ACTIVATING HUMAN ASPECTS THROUGH USERS' PARTICIPATION IN POST-OCCUPANCY EVALUATION OF BUILDINGS

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Abstract

Post-occupancy evaluation is the most important stage in the life cycle of buildings and the measurement of their performance that has many aspects: functional, human, physical, technical, environmental, and other aspects that depend on the nature of a building, which should not be ignored or overlooked. Many specialists have focused on all aspects and do not care enough about the human aspect. Therefore, the research aims at activating human aspects of a building during the processes of post-occupancy evaluation to achieve users' satisfaction and comfort by users' participation will be activated at various stages of post-occupancy evaluation; also, after submission, and implementation of its results and recommendations. In addition, a new formulation of the post-occupancy evaluation framework will be deduced from a previous study was analysed. This framework takes into consideration human aspects through the quality indicators of these aspects will be connected and inserted at all post-occupancy evaluation stages. Through users' participation will be activated as an effective and influential tool can deal with those standards and indicators to support and improve users' satisfaction and comfort within buildings. Besides, methods and means of collecting information will be used such as questionnaires. Questionnaires are an effective way for users' participation in evaluating factors and standards of human aspects based on the quality indicators of building and human performance. In addition, how to questionnaires are conducted by "Kano's Model" for measuring and evaluating performance, users' comfort, and satisfaction inside architectural spaces and buildings. Eventually, the practical example on one of the quality indicators of human performance "Indoor Air Quality" will be conducted.

Key words

Post-Occupancy Evaluation (POE), Human Aspect, User's Satisfaction, Kano's Model, User's Participation.

1. Introduction

Many buildings have suffered from difficulties in management and operation because of the comprehensive periodical review has not been conducted on human aspects and the performance efficiency of users that can negatively affect their productivity and performance. This issue can lead to lack of benefiting from the building at its intended purpose to the maximum degree possible and lack of achieving users' satisfaction and comfort. Also, during POE has been implemented for improvement and development; many specialists focus on functional and physical aspects and give them priority over other aspects. Although taking into consideration human aspects based

on users' participation is going to support the other aspects, enhance the future of the building, improve the performance of its functions, and increase users' efficiency.

2. Research Problem

Many specialists have considered functional and physical aspects more than human aspects; moreover, they do not take into consideration users' participation as a tool to deal with human aspects during the POE stages: preparation, practice, implementation, putting solutions, developing proposals, and after outputs of POE, have been applied.

3. Research Aim and Objectives

The aim of the research is to activate human aspects within a building during POE and link those aspects with all stages of POE for achieving users' satisfaction and comfort through activating and adopting their participation in the processes of the evaluation and improvement during those stages; consequently, this aim can be achieved through the following objectives:

- To investigate the concept of POE and vital role in the life cycle of a building, also its relation to the human aspect;

- To demonstrate the relationship between POE, performance with its classification and association with the quality indicators of human performance;

- To develop the POE framework to integrate with the quality indicators of human performance based on users' participation to achieve satisfaction and comfort;

- To activate the user's participation during POE through the assurance principles of its quality and confidence as a criterion for its efficiency;

- To select an appropriate tool for measuring, evaluating, and enhancing human aspects during POE as a way of achieving users participation; and

- To conduct a practical example based on the selected tool and technique to involve users in evaluating and improve one of the quality indicators of human performance as an empirical example.

4. Methodology

The study depended on the descriptive and analytical approach to investigate the general concept of POE and its important role in the life cycle of buildings; also, the study confirmed the relationship between POE, human aspects through the user's participation and its impact on the performance of the building. In addition, the quality indicators of human performance were

collected and classified, which measures and evaluates the performance of the building and users to develop and reformulate the framework of POE that will integrate with the human aspects based on users' participation. This framework was extracted and deduced from the study had been conducted to carry out the POE on George Porter Building of the Sheffield International College (SIC), England. The deductive approach was used to activate human aspects and achieve human comfort by users' participation in all POE processes that are conducted during the POE stages as an effective and influencing tool; also, the principles of participation quality assurance were identified and how confidence was confirmed as a criterion for participation efficiency. The appropriate measurement tool was identified and selected, which supports users' participation to measure and evaluate the human aspects during POE. Therefore, the research suggests using "Kano's Model" as a tool to measure and evaluate the quality indicators of human performance and a user's satisfaction; moreover, the applied technique of "Kano's Model" was explained, which serves the aim of the research. The practical approach used "Kano's Model" and its technique that depended on the developed framework of POE that integrates with the human aspects in evaluating "Indoor Air Quality" at the lecture hall in the faculty of engineering as a practical example of one from the quality indicators of human performance.

