MEASURING SATISFACTION WITH USER REQUIREMENT RELATED BUILDING PERFORMANCE ATTRIBUTES: A QUESTIONNAIRE

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Abstract

User satisfaction should be the primary concern of the infrastructure development agencies, especially in residential projects. Government residential projects are built with huge expenditure and maintenance of these assets also consumes enormous public funds. The facility maintenance agency remains accountable for the expenditure incurred on these assets to ensure performance. Presently public spending by government agencies lacks effective monitoring post construction especially on maintenance of assets. It makes the government agencies less accountable on their expenditure as also with the procedures/processes followed for maintenance of these assets. There is a need to put an effective system in place to firstly gauge and secondly monitor the performance of all such government assets. Mere expenditure of allotted funds by the end of a financial year cannot be a viable indicator to vouch for the genuineness of spending. The most ideal route to measure its effectiveness is the most important stake holder, viz. the end user. This paper is a part of an ongoing research where the ultimate overarching goal is to develop a conceptual framework to implement an intervention strategy for gauging and enhancing user satisfaction based on user requirement related building performance attributes. This paper deals with development of an instrument necessary to garner feedback on user satisfaction. The content of the questionnaire is based on carefully selected attributes for user requirements that reflect building performance. 84% of an expert group comprising of architects, planners, engineers, facility managers and academia agreed with the grouping and selection of attributes and 73% of them agreed with the need to amplify the attributes in the form of sub attributes for better comprehension of participants. Content, translational and construct validity of the questionnaire developed based on these attributes/sub attributes was also carried out establishing the veracity of the instrument. User satisfaction surveys conducted based on this survey instrument shall enable implementation of effective intervention strategies by FM agencies and also be a measure to establish their efficacy and accountability.

Keywords: Attributes, Building performance evaluation, Questionnaire, User satisfaction, Validation.

INTRODUCTION

Performance of a building can be best evaluated and understood by obtaining the feedback of occupants. The most ideal gauge is end user satisfaction. Infrastructure in rapidly developing countries like India is on an upswing and is equally flourishing in both private as well as public/government sectors. Stringent controls are exercised in private sector constructions as funds involved are of private parties and profits/return on investments are closely monitored. In case of public spending by government agencies, though construction of assets are carried out judiciously, where it lacks is the lack of effective monitoring post construction especially on maintenance of assets created. Moreover, the detached attitude of users/occupants towards these assets makes it a challenging task to evaluate the performance of these assets post occupation. It also makes the government facilities maintenance agencies less accountable with respect to their expenditure as also with the procedures and processes followed for maintenance of these assets. Central Public Works Department, State Public Work Department, Military Engineer Services and a few public sector undertakings are the major infrastructure development agencies in India. With more than 10000 crores of Indian Rupees being spent on maintenance of government residential accommodation, it is imperative to have a gauge to measure the effectiveness of the maintenance agencies as well their processes and procedures for facilities maintenance. It is ironical and surprising that no such means exists at present to actually measure and gauge the effectiveness of maintenance of government assets. Mere expenditure of allotted funds by the end of a financial year cannot be a viable indicator to vouch for the genuineness of spending. Moreover, technical assessment on the condition of the buildings by maintenance agencies themselves may lead to a bias in assessment. The most ideal

route to measure the effectiveness of maintenance is the most important stake holder in the gambit, viz the end user. If an end user is satisfied, then the asset can be deemed as performing and in turn the maintenance agencies, their procedures/processes also get validated.

This paper is a part of an on-going research where the ultimate overarching goal is to develop a conceptual framework to implement an intervention strategy for gauging and enhancing user satisfaction based on user requirement related building performance attributes. This paper deals with development of an instrument necessary to garner feedback on user satisfaction. The content of the questionnaire is based on carefully selected attributes for user requirements that reflect building performance. Such questionnaire designed and developed based on carefully identified attributes that are linked with user requirements will definitely enable the facility managers to prioritize their efforts and channelize their available resources to areas that enhances user satisfaction substantially. The questionnaire will also aid the facility managers in making the intervention strategies more effective. When the feedback obtained through this user satisfaction survey gets converted into an index (which is a future scope), it will enable the facility managers to gauge the effectiveness of the processes and procedures followed for maintenance of facilities as well as it establishes its accountability. It will also provide a benchmark for improvement of the maintenance efforts.

OBJECTIVE
Objective of this paper is to develop and validate a survey instrument based on user requirement related building performance attributes that can measure user satisfaction which in turn will reflect on the performance of residential buildings.

RESEARCH METHODOLOGY
The methodology followed for achieving the objective is best explained through the flow chart illustrated below in Fig 1. The research follows a two pronged approach in addressing the objective. Firstly, the user requirement related building performance attributes are identified and their linkages with user requirements are established. Subsequently, further extensive literature review is carried out to amplify the attributes in the form of sub attributes that explains the characteristics of attributes. The process also involves data collection through questionnaire survey for assigning rank and weights to attributes and sub attributes. The survey also validates the adequacy of attributes as well as the need for amplification of attributes. Secondly, the methodology involves formulation and validation of a survey instrument that can enable user satisfaction survey for garnering satisfaction among occupants of residential accommodation. SPSS and XLSTAT 2014 are the tools used for data analysis.

