Report on the Factor Analysis of Factors Affecting the Maintenance Management of Building as per Stakeholders, Developers and Consultants.

Ajinkya Sanjay Shinde[1], Prof. R. S. Kognole[2], Prof. N. P. Khatmode[3]

[1] *M.E. Construction Management Student, Department of Civil Engineering, BSCOER, Maharashtra, India*
[2] *Assistant Professor, Department of Civil Engineering, BSCOER, Maharashtra, India*
[3] *Assistant Professor, Department of Civil Engineering, BSCOER, Maharashtra, India*

ABSTRACT

The results of an experimental and numerical analysis of research aimed at identifying the components that cause building maintenance concerns in order to establish a plan for optimal residential building maintenance are presented in this paper. Building Maintenance Management Stakeholders were given a questionnaire survey to complete for the project. The Stakeholders rated the impact of essential factors from relevant literatures on the upkeep of such facilities. The Relative Importance Index (RII) was used to estimate the significance of each factor based on the respondents' judgments using IBM SPSS Software.

Keywords: *Maintenance Management, Stakeholders, Relative Importance Index (RII)*

I. INTRODUCTION

The existing management methods of maintenance contractors do not meet the current construction environment in a country like India, and there is a general lack of understanding about the necessity of maintenance work. Building a house appears to be easier than maintaining it, and in today's building sector, maintenance is considered non-urgent when compared to new projects.

In contrast to repair and maintenance operations, consultants and contractors are now participating in new initiatives. Building upkeep is essential for infrastructure development's long-term survival. The building's operations and other activities will rely on it. The term "maintenance" refers to a set of technical and related tasks aimed at retaining or returning a component to a working state. To work as efficiently and effectively as possible over time, buildings must be properly maintained. Future risks, budgetary constraints, and an interruption in service delivery to users would occur from the building deteriorating due to a lack of upkeep. Detecting building concerns will help to maintain construction quality and facility efficiency. The goal of this research is to better understand the views of users and stakeholders on building maintenance management, as well as to identify the key elements that influence the problem. This paper covers the study's stakeholder component.

II. METHODOLOGY:

In this work we conducted a questionnaire survey and sent it to the Stakeholders of the Maintenance Management in the building industry like consultants, developers, property owners and others who are actual stakeholders of the property through various electronic mediums like WhatsApp, etc.
The acquired data was then translated into a quantitative format, and the IBM SPSS Software Tool was used to do Factor Analysis on it (Statistical Package for Social Science)
We calculated the Relative Importance Index (RII) of the components discovered in the study after we completed the analysis, and then we estimated the relevance of the factors impacting Building Maintenance Management.

III. DATA COLLECTION:

A literature study of various research publications was used to build the questionnaire survey for this project. The Google Forms questionnaire was created and circulated online, with responses recorded.
This data will state point of view of different stakeholders which would increase the authenticity of our research data
The Google form that was used to conduct the study's questionnaire survey is linked below.

Link: https://docs.google.com/forms/d/e/1FAIpQLSedlY8KPl-ZHYLATf8tQaXJ4KmEL0q9a8QAdUVe2Mm5at9Xxg/viewform?usp=sf_link

IV. DATA ANALYSIS:

The data collected was converted into readable numeric form and analyzed by Factor Analysis in the IBM SPSS Software Tool version 21 (Statistical Package for Social Science version 21)

As follows :

…(P.T.O.)

❖ Factor analysis results for stakeholders, developers and consultant

Correlation Matrix[a,b]