5. POE Concept and its Important Role in the Life Cycle of Buildings

Buildings are designed for several main purposes such as people protection from their surroundings, wind, water, and so on. However, today people expect more from their buildings to be more benefits, appropriateness, or efficiency for its users. They want buildings to have the appropriate function for specific uses, comfortable, safe, and adaptable to new uses during the life cycle of their buildings (Rdesinski et al., 2009). The concept of sustainability and energy efficiency has made the construction industry and owners more accurate about how their buildings perform during the life cycle of those buildings. The performance of the building can be defined by the degree that the building can achieve a one or all expectations during its life cycle. Many theories and tools have been developed to evaluate a building from environmental adaptation to energy performance. POE is one of these methods and tools (Council et al., 2002). In the early 1990s, a group of specialists gathered to discover ways of monitoring, evaluating, and measuring the general performance of buildings to find an answer to the question "What is an effective building and how the specialists can measure its effectiveness?". They called this process "Post-Occupancy Evaluation" (Tookaloo and Smith, 2015). In other words, POE is the evaluation process of the behaviour of the building with a systematic and accurate manner after it was occupied (Mohammed, 2018). POE sets the responsibility during a complex and costly process to develop an existing building or construct a new building during their life cycle based on a formal report, a feasibility study, and a survey (Cranz, 2013).

6. The Relation between POE and Human Aspects by Users' Participation

As any systematic manner, POE has its own advantages and disadvantages. One of POE applications is the comparison between usage that a designer intended and a user put in the same environment or an area (Mustafa, 2017). The advantages of POE: First, it ensures the performance continuity of the building, particularly public buildings. In this context, the specialists have used a POE to determine defects of the building; formulate the criteria of design and construction; support performance measures of management; and, reduce the life cycle costs of the building by identifying design mistakes that could lead to increasing costs of maintenance and operation; in addition, clarifying design objectives. Second, POE provides a mechanism to understand the common interaction between buildings and users' aspirations where necessary ways of improving the environment for accommodating these aspirations are proposed (Vischer, 2002; Ilesanmi, 2010). Recognised benefits of POE include continuing the development, improving the relationship between users and building, supporting satisfaction and comfort for users, and reducing energy usage (Zimmerman and Martin, 2001). Subjective differences like a lack of agreement or personal feelings during interviews or surveys can also affect POE studies. Thus, it is important to limit, control, and otherwise, account for these differences in any POE study. POE is the collection of reviews of occupant's satisfaction, utilising space, and consuming the resource of a completed constructed building after occupancy to identify main occupants and issues of performance of the building. POE can also be used to analyse trends over time, identify ways in which to improve continuously processes and implement the outcomes of POE processes that increase responsibility for managers of buildings, unify best practices, and help the designer for understanding opportunities for improvements of the future project to what serves users' satisfaction on (Tookaloo and Smith, 2015).

7. The Relation between the Concept of Post-Occupancy Evaluation (POE) and the Performance of the Building

The performance of the building can be defined, what the degree to which a building can meet and achieve any or all of these expectations (Council et al., 2002). As was stated previously specialists met to discover ways of monitoring, evaluating and measuring the performance of the building to find an answer to the question "What is an effective building and how the specialists can measure its effectiveness". They called this process "Post-Occupancy Evaluation" (POE) (Tookaloo and Smith, 2015). Through the concept of POE, the performance of the building can be classified as technical, functional, and behavioural elements of the performance (Blyth et al., 2006). Those elements of the performance are measured and evaluated by the quality indicators of human performance that represent metrics, attributes, and items that evaluate specific qualities of any element from them to be measured as in Table 1. Those elements are directly connected with the

activities of a building and are required to be in accordance with occupants' needs.

Table 1: Shows the Quality Indicators of Human Performance that Measures, Evaluates, and Enhance the Elements of Three Aspects of the Building Performance. Source: (Blyth et al., 2006; Frontczak and Wargocki, 2011; Serag El Din et al., 2013; Sanni-Anibire et al., 2016)

The classification of a building performance elements under three aspects	Technical aspect	Functional aspect	Behavioural aspect
	• Structure; • Sanitation; • Fire safety; • Security; • Ventilation; • Health; • Thermal; • Visual; • Acoustical comfort; • Indoor air quality; and • Noise control.	• Accessibility; • The functionality in the buildings and spaces; • Spatial capacity for activities; • Adequacy of necessary facilities (utilities - telecommunications) ; and • These are directly connected with the activities within the building to achieve the responsiveness to change over time and efficiency.	• The connection between occupants' activities and the physical environment; • The effect of area size and number of persons that share, functional distance between spaces upon the frequency of use; and • Occupants' comfort is affected by the configuration of circulations on social interaction, and building's image.
The quality indicators of human performance that evaluate specific qualities of an element to be measured (These indicators covered the technical, functional, and behavioural aspects) in accordance with human aspects.			
The quality indicators of human performance	Quality of Design.	• Configuration of space; • Appearance of facilities and landscape; • Layout of building; • General aesthetic appearance (interior and exterior); and • Accessibility: access to facilities in a project.	
	Quality of Indoor Environment.	• Thermal comfort; • Indoor air quality; • Acoustic comfort; • Visual comfort; • Security and fire safety;	
	Quality of Outdoor Environment.	• Quality of air; • Control of noise; • Shading and control of shadows; • Exterior views; • Good smells; and • Security.	