NECESSITY OF RESEARCH
It is absolutely imperative for the facility management agencies especially government agencies to be made accountable to the processes and procedures they adopt for maintenance of residential assets. This research focuses on the feasibility to standardize user requirements based on an universally accepted document ISO 6241-1984 (E). An attempt is also made to quantify user satisfaction through selected attributes which is essential to quantify satisfaction level that can enable comparison and establish the effectiveness of intervention strategies applied by the FM agencies. This research is of paramount importance to the FM agencies as outcome of the user satisfaction surveys carried out through the questionnaire surveys can enable them prioritize the areas that need attention, prioritize resources in terms of manpower and funds and finally be a gauge to effectively monitor their performance. Quantification of the satisfaction as an index in further research will provide an indicator to FM agencies whether they move ahead or fall behind in sustaining the satisfaction levels over a period of time.
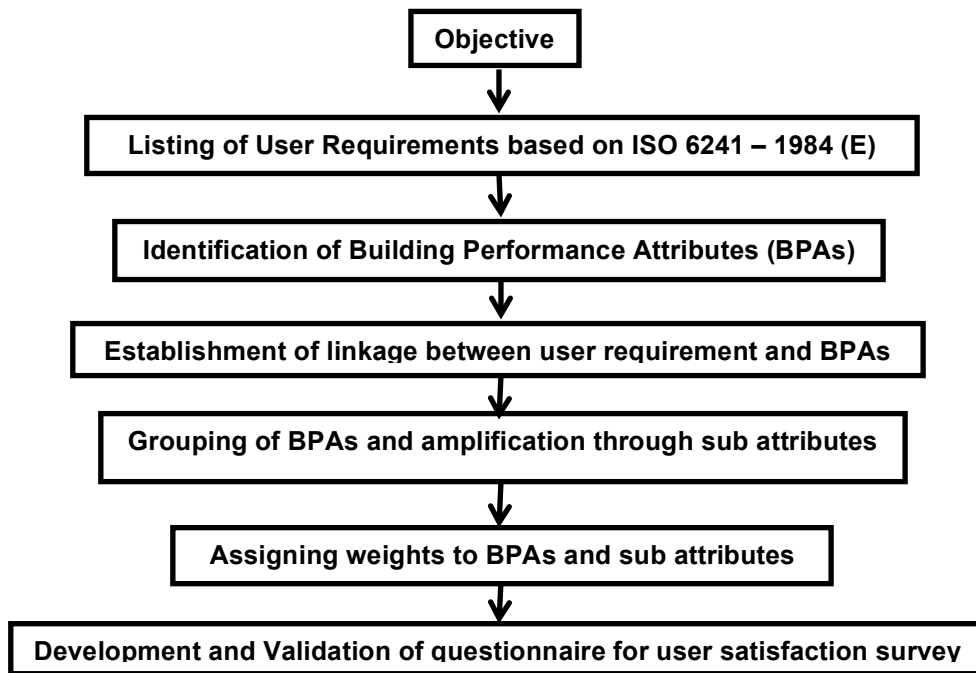
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Fig 1: Methodology for research

LITERATURE REVIEW

User requirement and building performance are the two major aspects being considered in this paper. For any building constructed, it is necessary to take care of the user requirements related to physical, functional and financial aspects (Gopikrishnan & Paul). Physical aspects relate to building fabric and properties, functional aspects to relationship of building with occupants and financial aspects to capital costs/life cycle costs of the building. All the three aspects discussed above are aimed at meeting users' needs, expectations and aspirations. A building can be deemed as performing if occupant is satisfied and vice versa. Loosemore and Hsin argue that it is extremely difficult to measure impact of a facility based on emotions, attitudes and behavior of occupants/users. Kotler defines satisfaction as a person's feeling of pleasure or disappointment resulting from comparison of the product's perceived performance/outcome in relation to his/her expectations. Many researchers consider satisfaction as overall measure while others feel that satisfaction is described best by a combination of facets or attributes. For instance, Day sees no difficulty in measuring individual's satisfaction/ dissatisfaction with overall outcome. Also, Czeipel and Rosenberg agree that consumer satisfaction can be thought of as a single overall evaluative response that represents summary of subjective responses to many different facets. Handy and Ptaff however disagree with overall satisfaction measurement, arguing that response to an overall satisfaction is only crudely measured. Zickmund corroborates Handy and Ptaff's views contending that measures of cognitive phenomena (such as satisfaction) are often composite indexes of a set of variables. This paper draws on views of Zickmund as well as Mbachu and Nkado with an approach of measuring user satisfaction with a set of attributes.

In case of government agencies which are responsible for construction and maintenance of assets through public funds, performance measurement is essential to ascertain outcome of constructing a facility and also establish accountability of service provider in ensuring end user satisfaction (Gopikrishnan & Paul). It is essential in private sector too, to remain competitive and cost effective in construction businesses. In both cases performance measurement is essential whereas indicators may vary depending on the goals for measuring the performance (Nik Mat et al.,).

User Satisfaction

Jiboye mentions user satisfaction as one of the best means to evaluate outcome of any facility. Hasselaar noted that an indicator is a sign that points to a condition to be measured, in order to evaluate specific qualities and performances. Criteria for measuring performance of buildings should be derived from parameters that have direct bearing on the user satisfaction. Residential satisfaction is a reflection of the degree to which inhabitants feel that their housing is helping them achieve their goals. Existing studies carried out in Nigeria on public housing (Ukoha & Beamish, 1997; Olatubara &

Fatoye, 2007; Fatoye & Odusami, 2009; Ibem et al., 2012; Clement & Kayode, 2012) focus on general performance of public housing in meeting occupants' needs and expectations. In attempt to garner satisfaction of all categories of users on building performance, Kian et al., and Kim et al., suggested use of six BPIs viz. spatial comfort, indoor air quality, visual comfort, thermal comfort, acoustic comfort and building integrity. Meir et al., approached BPE as a concept based on user experience and emphasized on inclusion of occupant's physiological and psychological comforts. From these studies, it is established that physical characteristics of residential buildings have significant influence on occupant's satisfaction with their residential environment. Ibem et al., attempted to examine physical characteristics of buildings in public housing and assess residents' satisfaction with physical, spatial, location, aesthetic and cost attributes of buildings.

