the response of Post-occupancy evaluation was formulated. The results of the user's satisfaction and behavior of each space of the building were presented, on the basis of which the recommendations and outcomes were proposed. It is also mentioned in this portion of the study that which building as a whole or part/feature has more efficiency in term of user's satisfaction. The effectiveness of features/ building element with respect to user response has been highlighted and the possible alteration that could enhance the efficiency of the building/s has also been discussed.

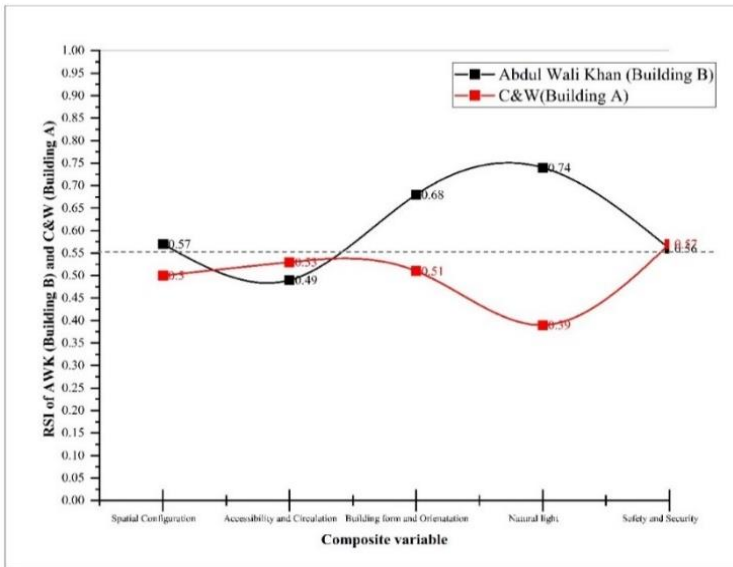
Figure 6
Scatter plot of SS and BP of AWK (Building B) and C&W (Building A) Source: Author



The relationship of Satisfaction Score and Building Performance has shown on the scatter plot in figure 6 which shows that the region A which has high SS and BP value has more number of black dots which indicates that the relative satisfaction value of Abdul Wali Khan (Building B) is higher than C&W (Building A). The region B has almost same number of red and black dots showing that the maximum number for RS fall in the medium region for both buildings. Similarly the region C which has the lowest number RS value has more number of red dots

which indicates that C&W (Building A) has the lowest Relative score. Furthermore, the highest values of RS is for glare control strategies in Abdul Wali Khan (Building B) and lowest is for worst condition of glare control in C&W (Building A).

Figure 7



Spline showing the RSI of composite variables of AWK (Building B) and C&W (Building A) Source: Author

To understand the overall scenario of composite variables the Relative satisfaction Index has been presented on Spline graph in figure 7. The graph indicates that relative satisfaction of Abdul Wali Khan (Building B) has higher value in Spatial configuration, Building form, orientation and natural light than that of C&W (Building A) while the relative satisfaction for accessibility, circulation, safety and security is higher in C&W (Building A) than Abdul Wali Khan (Building B).

Table 4

Mean value and relative score of each question of C&W (Building A) and Abdul Wali Khan Block B (Building B) Source: Author