	Psychological quality	• Promoting the identity by preserving the heritage and historic remains, making architecture responding to their context; • The user's privacy during the use of the space and the exercise of his daily activities; • Giving the opportunity for having a place by giving the ability to personalize the space; • Good relationships and daily interaction by providing gathering places; • Promoting the social participation in all the project processes; • Giving the ability to enjoy a natural landscape by providing a view of green areas distributed within the project; and • Providing appropriate methods to control and manage wastes.
	Quality of building support services	• Building services and infrastructures.

Table 1. Confirms that the relation between the performance of the building and POE aims at the attributes of human aspects such as survival necessities, health, and environmental quality, which affect occupants comfort and productivity and promote clear communication among its occupants, which are major factors in occupants' satisfaction by the quality indicators of human performance.

8. The Framework of Post-Occupancy Evaluation (POE)

Through the study conducted at the International College, Sheffield University, England to carry out a POE on George Porter Building of the Sheffield International College (SIC). The university decided to renovate two floors of the George Porter building, built in the late 1950s to serve as a laboratory, as a temporary home for the International College until completely finishing of new buildings of accommodation. The results were the staff and students are generally satisfied with their space and feel it is a "nice building to study and work in", also there are a number of factors that they feel should be treated. The main common concerns that had been chosen by occupants: (Morrison, 2008):

- Lack of spaces for expansion;

- The issues of thermal comfort (either too hot or too cold depending on location and season);

- Noise issues from the factory on adjacent building mean that windows cannot be opened to provide ventilation;

- Problems for visitors accessing the building, as there is poor signage in and around the building;

- Lack of some important services and facilities;

- Lack of space for informal meetings between staff and students and for larger teaching space and exams; and

- Solar gain and glare in some offices and classrooms.

The main common concerns that had been chosen by occupants are under the quality indicators of human performance in accordance with the occupants' needs as in Table 1. Solving proposals that can be learned and taken into account on future projects together with recommendations for improvements that can be carried out to address current issues have been included in a table at the end of that study, which the study has found they integrate with the quality indicators of human performance. The most important lessons are the occupants were satisfied with the results and with their participation. The evaluation of the performance of the building is a method for acquiring necessary information and knowledge for the efficiency of planning, design, construction, operation, and occupancy of buildings (Adeyeye at al., 2013) by practices of collaborative working and the executive processes for the POE are at a framework (Morrison, 2008). This framework of the POE was developed to integrate with the quality indicators of human performance based on Users' satisfaction and participation; the steps of an advanced framework:

A. Description of the project:
   1) Background;
   2) Description of the project and building; and
   3) The work team.
B. Methodology: (the findings of the workshop sessions, interviews, and questionnaires are set out as suggestions).
C. Results (process):
   1) Feasibility, design, and brief.
   2) Feasibility stage:
      I. Project Management;
      II. The work team from architects and other consultants is chosen;
      III. Briefing stage (Preparing-Surveying-Planning);
      IV. User /Occupant consultation, the lessons were derived through participation:
         - User's satisfaction and human comfort are achieved through their participation in the evaluation;
         - Occupants in the decision-making process are involved and worked very well in delivering the project within time;
         - A detailed contact sheet for the users is provided to explain the responsibility of individuals; and

- If you do not have a key contact, give someone else from the team a responsibility to communicate with users.

V. Detailed design stage/Design issues; and
VI. Approvals - planning and other restrictions on the project are accredited.

3) Construction stage:
   I. Appointment of main contractor and subcontractors is executed;
   II. Relationships among the project team are defined;
   III. Construction issues during construction are treated;
   IV. Program management and control are run;
   V. Financial issues are treated; and
   VI. Management of the site e.g. Disruption, health and safety have to be checked and taken into account.
4) Handover, aftercare, and moving in:
   I. Handover, documentation, and training;
   II. Moving in; and
   III. Issues after the handover.

D. The results: Project in use (the quality indicators of human performance by a questionnaire, interviews, and workshops);
E. The results: Section scores and Likes/dislikes exercise (This section reports the findings of the questionnaire at a section level rather than at an individual question level); and
F. Conclusions and recommendations.

The previous processes and stages represent an advanced framework of POE that can help to activate human aspects to achieve users' satisfaction and comfort through POE after users' participation was involved in the steps and procedures of the POE framework and show where the stage or step that can involve users in and users' role in this developed framework. The problem that appeared the teamwork after finishing POE was in the design of the questions of interviews and questionnaires that based on the team points of view. In addition, they did not rely on a systematic approach and the questions of interviews and questionnaires were not accurate and comprehensive to deal with the quality indicators of human performance. Consequently, this developed framework needs a technical tool to formulate the questions that are introduced to users to cover all human aspects in an accurate way.