Building Performance Evaluation
Extensive research has been carried out on building performance evaluation in developed countries. In the past few decades, progress has been made in developing different evaluation tools and approaches (Kim et al; Khair et al). Main categories of approaches presented in more detail by Khair et al include functional suitability, quality assessment, serviceability, environmental performance, energy consumption, design, construction/services and post occupancy evaluation (POE) on technical, functional and behavioral aspects of buildings. Most of the research carried out in building performance is maintenance, energy, health and hygiene or purely technically oriented. Ho et al. identified eight key environmental qualities that contribute to occupant's health viz. density, air, light, noise, thermal comfort, drinking water, waste disposal and cleanliness. These environmental qualities were then translated into a list of building specific attributes that can possibly be measured objectively. However, the assessment remains uni-directional, occupant's health, limiting the outcome only to enhance occupant's health. Moreover, out of the fourteen user requirements listed in table 1 of ISO 6241-1984 (E), research focuses only on hygiene.

Aigbavboa and Thwala grouped different characteristics under physical and social factors. The types of attributes chosen to arrive at relative satisfaction indices (RSIs) laid more emphasis on building spaces. It does not include important requirements like safety, lighting, waste disposal, drainage, accessibility etc. Factors like amenities, neighborhood etc. does not find a mention in the grouping in order to arrive at user satisfaction. It leaves an area for improvement in research for in depth study of physical, functional, sociological and environmental aspects of buildings/occupants for holistic assessment and a true measure of user satisfaction.

Researchers have grouped various attributes together depending on purpose of evaluation. While measuring residential satisfaction in a housing colony, Mohammed and Azim grouped 46 attributes in four components viz. housing and physical features, services within housing area, public facilities provided and social environment within housing area. Gopikrishnan and Topkar have grouped 13 attributes together which indicate user satisfaction more on functional aspects from facility maintenance perspective. While assessing maintenance aspects of high rise buildings, Nik Mat et al. grouped 16 attributes in three heads viz. functional, technical and image characteristics. Ibem et al. listed 27 attributes under five factors while carrying out performance evaluation of residential buildings. Khalil et al. identified 19 attributes for building performance during POE of public buildings. Meng and Minouge used 11 indicators while measuring maintenance performance in buildings. Hashim et al. used 10 attributes in four heads namely space, comfort, serviceability and safety. There are other case studies available too (Olenrawaju et al.; Shohet) wherein performance of buildings is assessed based on number of factors.

Literature review revealed that researchers identify and group attributes to evaluate performance of buildings for different purposes. Whatever be the purpose of evaluation, the underlying factor is that the occupant needs to be satisfied. There may be a case in point where the evaluation can indicate high performance but occupant satisfaction remains low. As an example, a structurally and aesthetically appealing building built in an inaccessible area may be performing well as a building but may not satisfy the requirement of occupants. Hence, a requirement was felt to synchronize the building performance attributes according to user requirements and then evaluate those aspects from occupants' feedback which will truly reflect the building performance. This research paper is attempt in that direction and in order to standardize the list of user requirements, already available internationally accepted universal standard ISO 6241-1984 (E) has been taken as a reference point with respect to user requirements in a building.

It is feasible to link the user requirements/satisfaction to building performance attributes in order to formulate an effective intervention strategy with an overall aim to enhance user satisfaction (Gopikrishnan & Paul, 2017). It is possible for facility managers to identify and prioritize areas needing

intervention thereby accounting for his resources in terms of time, effort and money with user satisfaction being the scale.

User Requirement

Though many lists are available to describe user requirements, this paper has considered the internationally recognized universal standard ISO 6241-1984 (E) – Performance of Building Standards to arrive at the user requirements as datum. User requirements obtained from ISO 6241-1984 (E) is listed under in Table 1.

Table 1: User requirements listed in ISO 6241-1984 (E)

S No	User Requirement	Governing factors
1	Suitability of space	Number, size, geometry
2	Durability	Retention of performance
3	Tactility	Surface properties, roughness
4	Dynamic requirement	Maneuverability, ease of movement
5	Tightness	Water proofing
6	Stability	Resistance to static and dynamic actions
7	Fire safety	Risks of outbreak of fire
8	Safety in use	During use of building ie movement, circulation
9	Visual	Natural and artificial lighting
10	Hygro thermal	Control of temperature
11	Air purity	Ventilation
12	Acoustical requirement	Intelligibility of sound, noise control
13	Hygiene requirement	Facilities for cleaning, waste water, materials
14	Economic requirement	Capital, running and demolition costs

Building Performance Attributes

Based on the extensive literature review highlighted in preceding sections of this paper, seven factors were identified as building performance attributes (BPAs) essential to be measured to assess building performance. These BPAs are listed as under in Table 2.

Table 2: Building Performance Attributes (BPAs)

No	Building Performance Attribute	No	Building Performance Attribute
(a)	Spaces	(e)	Lighting
(b)	Physical Condition	(f)	Air, Noise and Water
(c)	Safety	(g)	Waste Disposal
(d)	Finishes, Fittings and Furniture		

USER REQUIREMENTS AND LINKAGE WITH BPAs

Table 3 brings out the suggested linkage between user requirements listed in ISO 6241-1984 (E) given in Table 1 above and the BPAs obtained through rigorous literature review listed in Table 2 above.

