Methodology Paper on Study And Assessment For Damages And Maintenance Management of Residential Apartment In Pune City

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Abstract- *This paper describes the methodology used to ensure that this study conforms to the objectives that have been outlined. The topics covered in this paper are project design, descriptions of project instruments and data collection procedures, and the techniques employed for statistical analysis in this study.*

In a general sense, the analysis methodology is the steps or the sequence of work involved from the beginning of the study till the completion of the ultimate report. From the information obtained through the literature review, the questionnaire is then developed and distributed to the targeted participants. The targeted participants of the survey comprised primarily of people who are concerned about construction projects in their daily lives.

Afterward, the data obtained from the questionnaires is analyzed and their inferences are given. This will be followed by the discussions and suggestions and eventually, conclusions are drawn to conclude the study. The prepared questionnaire, its measure and method of analysis is also discussed in the paper.

Keywords- Maintenance, Damage, Building Construction, etc.

I. INTRODUCTION

The project design is defined as how the study is designed to achieve its objectives. Project design starts with a topic selection and is then followed by data collection methods, measurement procedures, and questionnaire design and data analysis. This study adopted questionnaire, the most common qualitative data collection method, to measure the adoption of damages & maintenance management of apartment buildings and the correlation to project performance in the construction organizations.

II. PROJECT INSTRUMENT

A structured survey questionnaire was employed consisting for 4 parts namely; general information about the Organization & Respondent's background, Building Information, Damage of various Building Components, Factors affecting Building Defects & Failures, Overview of Building Maintenance Management.

Based on an extensive literature review of building damages & maintenance of apartment buildings that influence the performance of projects conducted by the construction organizations, a questionnaire was developed. All of the variables identified were ensured to be ambiguous and captured the major theoretical construct of interests. Likert's scales were adopted because it highly represents the likelihood and the accuracy of the respondents' responses and it yields higher reliability coefficients with fewer items. In the study of Likert's, the reliability of the entire scale is maximized when the respondent answer by the means of a 4-point scale. Hence, this study adopted the 4-point Likert's rating scale. Responses for scales measuring the building components damages were recorded using the 4-point Likert's rating scale with a level of agreement of, (1) undamaged, (2) slight damage, (3) considerable damage, (4) severe damage.

1	2	3	4
Undamaged	Slight damage	Considerable damage	Severe damage

Figure 1 – Likert's Scale used for this Study

III. METHOD OF DATA COLLECTION

The survey questionnaire was sent to the top management of the organization such as managers, project managers, and quality managers, as they would have been involved in the strategic decision-making and management of the organizations. A cover letter explaining the objectives, significance, and details of the study, attached with a consent

form and survey questionnaire were sent to the respondents. The consent form was to seek participation approval, and at the same time, the confidentiality of every individual response was assured.

A sample of building case studies data collection sheet is as shown below. This sheet needs to be filled by the management or quality engineer at the site or organization who is aware of all the details regarding the organization. Data collection process is to be carry out by taking into account some basic information regarding the organization such as name of organization, name of owner, address of organization, turnover of organization, height of building which is to be considered as a case study for project work etc.

QUESTIONNAIRE MEASURE

The questionnaire is measured based on a 4-point Likert's Scale for Section-C i.e. damage of various building components in which 1 for severe damage to 4 for undamaged. Then Section-D is governing factors affecting building defects & failures in which a 5-point Likert's scale is used having 1 for strongly disagree to 5 for strongly agree. Overview of building maintenance management i.e. Section-E is having Yes-No-NA type questions.