9. Users' Satisfaction as a Measurement of the Performance Quality of a Building

The user and occupant is the key element in the process of evaluation. The performance of a building is not limited to energy conservation, life cycle costing, and functions of buildings. It also needs to focus on users' perspectives on buildings (Mamalougka, 2013, Mohammed, 2018). The relationship between building and users should be investigated. Problems and

their sources have to be identified and factors that influence the level of satisfaction should be determined (Serag El Din et al., 2013). The most important factor, as an indicator of success of the building in meeting the design objectives that is the level of user's satisfaction (Wilkinson et al., 2011). Many studies investigated users' satisfaction within a wide range of the management fields and social sciences, also built environment (Ibem et al., 2013; Parsaee et al., 2016). In general, satisfaction is the performance evaluation of functions and services to achieve the user demands and expectations (Parker and Mathews, 2001; Ueltschy et al., 2007; Hanif et al., 2010). By satisfaction can be compared the benefits or values that occupants or customers acquire to which are expected when a product or a service is used. Therefore, satisfaction is a measurement of the difference between the real and expected performance of functions or services in achieving users' requirements and expectations from the users' point of view in their building. It is based on the expectations theories, most studies on achieving satisfaction, if the performance of the product or service achieves users' requirements and expectations, it is said, "the user satisfied with the product and service". Buildings are as any other products consumers, specialists, occupants, and society planned and designed them based on numerous expectations and needs. The key expectation is those buildings will achieve their needs through promoting their daily activities (Ibem et al., 2013; Parsaee et al., 2016). Current studies (e.g., Kian et al., 2001; Nawawi and Khalil, 2008; Ilesanmi, 2010; Jiboye, 2012) have shown that users' satisfaction surveys have become a highly valuable tool in evaluating the performance indicators of buildings, also attitudes, needs, and expectations of human towards own buildings are understood. The performance evaluation of built environment has traditionally been based either on physical monitoring or user's satisfaction surveys principally because users give their views and feelings about their buildings depended on their experience and interactions with buildings (Ibem et al., 2013; Serag El Din et al., 2013). The specific qualities and performance in the context of a building are being evaluated. The view that the performance indicators of a building should be extracted from values that are distinguished the users, companies or the entire society. Therefore, criteria for measuring the performance of buildings should be identified from how users see their buildings and the importance that they attach to them. Similarly, at the beginning of the occupation of a building, users have various expectations on the performance of the building, in terms of the benefits that it will provide and the needs that should achieve (Fatoye and Odusami, 2009). Rarely studies associated users' satisfaction with the performance of the building.

9.1. Quality of Life

Quality of life is a complex and multidimensional concept that requires multiple approaches. There have been many attempts to answer, what is the quality of life? It has more than hundred definitions in the different disciplines. Quality of life is "user's satisfaction" in his life that comes from having good health, comfort, and relationship etc., rather than money (Jiboye, 2012). Quality of life refers to what is enhanced by the access to clean air,

water, land, and nontoxic materials to protect people and maintain biodiversity; and providing the access to adequate services and facilities that meet people's needs. All obstacles that decrease the participation in the daily activities of all users are Removed such as those with disabilities, women, children, and the elderly; and good relationships and daily interaction among users are promoted by providing gathering places; Also, job opportunities by encouraging the development of mixed-use (Serag El Din et al., 2013).

9.2. Human Comfort

Man feels comfortable when happens the equilibrium between the inside and the outside of the human body. There are a set of requirements and features to achieve human comfort (Fekry et al., 2014).

9.3. Requirements and Indicators of Human Comfort

Human is the key element affected by the building, then he affects the building, and he is the key element in selecting the appropriate design of a building so achieving human requirements is a major aim for the success of a building. Therefore, human needs are balanced state (thermal, visual, acoustic) to be able to do tasks with the maximum energy possible and without any stress. A psychological energy expressed in his response actions and behaviour. This energy helps him in interacting subconsciously with the surroundings besides other patterns of positive interaction (Frontczak and Wargocki, 2011). Therefore, the researchers can measure and evaluate the quality of life and human comfort by the quality indicators of human performance as in Table 1 to achieve users' satisfaction as a measurement of the performance quality of a building. Finally, the designer and team should look for tools, means, and techniques that help to achieve user's satisfaction and succeed the building to meet user's needs by user's participation in all processes that conduct during the life cycle; consequently, POE will succeed and help to activate human aspects.

10. User's Participation as an Effective and Influencing Tool in Post-Occupancy Evaluation (POE)

In the synthesis stage, the solution will be achieved and carried out. The features of synthesis are attempting to move forward and make or produce solutions of problems. The final solution has to be provided with achieving the satisfaction of all occupants "users and specialists", also parts of the problem relatively. Here, Satisfaction means adaptation and sustainable relations with design contexts and the desirability of human factors for users, clients, and citizen's point of view by participation (Parsaee et al., 2016; Valladares, 2017). Participation in design attempts to push human factors for moving towards dynamic rather than static; therefore, the process of spatial design becomes dynamic and integrative. It is believed that participatory design is a better tool for managing relative to traditional design based fundamentally on inputs of an expert. Several reasons are given include (Hassan et al., 2011):

- A good tool for managing conflicts;

- An appropriate tool to create a virtual interactive system based on rules and relationships;

- A tool of planning for analysis and evaluation of many issues;

- A tool to prioritise from the needs of the building and space;

- A tool for making a new sense of having of both difficulties and solutions, which leads to more effective and sustainable development action plans implementation; and

- A tool for Identifying socially accepted solutions and improve decisions related to users.