External Factors

Apart from the requirements/expectations from the building that a user occupies, there are certain other factors that influences user satisfaction namely the amenities that come along with the building and also societal pattern in the locality of residential complex. Location of the residential complex itself can be a factor to influence user satisfaction. In spite of a high quality construction, due to difficulty in access to the area, user satisfaction can get affected. Similarly, proximity to amenities like shops, walkways, parks, play areas, access to public transport, availability of adequate parking, uninterrupted electric and water supply etc. also need to be incorporated while obtaining user satisfaction. Though degree of congeniality and amenability of neighborhood, community participation etc. also influence user satisfaction, facility managers do not have any control over such factors. Care should be taken to ensure that feedback given by users do not get biased by societal requirements. Leaving out societal requirements may result in the effect of these factors getting distributed among other factors. Hence, it will be in order to garner the feedback on societal requirements too.

Table 3: Linkages of BPAs with user requirements

No	User Requirement	BPA influencing user requirement						
		Spaces	Physical Condition	Safety	Finishes, Fittings & Furniture	Lighting	Air, Noise and Water	Wastage Disposal
1	Suitability of spaces	✓			✓			
2	Durability		✓					
3	Tactile		✓					
4	Dynamic	✓	✓					
5	Tightness		✓					
6	Stability	✓	✓					
7	Fire Safety			✓	✓			
8	Safety in use			✓	✓			
9	Visual	✓	✓		✓	✓		
10	Hygrothermal						✓	
11	Air Purity						✓	
12	Acoustical	✓			✓		✓	
13	Hygiene		✓				✓	✓
14	Economic	Not considered in case of government residential accommodation from user angle						

Another major factor that influences user satisfaction is the degree of expectation which will depend on the understanding of the users with respect to his/her entitlement based on current official standing in case of government employees. In case of a government employee, it would be safe to mention that user satisfaction should be measured against what is provided in comparison with entitlement. In spite of being aware of entitlement and matching provisioning, if user satisfaction still remains low, it will provide an insight to policy makers regarding the growing aspirations of government employees.

GROUPING OF ATTRIBUTES
Building performance evaluation over the years in the form of POE or otherwise reveals two fold purposes viz. evaluation of construction and maintenance management. Such evaluation is also essential to implement knowledge of usability in construction of new projects and management of existing buildings (Lindahl *et al*., 2011). In all these cases, attributes identified and linked with user requirements are relevant. For tangible utilization of user satisfaction surveys, there is a need to group these user requirement linked BPAs with intervention strategies that enable the FM to focus on areas deserving priority. Intervention strategies for enhancement of user satisfaction are generally in terms of physical, environmental and external factors. Moreover, the intervention strategy as well as grouping should facilitate both FM as well as administrative managers of the locality to target holistic enhancement of user satisfaction. Table 4 presents grouping of the user requirement linked BPAs.

SUB ATTRIBUTES
This section explains what and why sub attributes are essential. Satisfaction level will be garnered from occupants of buildings through questionnaire in the form of user satisfaction surveys. Without adequate description of the BPAs, it will be extremely difficult for a user to comprehend the actual meaning of these attributes and may ultimately end up giving an arbitrary response. Similarly, there is likelihood that the participant answering the question may not exactly be able to perceive what the researcher means by the attribute. Being a layman, unaware of technical considerations involved, there is a chance of participant's response not in sync with reality. While asking for a feedback on attributes like Safety; Physical Condition; Spaces; Air, Noise and Water; Lighting; Finishes, Furniture, Fittings; and Waste disposal, these attributes need to be adequately amplified in the form of sub attributes, describing the characteristics of each attribute so that participants can provide a correctly comprehended feedback than guesswork. National Building Code issued by Bureau of Indian Standards, Government of India was referred to compile the characteristics of BPAs. Tables 5 below describe each attribute in the form of sub attributes and self-explanatory characteristic of each sub attribute (Gopikrishnan & Topkar). These attributes, sub attributes and description of characteristics of each sub attribute will form the basis of survey instrument that will be used for user satisfaction surveys. Building factors are the attributes that are directly related to building performance and external factors are those attributes not directly related to building performance but likely to have a bearing on user satisfaction (Gopikrishnan and Paul). On checking the necessity for amplification, 73% of an expert group comprising of facility managers, engineers, architects, academia, and consultants

agreed to the fact that amplification will definitely facilitate the respondents to comprehend the questionnaire better and provide appropriate inputs on user satisfaction (Gopikrishnan and Paul).

Table 4: Grouping of user requirement related BPAs

No	Factor	Attributes	User requirement
1	Physical	1.1 Spaces 1.2 Finishes, Fittings & Furniture	Suitability for spaces for specific use
		1.3 Physical Condition	Durability requirements Tactile requirements Dynamic requirements
		1.4 safety	Tightness requirements Stability requirements Fire safety requirements Safety in use requirements
2	Environmental	2.1 Lighting	Visual requirements
		2.2 Air, Noise and Water	Hygrothermal requirements Air Purity requirements
		2.3 Waste Disposal	Acoustical requirements Hygiene requirements
3	External	3.1 Societal	Community participation Congeniality of neighborhood
		3.2 Accessibility	Accessibility to public transport Location of building
		3.3 Amenities	Proximity to shops, walkways etc Parking, shops, recreational facilities etc

Table 5: Attributes amplified into sub attributes with description of characteristics