		Moisture	Qualityofmaterials	Designcomplexity	ChemicalagentsAlkalisandChlorides	Heavyrains	Wearandtear	BiologicalagentsFungiInsects	BuildingArchitecture
Correlation	Moisture	1.000	.408	.489	.503	.136	.586	.560	.102
	Qualityofmaterials	.408	1.000	.614	.282	.045	.478	.150	.136
	Designcomplexity	.489	.614	1.000	.440	-.143	.631	.060	.520
	ChemicalagentsAlkalisandChlorides	.503	.282	.440	1.000	.280	.627	.503	.176
	Heavyrains	.136	.045	-.143	.280	1.000	.158	.082	-.077
	Wearandtear	.586	.478	.631	.627	.158	1.000	.230	.687
	BiologicalagentsFungiInsects	.560	.150	.060	.503	.082	.230	1.000	-.251
	BuildingArchitecture	.102	.136	.520	.176	-.077	.687	-.251	1.000
	Geographicallocationandsitelocation	.273	.301	.196	.189	.409	.213	.278	-.255
	Ageofthebuilding	.483	.750	.308	.243	.396	.206	.269	-.321
	Nonuseofbuildingafterconstruction	.081	.219	.614	.056	-.363	.478	-.452	.686
	Faultyconstructionpractices	.105	.408	.225	.073	.160	.123	-.065	-.060

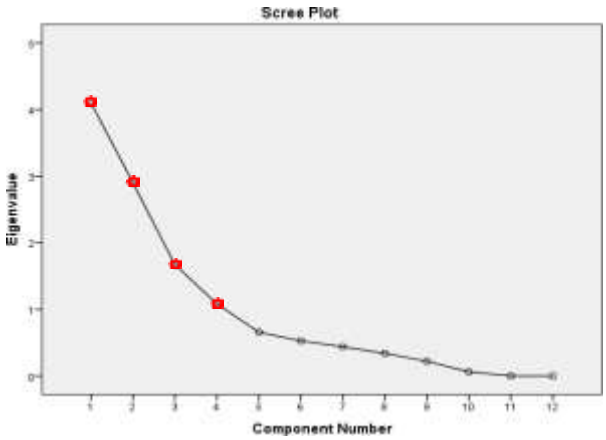
Geographicallocationandsitelocation	Ageofthebuilding	Nonuseofbuildingafterconstruction	Faultyconstructionpractices
.273	.483	.081	.105
.301	.750	.219	.408
.196	.308	.614	.225
.189	.243	.056	.073
.409	.396	-.363	.160
.213	.206	.478	.123
.278	.269	-.452	-.065
-.255	-.321	.686	-.060
1.000	.575	-.028	.524
.575	1.000	-.276	.658
-.028	-.276	1.000	-.094
.524	.658	-.094	1.000

Communalities	Initial	Extraction
Moisture	1.000	.738
Qualityofmaterials	1.000	.771
Designcomplexity	1.000	.839
ChemicalagentsAlkalisandChlorides	1.000	.724
Heavyrains	1.000	.901
Wearandtear	1.000	.901
BiologicalagentsFungiInsects	1.000	.883
BuildingArchitecture	1.000	.872
Geographicallocationandsitelocation	1.000	.609
Ageofthebuilding	1.000	.935
Nonuseofbuildingafterconstruction	1.000	.860
Faultyconstructionpractices	1.000	.723

Extraction Method: Principal Component Analysis.

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	4.102	34.183	34.183	4.102	34.183	34.183	3.034	25.280	25.280
2	2.901	24.176	58.359	2.901	24.176	58.359	2.835	23.622	48.902
3	1.671	13.924	72.284	1.671	13.924	72.284	2.580	21.497	70.400
4	1.081	9.011	81.295	1.081	9.011	81.295	1.307	10.896	81.295
5	.657	5.472	86.767						
6	.526	4.386	91.154						
7	.438	3.653	94.807						
8	.339	2.829	97.635						
9	.220	1.836	99.472						
10	.062	.518	99.990						
11	.001	.010	100.000						
12	-1.002E-013	-1.017E-013	100.000						

Total Variance Explained



None of the variables in the communality table above have a community value of less than 0.5.

Extraction Method: Principal Component Analysis.

*Component Matrix*a*

	Component			
	1	2	3	4
Wearandtear	.791	.426	-.203	.229
Qualityofmaterials	.761		.328	-.291
Designcomplexity	.752	.467	.136	-.193
Moisture	.745		-.374	-.201
Ageofthebuilding	.690	-.582	.325	-.122
ChemicalagentsAlkalisandChlorides	.663		-.505	.172
Geographicallocationandsitelocation	.531	-.472	.258	.195
Nonuseofbuildingafterconstruction	.251	.852	.265	
BuildingArchitecture	.290	.834		.305
BiologicalagentsFungiInsects	.397	-.419	-.685	-.285
Faultyconstructionpractices	.455	-.348	.627	

Heavyrains	.265	-.468		.779

Extraction Method: Principal Component Analysis.

a. 4 components extracted.