It enables people to work together in cooperation spirit and make decisions about their building. This can be succeeded by sharing visions and information among partners, changing activities, sharing resources, and enhancing each other's capacity for the mutual benefit. It has been concluded the seven features in participation to the empowerment of users: (the self-efficacy, knowledge and skills, opportunities, action, resources (funding), impact, establishing confidence, and respect) (Kaya, 2004). Establishing "confidence" as an important factor for participation efficiency is sometimes regarded as the actual benefit of participatory processes due to its positive influence on social relations, systems, and psychological performance, which goes even beyond the current design process. Looking at participation as a process of social interaction involves different parts where confidence represents a significant aspect of structuring mutual relationships (Valladares, 2017). Therefore, the confidence can facilitate an open dialogue and productive cooperation among different users and specialists, as well as influence of the general support for decisions and projects to develop gradually over time from a low level of primary confidence at the beginning of interaction towards a higher level, which is knowledge. Perceiving the confidence related to attributes such as transparency, openness, competence, and reliability that is evaluated as practical indicators of confidence (Jensen, 2006; Hassan et al., 2011).

11. Tools of Measurement for Supporting Human Aspects during Post-Occupancy Evaluation (POE)

The appropriate measurement tool is Identified and selected to measure and evaluate human aspects during a POE process as a mean of achieving user's participation and supporting user's satisfaction and comfort. The different techniques of evaluation share in the quantitative evaluation, while evaluation indicators differ among them. The quality indicators of human performance are subjective and qualitative, so reliance on quantitative measurements reduces the credibility and accuracy in evaluating (Frontczak and Wargocki, 2011; Fekry et al., 2014).

11.1. Evaluation and Measurement of Human Aspects

For example, the difference in quality indicators of human performance has to be taken into account, which differs among countries because of their association with different natural conditions and climatic features. These conditions differ from a country to another and may differ among different areas in the same country, while the variety of this quality is not usually reflected on the current evaluation indicators. For example, indicators used in the consumption evaluation of energy in Europe do not reflect differences in its distribution according to different climatic conditions, as various national laws all over the European Union, were unified of energy performance of buildings, which is not logic. In addition, the design of indoor and outdoor environments and psychological quality vary from place to another (Fekry et al., 2014). Therefore, the quality indicators of human performance in the current evaluation of buildings have problems in the manner of evaluation:

- It separates among the evaluation indicators to achieve the requirements of human comfort; and

- It neglects to evaluate the achievement of psychological comfort requirements.

A set of questions has appeared about the adequacy of the existing items in evaluating the quality indicators of human performance and the efficiency of evaluation approaches that were used. The main problem can be summarised in the use of quantitative standards to measure the achievement of the requirements of human comfort despite their descriptive and subjective features, which drive the research to find a suitable tool to deal with all indicators "descriptive and subjective".

11.2. The Proposed Measurement Tool of Human Aspects

POE is usually carried out about a year after project completion and can include both objective and subjective techniques such as questionnaires, interviews, focus groups, observation, documentation audits, and technical monitoring. Ideally, as wide a range of stakeholders as possible should be involved to provide a holistic picture of the project, its successes, and shortcomings (Morrison, 2008; Sanni-Anibire et al., 2016). Through understanding how existing buildings affect occupants, designers can minimise problems and capitalise on successful design features that improve the system of performance. Different researchers have suggested and developed models or methodologies that focused on the performance of the building and its facilities. These studies include their methodologies that involved tools for collecting data such as questionnaires, walk-throughs, and discussions of focus group, interviews, and observations (Morrison, 2008; Mohammed, 2018).

Questionnaires are the most feasible approach in dealing with those features rather than traditional quantitative ones. The research suggests using “Kano's Model” to evaluate the quality indicators of human performance and user’s

satisfaction. This model first appeared to evaluate the quality of management and marketing technology to measure users' comfort; consequently, this model can be used to evaluate buildings and measure occupants' satisfaction, according to meet their requirements in buildings (Matzler, 1998; Garibay, 2010; Violante, 2017).

This tool depends on conducting a questionnaire in evaluating a building in use and a questionnaire is structured in such a way as to encourage discussion of the main problems of success or concern (Morrison, 2008). Questionnaires are carried out through a series of steps and stages that begin by defining the aim, objectives, and data that a researcher will ask about, the aim and objectives are converted into a set of questions and inquiries, then the questionnaires are sent to the intended people. It is preferable to collect 75% or more of the needed answers to be sufficient to analyse the information. It has been found from the field investigations that 20–30 of users in the homogeneous groups are enough to identify 90–95% of all possible features of the product (Matzler, 1998; Fekry et al., 2014; Violante, 2017).

11.3. Kano's Model

Kano's Model is a theory of developing, studying, and examining a product. Prof. "Noriaki Kano" develops customer's satisfaction in the 1980s. The main aim of Kano's Model is to help teams to discover, classify, and integrate three categories of customer's needs and Attributes or features into the product or service they are developing (Garibay, 2010). Kano's model offers some insight about the attributes or features of a product, which are considered to be important for customers. The purpose of the model is to support a feature of a product and discuss for the better development from the researcher's understand. As in Fig. 1 illustrates the "Kano's model" that concentrates on distinguishing the features of the product, as opposed to distinguishing at the beginning on customer's needs (Fekry et al., 2014). As in Fig. 2 illustrates the types of three attributes, which are mapped in a coordinate system with "Customer's Satisfaction" up the y-axis, and "Degree of Achievement" (how well a given attribute is executed in your product) along the x-axis.