Sub Attribute	Description
Building Factors	
BF1 – Safety	
(a) Physical Safety	Provides safety against accidents due to falling, tripping etc
(b) Fire Safety	Adequate fire extinguishers, water sprinklers, fire alarms, ventilation etc
(c) Electrical Safety	Against electrical accidents due to loose fittings, wires etc
(d) Disinsection	Protects from insects in the form of mosquito proofing, Fumigation etc
BF2 – Physical Condition	
(a) Safety	That provides a feeling of safety
(b) Performance	Provides comfort in performing intended tasks
(c) Productivity	Indicates increase/decrease in productivity based on condition
(d) Psy Comfort	Provision for maintenance of roofs, walls, ceiling
(e) Maintenance	Impact of physical condition on the occupant
BF3 – Spaces	
(a) Space Adequacy	Should have adequate space to perform intended tasks
(b) Height Adequacy	Should have adequate height for ventilation and lighting
(c) Accessibility	All spaces should be easily accessible with stairs, ramps, lifts etc .
(d) Grouping	Avoid infructuous movement, promote efficiency and administration
(e) Redundancy	Space should not be redundant, unusable or more/less
BF4 – Lighting	
Uniformity	Uniformly lit to perform the tasks and improve performance
Control	Has easily accessible control to both natural and artificial lighting
Energy savings	Facilitates energy savings
Glare	Has proper shading devices to avoid glare
Maintenance	Facilitates easy access and handling for maintenance
BF5 – Air, Noise and Water	
(a) Air	Not be replete with automobile exhaust, other hazardous gases
(b) Noise	Control of external and internal noise with intelligibility of sound
(c) Water	Clean enough for earmarked purpose like drinking, washing etc
(d) Control	Has easily accessible control to both natural and forced ventilation
(e) Ventilation type	Has provision for forced ventilation also in the form of air conditioning
(f) Maintenance	Facilitates easy access for handling and maintenance
BF6 – Finishes, Furniture and Fittings	
(a) Finishes	The internal/external finishes should for an attractive appearance
(b) Concealment	The plumbing and wiring should preferably be concealed
(c) Furniture	Should have essential furniture to cater for intended purposes
(d) Fixtures	Fixtures in the rooms should serve their purpose
(e) Special fittings	For physically challenged people in toilets
BF7 – Waste Disposal	
(a) Adequacy	Should have adequate garbage bins, incinerators etc for disposal
(b) Cleanliness	Has a positive impact because of the hygiene and sanitation
(c) Drainage	Should be able to drain off water, avoid stagnation
(d) Sewage disposal	Efficiency in which sewage and sullage of building is disposed off

External Factors
EF1 – Accessibility
(a) Access   The facility should be easily accessible for the occupants/users
(b) Comfort   Should be wide enough and comfortable for vehicles/pedestrians
(c) Location   Proximity to shops, walkways, play areas, parks and other amenities
EF2 – Amenities
(a) Open spaces   Adequate open spaces should be available for the users/occupants
(b) Parking   Adequate and clearly marked parking with ingress/egress
(c) Security   Against theft, burglary, crime rate in the area etc
(d) Traffic safety   In the form of barriers, speed breakers etc on the internal roads
(e) Connectivity   Telephone and internet connections should be available in the facility
EF3 – Societal Issues
(a) Neighbourhood
(b) Social Status
(c) Education   Similar to the occupant
(d) Religious Spaces
(e) Financial Status

RESULTS AND FINDINGS
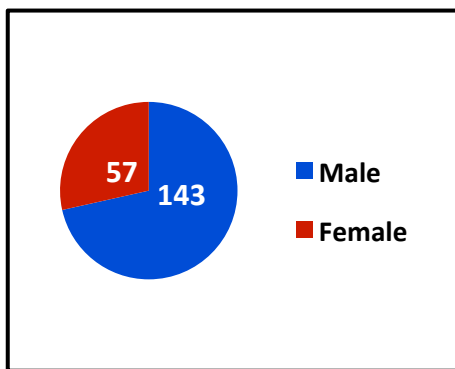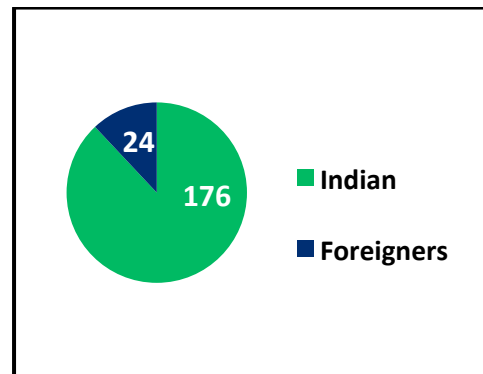