*Rotated Component Matrix*a*

	Component			
	1	2	3	4
BuildingArchitecture	.908	-.206		
Nonuseofbuildingafterconstruction	.874		-.167	-.258
Wearandtear	.747	.159	.522	.210
Designcomplexity	.716	.394	.335	-.242
Ageofthebuilding	-.155	.901	.293	.112
Faultyconstructionpractices		.827	-.147	.133
Qualityofmaterials	.316	.737	.290	-.209
Geographicallocationandsitelocation		.668	.158	.364
BiologicalagentsFungiInsects	-.336		.877	
Moisture	.194	.281	.788	
ChemicalagentsAlkalisandChlorides	.287		.740	.300
Heavyrains	-.105	.207	.106	.914

Extraction Method: Principal Component Analysis. Rotation Method: Varimax with Kaiser Normalization.

Rotation converged in 5 iterations.

Component Transformation Matrix

Component	1	2	3	4
1	.460	.630	.613	.128
2	.845	-.415	-.145	-.304
3	.145	.642	-.744	-.118
4	.230	-.140	-.224	.937

Extraction Method: Principal Component Analysis. Rotation Method: Varimax with Kaiser Normalization

V. CONCLUSION:

From the above analysis of the factor loadings in **stakeholder, developer and consultant data** obtained for underlying factors through factor and descriptive analysis it can be determined that factors such as **age of building, quality of materials, faulty construction practices, moisture and wear and tear of buildings** had the major responses from the stakeholders, developers and consultants and are the **4 factors** which majorly contribute in affecting the effective maintenance of buildings.

REFERENCES:

1. Michael A. Lacasse, Abhishek Gaur and Travis V. Moore (2020) Durability and Climate Change—Implications for Service Life Prediction and the Maintainability of Buildings published in National Research Council Canada, Construction Research Centre building 10, 53
2. Onur Avci et.al (2020) A review of vibration-based damage detection in civil structures: From traditional methods to Machine Learning and Deep Learning applications; Elsevier 147 (2021) 107077
3. Olanrewaju Abdul Lateef, A et.al (2020) Systemic building maintenance management for Malaysian University Campuses: An Analytical Analysis; Department of Civil Engineering, University Technology PETRONAS, Malaysia
4. Yasir Shaikh et.al (2018) A Case Study of Existing Institutional Building for Assessment and Repair; International Journal of Science and Research (IJSR) ISSN: 2319-7064
5. Aliyu Ahmad Aliyu et.al (2016) an assessment of building maintenance management practice for abubakar tafawa balewa university teaching hospital, bauchi; Research gate publication/320173109
6. N. Ahzahar et.al (2011) A Study of Contribution Factors to Building Failures and Defects in Construction Industry; Procedia Engineering 20 (2011) 249 – 255 https://doi.org/10.1016/j.proeng.2011.11.162
7. Shirley Jin Lin Chua et.al (2018) Building Maintenance Practices towards the Common Defects and Resident's Satisfaction of Elderly Homes; Journal of Design and Built Environment · June 2018
8. Ng Ban Kiong et.al (2013) Analysis of Building Maintenance Factors for IBS Precast Concrete System; International Journal of Application or Innovation in Engineering & Management (IJAIEM) Volume 2, Issue 1, January 2013
9. Isaac Ofori et.al (2015) Establishing Factors Influencing Building Maintenance Practices: Ghanaian Perspective; Journal of Economics and Sustainable Development ISSN 2222-1700 (Paper) ISSN 2222-2855 (Online) Vol.6, No.24, 2015
10. Seth Emmanuel Allotey (2014) An Evaluation of the Impact of Defects in Public Residential Buildings in Ghana; Civil and Environmental Research ISSN 2224-5790 (Paper) ISSN 2225-0514 (Online) Vol.6, No.11, 2014