1	2	3	4	5
Strongly Disagree	**Disagree**	**Neutral**	**Agree**	**Strongly Agree**

Figure 2- Likert's Scale used for This Study

The rating scale used for the questionnaire is;

1 = Strongly Disagree
2 = Disagree
3 = Neutral
4 = Agree
5 = Strongly Agree

DESCRIPTIVE STATISTICS

Simple descriptive statistics involving mean and variance can be used for construct validation in a questionnaire. Item mean and item standard deviation were applied to test whether the items in each hypothesized grouping contain approximately the same proportion of information about the construct being measured. It is also used to examine whether the items have roughly equal standard deviations, such that they contribute equally to the total scale score. In other words, items should have roughly equivalent means and standard deviations within a Likert scale, respectively. Likert scale is a subjective scoring system that allows respondents to quantify how much they agree with the point .of view in the item.

Since we are measuring how widely a set of scores is dispersed about the mean we are measuring variability. We can calculate the deviations about the mean, and express it as standard deviation. Standard deviation measures variability within a distribution. Standard deviation is a number that indicates how much, on average, each of the values in the distribution deviates from the mean (or center) of the distribution.

SAMPLE CALCULATIONS

The Weighted Mean formula is given as:

$$\text{Weighted Mean} = \frac{\Sigma\,(\mu * n)}{N} = \frac{1\,\mu_1 + 2\,\mu_2 + 3\,\mu_3 + 4\,\mu_4 + 5\,\mu_5}{N}$$

Where,
μ is the weightage given to each factor by the respondents;
n is the frequency of the respondents;
N is the total number of respondents.

I.D.	Likert's Scale	Responses (X)	Total	$Mean_w$	Std. Dev.	Relative Weight (%)
D-1	1	2	25	3.56	4.53	71.2
	2	3				
	3	3				
	4	13				
	5	4				

Figure 3- Sample Calculations for Mean, Standard Deviation & Relative Weight

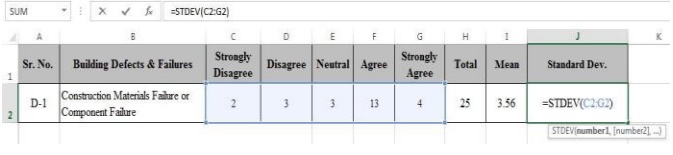
Where,
μ_1=2, μ_2=3, μ_3=3, μ_4=13, μ_5=4
N = 2 + 3 + 3 + 13 + 4 = 25

Calculations:

$$Mean_w = \frac{1*2 + 2*3 + 3*3 + 4*13 + 5*4}{25} = \frac{89}{25} = 3.56$$

Therefore, the weighted mean is found to be **3.56**

Then the standard deviation is calculated using directly with Microsoft excel as follows:



=STDEV(C2:G2)=4.53

Sr. No.	Building Defects & Failures	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	Total	Mean	Standard Dev.
D-1	Construction Materials Failure or Component Failure	2	3	3	13	4	25	3.56	4.53

Therefore, the standard deviation is found to be 4.53

Also the relative for each factor was calculated using the formula:

Relative Weight = (Mean ÷ 5) × 100
For factor D-1 i.e. Construction Materials Failure or Component Failure, Relative weight will be:
Relative weight = (3.56/5)*100 = 71.2 %
Therefore, the relative weight is found to be 71.2%

VI. SUMMARY

In this paper the questionnaire survey design and methodology employed in meeting the research objectives set was discussed in detail. At first the chapter starts with an introduction. Then project design was outlined, in which it was explained that for the purpose of the analysis of this study, questionnaire survey was chosen as it is the most common qualitative data collection method. Then project instrument was mentioned in detail which shows that the questionnaire will use the Likert Scale for collecting responses. Next was data collection process in which a sample of questionnaire format was shown. The questionnaire was divided into 5 sections namely general information about the organization, respondent's profile, damage of various building components, governing factors affecting building defects & failures, overview of building maintenance management. Section-C uses 4-point Likert's scale, Section-D uses 5-point Likert's scale; Section-D asks Yes/No/NA type questions. Then questionnaire measure was explained. Finally, descriptive statistics was outlined and sample calculations were shown.

From the above mentioned, a conclusion can be made that the methodology outlined was appropriate for addressing the objectives of the research. The findings, as well as the results of the methodology discussed in this section, will be presented in the next paper.

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