Fig 2(a): As per Gender
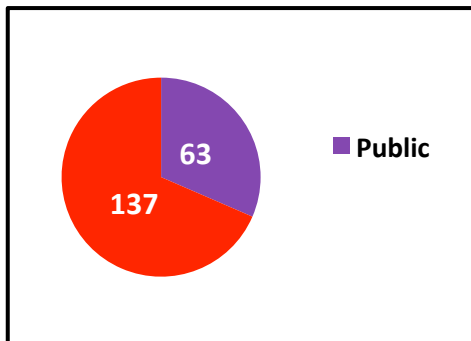

Fig 2(b): As per Location
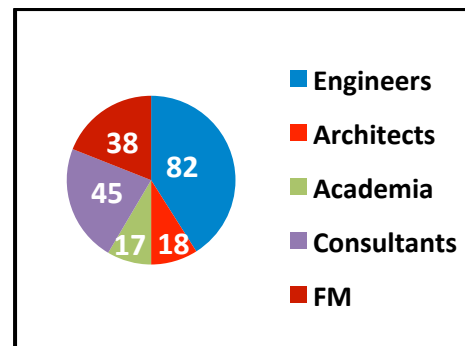

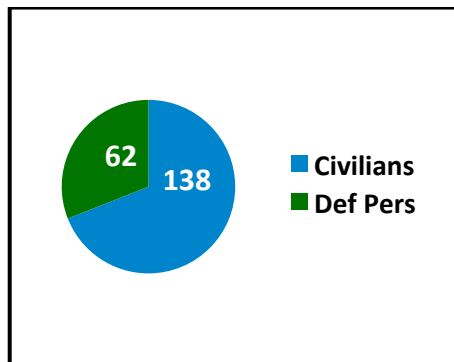**Fig 2(c): As per Sector**

Fig 2(d): As per Profession

Fig 2(e): As per Category

Responses

Responses that were garnered through user satisfaction survey were grouped as per Gender, Location, Sector, Profession and Category. The charts depicted in Fig 2(a) to 2(e) give an idea on wherefrom these responses were received. These grouping enabled comparisons to check for consistencies of responses among various groups during data analysis

Queries on Attributes and Sub Attributes
Two questions were asked to the experts. One was whether these attributes are adequate enough to represent the building performance reflecting user requirements. Second question was whether it was required to amplify the attributes in the form of sub attributes in the survey instrument to enable better comprehension of the attributes. For the query on adequacy of attributes, 168 participants, i.e. 84% agreed that the attributes are adequate to represent user requirement related BPAs as shown in Fig 3 (a) below. Out of the 13 responses who have not agreed on the adequacy of attributes, only four of them gave reasons for inadequacy. While one response suggested 'Vaastu Sastra' be added as an attribute, one suggested adding 'Architectural aspects' like façade etc. as an attribute. One of the respondents was of the opinion that Age, Sex, Demographic factors were missing, though it was not the case. One respondent commented that importance of attributes can be different for different scenarios. However, the 19 responses who couldn't respond did not have any specific answers for the same.
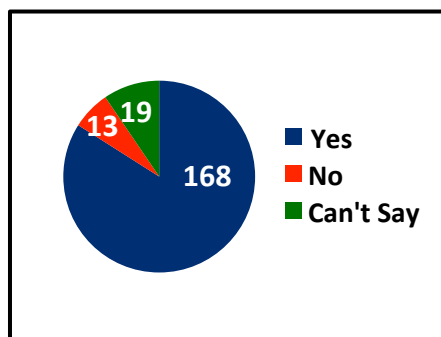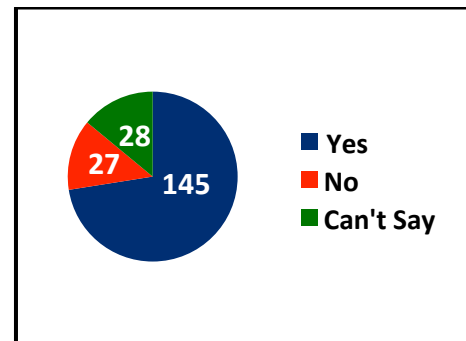

Fig 3(a): Response on Adequacy

Fig 3(b): Response on Amplification

QUESTIONNAIRE FOR USER SATISFACTION SURVEY
Based on the attributes and sub attributes identified, a questionnaire was formulated for conduct of user satisfaction survey in residential areas. A likert scale of 1 to 5 was uniformly adopted for the seven attributes directly related to building performance. Dichotomous questions were used for the external factors to understand the perception of occupants with respect to external factors i.e. Accessibility, Amenities and Societal issues. Questions have been appropriately worded in a manner the participant can clearly comprehend what the researcher is exactly asking and can convey the best possible unambiguous feedback. The ratings instead of being numbered from 1 to 5 have been labeled specific to the nature of the opinion likely to be endorsed by the respondent.

The questionnaire has been divided into four sections. Section I covers the personal details, Section II the ratings in a likert scale of 5 for seven attributes directly related to building performance. Section III lists the external factors with dichotomous questions and finally Section IV has a space for endorsement of additional comments in case the respondent likes to endorse. The format of questionnaire is enclosed as an annexure to this paper.

Pilot Survey
A pilot survey was undertaken to validate the questionnaire. One of the residential colonies of a military station was chosen for the pilot survey. The occupant profile was studied and sampling was carried out as per stratified random sampling technique. The questionnaire was administered to a sample size of 100 (n) among Officers, Junior Commissioned Officers and Other Ranks. The questionnaire was physically distributed to all participants. The content of the questionnaire was explained to the respondents by the survey team in english and local vernacular language as understood by the respondents. The exercise was carried over a period of 3 days. On collection and initial screening of data, 26 responses out of 100 were found with minor errors which were rectified by revisiting the residential accommodation of the respondents.

Data Analysis

XLSTAT 2014 was used to analyze data. Preliminary checks were conducted to find blank pages, blank columns, and any specific pattern in responses. Errors in measurement for types I and II errors were checked and found appropriate. Once the data were prepared for analysis, the following analysis with respect to Section II of questionnaire was conducted to ensure translation, construct, and reliability validation of the questionnaire.