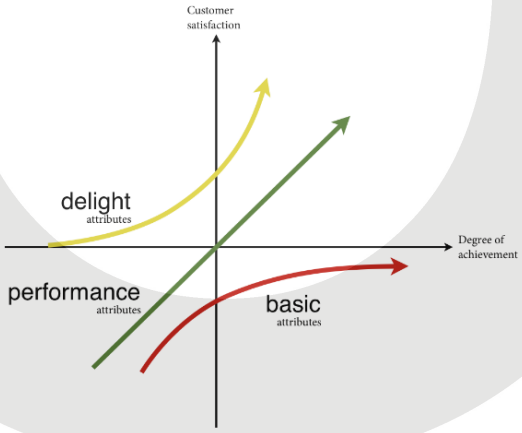

Fig. 1: The Types of Three Features of Kano's Model. Source: (Holst, 2012)

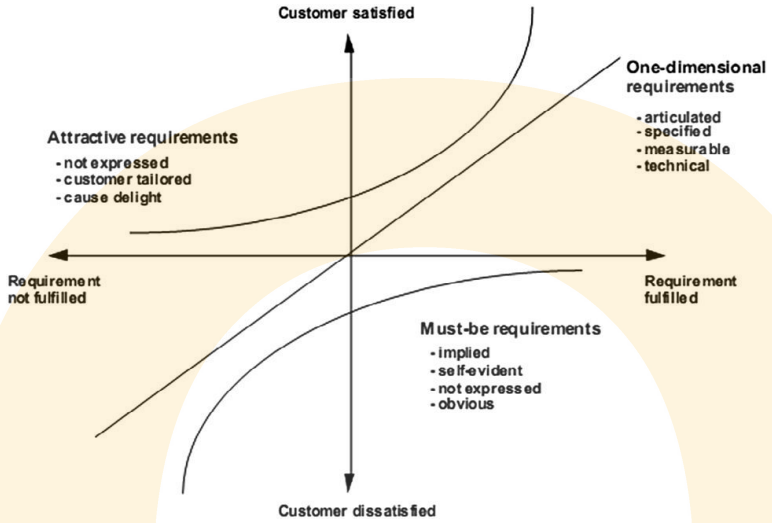

Fig. 2: Illustrates Kano's Model to help a Researcher to Analyse the Experience of a User or a Customer for a pProduct, an Indicator, or a Feature. Source: (Violante, 2017).

Kano's Model added an overview of the requirements of a product into three attributes, which was not shown before. It was taken from the traditional product evaluation to apply after that on any indicator of the performance of a building and a project (Violante, 2017; Matzler, 1998):

The first category ("Must-Be" requirements): is related to the essential attributes that must be found in any product, which is linked to the minimum requirements, which cause resentment if not complete and does not cause satisfaction if not accomplished, such as providing spaces of the service beside the functional spaces in buildings.

The second category ("One-Dimensional" requirements): are related to the attributes that are one-dimensional, which means that the more the performance of products increase the more the user's satisfaction increase and vice versa (one dimensional), such as service spaces are furnished and ventilated to support the functional spaces that they serve.

The third category ("Attractive" requirements): is related to the attractive and exciting attributes, which lead to a higher user's satisfaction but does not cause dissatisfaction if not obtained (attractive), such as providing these spaces with some amenities such as air-conditioning, news screen, and Wi-Fi.

"Noriaki Kano" also developed change axes of user's satisfaction and the relationship of which the change with what the user needs from a product, what he expects, and do not expect.

The Questionnaire based on "Kano's Model" summarises user's satisfaction about the product features. Must-Be, one-dimensional, and attractive requirements, as well as the requirements of the product, toward which the customer is indifferent (do not care), can be classified by a questionnaire. For each an attribute or a feature of the product a pair of questions is formulated

to which the customer can answer in one of five different ways (may be one of the following options: (like – must be – neutral – live with – dislike). The first one is about the user's reaction when receiving an attribute in the product. The second is about his reaction when there is a lack of this attribute inside the product (Fekry et al., 2014). The answer to these questions may be from the following options (only one) as in Table 2.

Table 2: Shows Kano's Model used to Evaluate User's Satisfaction for the Attributes of the Product Depending on the Answer of two Questions. Source: (Matzler, 1998; Wang and Ji, 2010).

Customer's requirements			The dysfunctional form of the question				
			Reaction without the feature (negative)				
			like	must be	neutral	live with	dislike
The functional form of the question.	Reaction with the feature (positive).	like	Q	A	A	A	O
		must be	R	I	I	I	M
		neutral	R	I	I	I	M
		live with	R	I	I	I	M
		dislike	R	R	R	R	Q
Where: A (attractive) – M (must-be) – R (reverse) – O (one-dimensional) – Q (question- able) – I (indifferent).							

From the answers to two questions in each category of three: The first answer, which is placed in the vertical direction in the questionnaire table of Kano's Model. The second answer, which is placed in the horizontal direction in Table 2. The final result is obtained at the intersection of the two answers, which represents one of the categories of the six user's satisfaction that were previously represented.