Composite variable	Q. No	Question detail	Mean value of SS & BP of C&W	Relative Satisfacti on score of C&W	Mean value of SS & BP of AWK	Relative Satisfacti on score of AWK
Spatial Configuration	01	Design of all building spaces	0.40	0.5	0.63	0.58
	02	Spaces arrangement/configuration	0.44		0.66	
	03	User's needs & requirements	0.49		0.54	
	04	Design of room/space	0.67		0.61	
	05	Rooms facilities	0.52		0.43	
	06	Provision of all building services	0.51		0.40	
	07	Indoor air quality	0.65		0.59	
	08	Humidity and dryness in rooms	0.51		0.67	
	09	Cleanliness of building	0.51		0.54	
	10	Noise control strategies	0.38		0.75	
Accessibility & Circulation	11	Horizontal and vertical circulation	0.40	0.53	0.62	0.5
	12	Way finding and ease of movement	0.52		0.63	
	13	Accessibility for differently abled persons	0.39		0.42	
	14	Facilities for differently abled persons	0.44		0.33	
	15	Ease of movement from parking to office	0.61		0.41	
	16	Vehicular Circulation of building	0.68		0.40	
	17	Availability of parking space	0.59		0.38	
	18	Provision of elevators	0.76		0.87	
	19	Peak hours footfall	0.51		0.51	
	20	Walkways, corridors blockage in peak hours	0.44		0.44	
Building form & Orientation	21	Climate, sunlight based design	0.40	.51	0.65	0.68
	22	Intelligently used building material	0.58		0.73	
	23	Maintenance free building materials	0.45		0.82	
	24	Building material helps in normalize temp	0.43		0.62	
	25	Façade of Building	0.67		0.85	
	26	Maintenance facility of building	0.56		0.43	
Natural building's Light	27	Amount of natural light in room	0.61	0.39	0.73	0.74
	28	Purpose built design for natural light	0.40		0.83	
	29	Natural light in building	0.30		0.81	
	30	Artificial light in building	0.50		0.51	

	31	Natural light in walkways & service area	0.32	0.56	0.67	0.57
	32	Glare control strategies in building	0.29		0.90	
	33	Routine work in case of no artificial building	0.35		0.78	
Safety & Security	34	Building safety in case of unforeseen	0.52	0.56	0.55	0.57
	35	Digital surveillance of building	0.65		0.66	
	36	Natural surveillance of building	0.42		0.69	
	37	Building design Sustains any act of terrorism	0.48		0.45	
	38	Evacuation in case of emergency	0.68		0.63	
	39	Condition of emergency routes and exits	0.68		0.49	
	40	Safety measures of building	0.56		0.51	

The detailed information about the functionality of each variable is shown in table 4 which indicates that AWK (Building B) has performed well in term of natural light with highest RS value of 0.74 as compare of C&W (Building A). The open serving veranda at both side of AWK building provide defused sunlight in the both verandas and also in the offices whereas, the closed end corridors in C&W (Building B) produce an unpleasant glare which reduced the natural light and visibility even in daytime. The medium rate of assessment has been observed in both buildings in term of accessibility and circulation. The lack of design intend was also observed and recorded in both buildings related to safety and security and as ranked as 0.56 and 0.57 in Building A&B respectively

CONCLUSION

In essence, post-occupancy evaluation is a powerful tool for assessing both the drawbacks and advantages of a building. It provides insights into how well a building serves its occupants, how efficiently it operates, and whether it adheres to safety and various requirements of its users. Focusing on the occupants as the primary driving force behind the process, the study underscores the critical need for significant improvements in many aspects of government buildings. The major aspect that requires substantial enhancement is provision of natural light in the workspaces of building occupants. This study reveals a very poor condition of natural light in C&W (Building A) with Relative Satisfaction score of 39%.

It's important to ensure that government buildings are accessible to all individuals, including those with disabilities. If an average of 60% of users are not satisfied with the services and facilities related to differently abled people in these buildings, it indicates a significant issue that needs to be addressed. The figures of this study indicates that almost 57% of users are not satisfied with the facilities provided for differently abled persons in C&W (Building A). The more alarming situation is the non-availability of elevators and ramps in both buildings. Ensuring accessibility is not only a legal requirement in many places but also a fundamental aspect of promoting equality and inclusivity. The relative score for Building Performance and users satisfaction for Building form and orientation of AWK building (Building B) is 68% which is higher than 51% of C&W (Building A). It can be concluded that there is more acceptability of linear geometrical form of building in Khyber Pakhtunkwa. The Post-Occupancy process model summarize that the overall performance of building in terms of users satisfaction of Abdul Wali Khan (Building B) is better than C&W (Building A).

Incorporating Post-occupancy evaluation as a policy document in the planning commission can indeed enhance the quality and efficiency of building projects in Pakistan. It can lead to more sustainable, user-friendly, and cost-effective buildings while promoting accountability and data-driven decision-making in the construction industry.

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