Translational Validity

Under Translational validity, content validity and face validity were checked. Content validity is examined to ascertain whether the content of the questionnaire is appropriate and relevant to the study. Content validity indicates that the content reflects a complete range of attributes under study and is usually verified by seven or more experts. In the present case, a list of these attributes was discussed with construction industry experts, including architects, engineers, consultants, and academicians and facility managers. 84% agreed that the attributes are adequate enough and 73% agreed that amplification of attributes in the form of sub attributes shall be useful. The face validity was determined by examining the ease in which the respondents answered the questionnaire. Feasibility, readability, and word clarity were considered during the framing of the questionnaire. Instructions enabled the respondent to easily understand the contents of each section. The layout and style of the questionnaire provided comfort to the participant while answering the questions.

Table 6: Results for construct validity

Test	Purpose	Range	Result
KMO correlation coefficient	Sample Adequacy	0.5-0.7 = Mediocre 0.7-0.8 = Good 0.8-0.9 = Great >0.9 = Superb	>= 0.7 for all attributes
Eigen Value	Factor Relevance	>1	>1 for all attributes
Factor Loadings	Correlation	>0.5	>0.5 for all attributes
Cronbach Alpha	Reliability	Minimum 0.7	>0.7 for all attributes

Construct Validity

Construct validity of the questionnaire was ascertained by conducting a confirmatory factor analysis of the collected data. XLSTAT 2014 was the software used to generate the output, based on which a conclusion could be made regarding the construct validity of the questionnaire. The results obtained on confirmatory factor analysis are listed above as Table 6.

CONCLUSIONS

The research has been successful in garnering opinion of a select group of experts comprising of facility managers, engineers, architects, academia and consultants in finding consensus with respect to the identified attributes representing user requirement. On completion of the development and validation of the questionnaire, it could be concluded that the survey instrument was largely effective and could be applied for a full-scale user satisfaction survey. The response rate in the pilot survey is 100% as survey was conducted by physically distributing questionnaires to known occupants in government residential accommodation. Direct interaction of the researcher with the respondents has ensured the quality of the feedback. Moreover, apprehension about lengthiness of the questionnaire was unfounded because most respondents did not complain. It is necessary to ensure adequate time for the survey. A vernacular questionnaire with appropriate translation will be quite useful so that responses remain consistent. If the questionnaire is to be sent by email or the feedback is to be obtained remotely, then a vernacular questionnaire is considered to be an essential requirement.

The pilot survey has allowed the credibility of questionnaires for further applicability to be established in a full-scale user satisfaction survey for building performance evaluation. In this study, a pilot survey was conducted on a residential colony in a military station to elicit user satisfaction on building performance. Hence, the attributes, their characteristics, and formulation of questions were determined for this purpose. However, the methodology for designing a questionnaire remains the same for any type of facility. The ethical concerns need to be addressed during conduct of such user surveys. The limitation to this research is that the scope is confined to residential buildings of government/public sector. As a future scope, in case different layers of attributes are added with the present set being core attributes, the questionnaire too can be modified accordingly and extended to other facilities and other construction agencies too. Also as a further scope, an index can be

formulated based on the weights for each attribute/sub attribute. Effectiveness or otherwise of the intervention strategy implemented by the FM agency can be checked pre and post implementation of intervention strategy through the change in index.

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ANNEXURE

QUESTIONNAIRE FOR USER SATISFACTION

INSTRUCTIONS

(a) The questionnaire has four sections	**(b) Please fill details as asked for in Section I**
(c) Fill ratings by ticking the shaded boxes on the right hand side	**(d) Indicate Yes or No in Section III**
(e) Provide additional comments if any, in Section IV	

SECTION I – PERSONAL DETAILS

Date:	**Loc:**	**House No:**
Rank:	**Name:**	**Unit:**

SECTION II - RATINGS

1-SAFETY – Provisions in the building other than structural safety

(a) Physical Safety – Safety against slipping, tripping, falling from windows and terraces

Highly Safe		Quite Safe		Barely Safe		Unsafe		Highly Unsafe	

(b) Fire Safety – Adequacy of arrangements for safety against fire – Equipment, Water, Escape routes

Highly Adequate		Quite Adequate		Barely Adequate		Inadequate		Highly Inadequate	

(c) Electrical Safety – Condition of switches, wiring and electrical fitments

Excellent		Very Good		Good		Bad		Very Bad	

(d) Dis-insection – Provisions for mosquito proofing, fly proofing and protection against insects

Highly Adequate		Quite Adequate		Barely Adequate		Inadequate		Quite Inadequate	

2-PHYSICAL CONDITION – Structural Condition of the building

(a) Safety – Structural safety based on appearance of the building

Highly Safe		Quite Safe		Barely Safe		Unsafe		Quite Unsafe	

(b) Performance – Comfort level the building provides in performing designated tasks in various rooms

High Comfort		Sufficient Comfort		Bare Comfort		Discomfort		High Discomfort	

(c) Productivity – Impact the condition of the building has on productivity

Highly Positive		Quite Positive		Barely Positive		Negative		Highly Negative	

(d) Psychological Comfort – Psychological impact of the building condition on you

Highly Positive		Quite Positive		Barely Positive		Negative		Highly Negative	

(e) Maintenance – Attention that the physical condition of the building needs now

Least		Little		Regular		Urgent		Most Urgent	

3- SPACES – Spaciousness and grouping of the rooms in the building

(a) Space Adequacy – To perform intended tasks and moving space

Highly Adequate		Quite Adequate		Barely Adequate		Inadequate		Highly Inadequate	

(b) Height Adequacy – Sufficient for air circulation, easy movement and preventing echo