Similar results expressing users' satisfaction (A–M–R–O– Q–I) are gathered in a result table, then the percentages of each are calculated. These percentages can help in identifying the importance order the products' features. To complete the evaluation of the product's features; the coefficient of customer's satisfaction (CS) should be calculated in two forms (three times). The first form with a positive signal could be calculated by the formula: (A + O) /(A + O + M + I), while the second form with a negative signal and could be calculated using the formula: (O + M) /(A + O + M + I) × (-1) as in Table 3. The positive CS coefficient ranges from (0 to +1); the closer the value is to (+1), the higher influence on customer's satisfaction. A positive CS coefficient, which approaches (0), signifies that there is very little influence. At the same time; however, consider the negative CS coefficient.

If it approaches (-1), the influence on customer dissatisfaction is especially strong if the analysed product feature is not fulfilled. A value of about (0) signifies that this feature does not cause dissatisfaction if it is not met (Garibay, 2010; Wang and Ji, 2010).

Table 3: An Illustrative Table to Calculate the Positive and Negative User's Satisfaction Coefficient (CS) for a Product's Features. Source: (Matzler, 1998; Garibay, 2010).

Product requirements	A %	O %	M %	I %	R %	Q%	Total (%)	Category (helps in ordering priorities)	coefficient of customer's satisfaction (CS)	Satisfaction	Dissatisfaction
1st "must-be"							100	M			
2nd "one-dimensional"							100	O		= (A+O) /(A+O +M+I)	= (M+O) /(A+O+M+I) *-1
3rd "Attractive requirements"							100	A			

Finally, the two positive and negative results are collected in one result, which can be used to evaluate a product's features. The value comes closer to (+1), the product is better, while it is ineffective when the value is (0), and it leads to individual's dissatisfaction as it comes closer to (-1). Thus, each indicator from Table 1 will be measured through six questions that are presented to the occupants of the building and specialists to cover all three attributes of the studied indicator.

12. The Proposed Technique of Using Kano's Model to Evaluate the Quality Indicators of Human Performance s that Mentioned in Table 1

Questionnaires based on "Kano's Model" can be used to measure the indicators related to a group of users. Those groups should be standardised and linked to a building, such as users of a building, visitors, passers, and owners. Owners like constructors and operators of a building. Some scores of an element may depend on combining the results of individual views besides other calculations (Matzler, 1998; Garibay, 2010; Wang and Ji, 2010; Fekry et al., 2014; Violante, 2017). The questionnaire results can be provided with the documents provided by the designer, and some can also be provided

through the life cycle of the building, as they require some time that can exceed the period of evaluation, like the indicators linked to the users' comfort and satisfaction during the operational stage of the building. Therefore, buildings can be evaluated before getting a final result of these indicators. Then the evaluation is completed by collecting data of a certain percentage of groups of the users related to the indicators were evaluated during a specified period. For instance, determining the first year of the occupancy from the final size of the building evaluation to sure that the required levels of comfort and satisfied are achieved, which require providing initial function permits to operate the building according to the preliminary results. Then the specialists are revising continuously to update and develop these results as an example, every an annual quarter (Morrison, 2008).

13. The Applied Study How to Measure and Evaluate the Quality Indicators of Human Performances

The applied approach was used to the proposed technique and the POE framework that integrates with human aspects in evaluating "Indoor air quality" (IAQ) as one of the quality indicators of human performance as a practical example. The classification of Kano's model will be based on, which classifies the attributes of any product to three (Must-Be, One-Dimensional, and Attractive). The researcher will employ it to classify the features or attributes of "Indoor air quality"(IAQ) was listed in Table 1 to can be measured and evaluated it.

Indoor air quality"(IAQ) depends on many factors and variables (Davara et al., 2006; Mandin et al., 2017; Slezakova et al., 2018):

- Temperature;
- Relative humidity;
- The pollution rates;
- The air purification; and
- Ventilation.

Since the indoor air response to any changes in IAQ depends on a number of seasonal factors such as heating facilities, ventilation, building permeability, pollutant stability, meteorological factors, indoor activities, and human occupancy duration (Davara et al., 2017; Mandin et al., 2017). Indoor activities that generate pollutants include the use of emissions from printers, photocopiers, gas or kerosene stoves for heating and cooking, cleaning and the use of a variety of consumer products, including tobacco smoking (Baek et al., 1997). The density of human occupancy increases with people prefers to spend more time indoors in winter than summer with insufficient ventilation. Therefore, it can play an important role in defining the quality of air in winter more than summer (Fang et al., 2004).

The monitor of the air quality was carried out to collect data on the air levels of indoor and ambient of various constituents. Air conditioning systems can make a positive impact on IAQ or the opposite. This depends on a partial solution, although upon the standards of maintenance and operation of the utilised system were used in any building (Slezakova et al., 2018). The filtration efficiency of outdoor air, hot or humid climate zones. The current studies have also dealt with some specific parameters such as relative humidity, manufactured vitreous fibres particulate matter, and semi-volatile organic compounds (Wolkoff, 2018).