Highly Adequate		Quite Adequate		Barely Adequate		Inadequate		Highly Inadequate	

(c) Accessibility – Good Layout and easy access to all spaces in the building

Very Easy		Quite Easy		Barely easy		Difficult		Very Difficult	

(d) Grouping – Provision for privacy and minimize infructuous movement

Excellent		Very Good		Good		Bad		Very Bad	

(e) Redundancy – Any part of the building unusable/waste of space

No Redundancy		Little		Very Little		High		Very High	

4-FINISHES, FIITINGS & FURNITURE - Effectiveness of finishes, fittings and furniture

(a) Finishes – Internal and External appearance of the building

Excellent		Very Good		Good		Bad		Very Bad	

(b) Concealment – Concealment of internal plumbing and electric wiring and other conduits

Highly Adequate		Quite Adequate		Barely Adequate		Inadequate		Highly Inadequate	

(c) Furniture – Adequacy of built in and movable furniture for performance of intended tasks of spaces

Highly Adequate		Quite Adequate		Barely Adequate		Inadequate		Highly Inadequate	

(d) Fixtures – Adequacy, Elegance and Effectiveness of fittings and fixtures

Highly Adequate		Quite Adequate		Barely Adequate		Inadequate		Highly Inadequate	

(e) Special Fittings – That caters for specially abled occupants in the building

Highly Adequate		Quite Adequate		Barely Adequate		Inadequate		Highly Inadequate	

5-Air, Noise, Water – Quality of Air, Noise and Water in the building

(a) Air Quality – Sufficiency of air in quantity and quality for respiration, thermal comfort and freshness

Highly Sufficient		Quite Sufficient		Barely Sufficient		Insufficient		Highly Insufficient	

(b) Water Quality – Sufficiency of water quality for consumption

Highly Sufficient		Quite Sufficient		Barely Sufficient		Insufficient		Highly Insufficient	

(c) Noise - Comfort level of noise in the interiors of the building

High Comfort		Sufficient Comfort		Bare Comfort		Discomfort		High Discomfort	

(d) Control – Easy access of controls for ventilation

Very Easy		Quite Easy		Barely easy		Difficult		Very Difficult	

(e) Maintenance – Degree of ease for access and handling for maintenance

Very Easy		Quite Easy		Barely easy		Difficult		Very Difficult	

(f) **Type** – Adequacy of provision for both types of ventilation – Natural and Forced

Highly Adequate		Quite Adequate		Barely Adequate		Inadequate		Highly Inadequate	

6-LIGHTING – Illumination provided in various areas of the building

(a) Uniformity – uniformity of illumination in all spaces of the building

Highly Uniform		Quite Uniform		Barely Uniform		Un Uniform		Highly Un uniform	

(b) Control – Accessibility of controls to lighting

Highly Accessible		Quite Accessible		Barely Accessible		Inaccessible		Highly Inaccessible	

(c) Energy Savings – Efficiency of the provisions with respect to energy savings

Highly Efficient		Quite Efficient		Barely Efficient		Inefficient		Highly Inefficient	

(d) Glare – Effect of glaring of illumination on eyes

No Glaring		Barely Glaring		Little Glaring		Glaring		Highly Glaring	

(e) Maintenance – Degree of ease of handling for maintenance

Very Easy		Quite Easy		Barely easy		Difficult		Very Difficult	

7-Waste Disposal – State of Sewage and Drainage

(a) Sewage – Adequacy of sewage arrangement to drain off sewage from the building

Highly Adequate		Quite Adequate		Barely Adequate		Inadequate		Highly Inadequate	

(b) Cleanliness – Efforts to keep the sewage and drainage lines clean

Highly Adequate		Quite Adequate		Barely Adequate		Inadequate		Highly Inadequate	

(c) Drainage – Adequacy of drainage to drain off rain water and avoid stagnation

Highly Adequate		Quite Adequate		Barely Adequate		Inadequate		Highly Inadequate	

(d) Adequacy – Provision of garbage bins, Dust Bins and Incinerators for disposal of waste from building

Highly Adequate		Quite Adequate		Barely Adequate		Inadequate		Highly Inadequate	

SECTION III – EXTERNAL FACTORS

8-ACCESSIBILITY

	Yes		No	
(a) Access - Easy access to the building premises to the occupants	Yes		No	
(b) Comfort - Access comfortable enough to allow for vehicles and pedestrians	Yes		No	
(c) Staircases - Adequate and comfortable stairs to allow access to all floors	Yes		No	
(d) Location - Stairs/Lifts ideally located to avoid infructuous movement	Yes		No	
(e) Ramps - Provision of ramps for easy access of special people	Yes		No	
(f) Access - Easy access to the building premises to the occupants	Yes		No	
(g) Maintenance - Easy all round access to the building premises to the occupants	Yes		No	

9-AMENITIES

(a) Open Spaces - Adequate open spaces in the vicinity of the building	Yes		No	
(b) Parking - Sufficient parking spaces for two/four wheelers	Yes		No	
(c) Security – The locality is free of theft, burglary and related crimes	Yes		No	
(d) Traffic Safety - Adequate road signs and related appurtenances for road safety	Yes		No	
(e) Connectivity – Good Telephone and Internet connectivity	Yes		No	

10-SOCIETAL ISSUES

(a) Neighborhood - Congenial neighborhood	Yes		No	
(b) Social Status - Compatible social status amongst the occupants	Yes		No	
(c) Education - Comfortable education level facilitating pleasant interaction	Yes		No	
(d) Religious Spaces - Caters to the all types of religious requirements of occupants	Yes		No	
(e) Financial Status- Compatible financial status enabling comfortable co-existence	Yes		No	

SECTION IV – ADDITIONAL COMMENTS IF ANY

Signature:	**Contact No:**