The practical implications from (Fang et al., 2004; Mandin et al., 2017) the findings of these studies show the importance of the indoor air temperature and the humidity on the perceived air quality. In the practical study, the rate of required ventilation for comfort and health should no longer be independent of the indoor air temperature and humidity. Thus, the researcher can formulate questions for the questionnaire on the features of IAQ according to Kano's Model to apply to the lecture hall in the faculty of engineering as Table 4:

Table 4: Formulating the Questions for the Questionnaire about the Features of the Indoor Air Quality According to "Kano's Model".

Category (Helps in ordering priorities)	O	The questions		Feature/ Attribute
		The Functional form of the question (positive)	The dysfunctional form of the question (Negative)	
1st "must-be"	Q1	How do you feel about the temperature of the Lecture Hall?	How do you feel if the temperature of the lecture room has changed?	The temperature of indoor air.
	A1	○ I like it that way. ○ It must be that way. ○ I am neutral. ○ I can live with it that way. ○ I dislike it that way.	○ I like it that way. ○ It must be that way. ○ I am neutral. ○ I can live with it that way. ○ I dislike it that way.	
2nd "one-dimensional"	Q2	Is the ventilation of the Lecture Hall suitable for you; How do you feel?	Does the ventilation of the Lecture Hall need to improve; How do you feel?	Ventilation.

	A2	○ I like it that way. ○ It must be that way. ○ I am neutral. ○ I can live with it that way. ○ I dislike it that way.	○ I like it that way. ○ It must be that way. ○ I am neutral. ○ I can live with it that way. ○ I dislike it that way.	
3rd "Attractive requirements"	Q3	How do you feel about the smell of the lecture hall; Is it a lovely smell for you?	Do you want to treat the smell of the lecture hall; Do you smell unpleasant to you?	The pollution rates and air purification.
	A3	○ I like it that way. ○ It must be that way. ○ I am neutral. ○ I can live with it that way. ○ I dislike it that way.	○ I like it that way. ○ It must be that way. ○ I am neutral. ○ I can live with it that way. ○ I dislike it that way.	

During the questionnaire was distributed to the students and teachers of the lecture hall. They positively reacted with the questionnaires and did not add any features about that to be included in the questionnaire (One hundred samples were distributed).

The results were gathered through the Kano's Model by Microsoft's Excel program. Then the necessary modifications were made with the users' participation to make the indoor air quality of the lecture hall is successful and acceptable to feel human comfort through users' satisfaction.

14. Results and Discussion

- The rank of priorities has to be determined for the features or attributes of each quality indicator of human performance to active human aspects through the studied space or building after involving users' participation;

- The quality of these features has to be checked to delete, modify, upgrade, or add;

- Those indicators need to be found out what if they are important and effective, according to the nature of a building;

- Are there other indicators that need to be measured and evaluated?

- There are the indicators have more than the three attributes may reach five features, therefore they will be categorised through the three categories of Kano's model;

- It is possible to reconsider the classification of the features of an indicator, check the extent of their validity throughout the applied study on the building occupants and spaces or what if they need to be reformulated or other features appeared, and they were not taken into account during the study of this indicator; and

- The researcher confirmed the role of users' participation in the proposed classification of the indicator features are being studied, according to Kano's model, also users' satisfaction as a sign to activate human aspects.

15. Conclusion

- The main conclusion is the POE framework that integrates with the quality indicators of human performance based on users' satisfaction and participation that is concluded and deduced from the analytical study of the POE of George Porter Building at Sheffield International College;

- The evaluation of the building performance follows different approaches, tools, and indicators that can be used, also how to employ Kano's Model as a technique or a method to measure and evaluate the quality indicators of the human performance;

- The POE process implementation increases the responsibility for managers of buildings, standardising best practices, and helping the designer to understand opportunities for future improvements of the project for what serves users' satisfaction and comfort;

- The different approaches to evaluate the building performance, also the tools and indicators used to contribute to policy, practice, and research when they focus on issues that are related to users' satisfaction where users' satisfaction has a direct relationship with the overall functions and the building performance to meet the users' needs and expectations;

- The performance measurement criteria of buildings should be identified based on how users see their buildings and the importance that users attach to their buildings. At the beginning of a building occupancy; the users have various expectations on the building performance in terms of the benefits that it will provide and the needs it should achieve; therefore, it has to connect users' satisfaction with the building performance;

- The same people can differently realise the building at different times, or different people at the same time, those expectations of the building users and the community varied among them. Therefore, to capture the feelings and expectations of all categories of users during the performance evaluation of buildings. On one hand, it is suggested to adopt the building performance indicators as in Table 1. On the other hand, the building performance evaluation based on the concept of users' experience during the building and their participation in POE;

- Users' participation has to be activated as an effective tool and confidence has to be supported as the most important criterion for participation efficiency. Consequently, the building occupants and specialists will be employed to cover all attributes of this indicator will measure each indicator; and

- The classification of the features of each indicator has to be reviewed, which based on Kano's Model is more important and to be checked the extent of its validity during the applied study on the building occupants and its spaces. On the other hand, this classification needs to be reformulated or other features appeared that have not been taken into account while studying this indicator.

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