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A Study on Eco-friendly Building Management with Respect to Feasibility of Implementation

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Abstract*: The purpose of the study is to examine the factors affecting the eco-friendly building management with respect to feasibility of implementation. A cross sectional research on 487 citizens and 500 students through questionnaire method and analysed using SPSS software. The population of study consists of resident's views on eco-friendly building management in Kochi. The study was conducted during the period of October 2016 to January 2017. This study identified five dimensions of eco-friendly building management such as public interests, environmental impact, economy, material management and water and energy management. Furthermore, this study confirmed that there is significant impact on public interests, environmental impact, economy, material management.*

Keywords: *Eco-friendly building, economy, feasibility, resident's interests, sustainable*

I. Introduction

With a corporation limit population of 612,343, and metropolitan population of 2.1 million, Kochi is the second largest city in Kerala after Thiruvananthapuram and the largest urban agglomeration in Kerala. Like other fast-growing cities in the developing world, Kochi suffers from major urbanizationproblems. The city was ranked 10th among Indian cities in terms of house-cost and availability, urban household crowding and household incomes.

The erection of skyscrapers and apartments are rapidly increasing as of late turning the city into a concrete jungle. Most of the major places where commercial and economic growth is comparatively more, has high land acquisition rates. This leads to construction of apartments and flats instead of individual houses which eventually causes hazardous impacts on environment.

Green architecture, a key to architectural sustainability, is the need of the hour for Kochi as the city needs to bridge the gap between current building practices and true sustainability. The growth and development of communities has a large impact on natural environment. The manufacturing, design, construction, and operation of the buildings in which we live and work are responsible for the consumption of many of our natural resources.

The building construction industry produces the second largest amount of demolition waste and greenhouse gases (35-40%). The major consumption of energy in buildings is during construction and later in lighting or air-conditioning systems. Further, occupant activities generate large amount of solid and water waste as well. In this context, there arise the need for a sustainable building.

Sustainably built green buildings are environmentally responsible and resource-efficient, right from location selection to the demolition after its lifecycle ends. A green building uses less energy, water and other natural resources creates less waste and greenhouse gases and is healthy for people living or working inside as compared to a regular structure. Building green is not about a little more efficiency. It is about creating buildings that optimize on the use of local materials, local ecology and most importantly they are built to reduce power, water and material requirements.

Natural resources are being depleted at a rate faster than their replenishment, hence giving rise to an outcry for sustainable development. Many governments are taking a regulatory stance in trying to curb direct environmental pollution, but non-statutory means can be an effective supplement to achieve sustainable construction. There is a huge potential of existing buildings to adversely affect the environment unless their operation and maintenance methods are checked and evaluated. Aside from energy/water efficiency, many other significant sustainability improvements can be made in existing buildings in terms of resource use, waste water reduction via recycling programs and also sustainable purchasing policies, procurement and ongoing operations & maintenance procedures which will improve a buildings' performance.

In the present scenario where green buildings are not luxury but a necessity, awareness among the people is a must for implementing sustainable development. The existing misunderstanding about green building is also a setback which needs to be rectified by providing much needed knowledge on the concept. This is to be achieved by awareness programs and studies of green retrofitting.

II. Literature Review

Arpad Horvath (1999)quoted that construction must pay heed to the widespread social interest in environmental preservation. Construction is supposed to provide the infrastructure for the ever-improving lifestyle of the world population. The construction industry as one of the largest and most important industries and at the same time one of the largest polluters, cannot wait until the goals of sustainable development have been identified and tool to achieve them have proved practical. [1]

Bo Xia et.al (2014)has cited that the construction industry has a responsibility to ensure the sustainability of both its products and processes. Sustainability assessment is a procedure used to ascertain whether environmental and social changes arising from human activities and use of resources are decreasing or increasing our ability to maintain long-run sustainability. [2]

Katherine S. Dewlaney etal. (2012)revealed that though the rapid growth in LEED is exciting, it is essential for designers and constructors to identify, analyze, manage, and respond to the increased safety risks associated with sustainable design and construction. The influence of sustainable design and construction methods were qualified as direct multipliers (positive or negative) against base-level conditions. This increase in risk knowledge is essential for identifying the highest risk design elements and construction activities and for prioritizing safety resources that must ultimately be allocated to respond to these risks. [3]

J.K. Yates (2014)has said that some of the sustainability practices that could being co-operated into the construction phase of industrial construction projects include designers incorporating materials that are reusable, recyclable, or that require less resources to produce and transport; using sustainable practices to help reduce energy consumption during construction and operation, and using renewable energy alternative technologies. [4]
Manoj P K (2013)has cited that affordable housing developments are incorporating green features like energy saving appliances and straw bale insulation that reduce utility build: air quality improvements that reduce health care expenses and community and personal gardens that provide local, organic produce at little cost. Low-income families have long struggled to balance the cost of shelter, food, health care and utilities. Green, affordable housing presents an opportunity to reduce variable costs, such as utility and transportation expenses, which disproportionately affect low income people. [5]

Patrick T.I. Lam et al. (2010)mentioned that green specifications constitute one of the important elements in construction. New sustainability requirements and changing priorities in construction management have spurred the emerging green specification to a faster pace of development. Involvement by the stakeholders should be the most important factor for preparation of green buildings [6]

Rodolfo Valdes-Vasquez (2013)declared that a truly sustainable construction projects need to include not only social considerations for the final users but also considerations such as the project's impact on the surrounding community and the safety, health, and education of the workforce and integrating these considerations will improve both long-term project performance and the quality of life for those affected by the project. [7]

Rupali Kapure et al. (2014)stated the challenge of greening existing building is to demonstrate achievement while still respecting budgets, addressing tenant/occupant resistance to change and meeting corporate constraints on activities. The biggest barrier to greening is the perception that they cost more to the owners than the deliver in the way of benefits. Long-term investments in energy efficiency and water savings are the economic drivers for greening existing buildings. [8]

Sathynarayanan Rajendran et al. (2009) revealed green building concepts, applied to the design, construction, and operation of buildings, can enhance both the economic wellbeing and environmental health of a buildings final occupants. The building industry's current perspective of sustainability is centered primarily on the principles of resource efficiency and the health and productivity of the buildings occupants. While the terms 'Green' and 'Sustainable' have been used interchangeably in the construction industry, yet they are different. Green is a term used to address primarily the design and construction practices that impact the environment. Sustainability is a broad concept which in addition to the environmental aspects addresses the continuity of economic and social aspects of human society. [9]

Sunitha Bansal et al. (2015) quoted a well-designed and well operated building will have enhanced value, demand and lower operating cost. The need to build, operate and maintain our buildings in a more sustainable way will only increase as energy cost rise, potable water and material resources increasingly scares

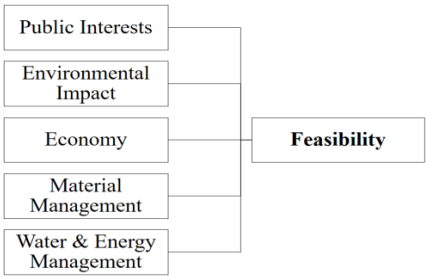
and the impact of Govt. Legislation increases. Mandatory Regulations have to be imposed by the Govt. to enforce greener built environment and also incentives be given to those who implement. [10]

III. Research Gap

Although many studies have been conducted with regard to eco-friendly building management, most of them have been conducted in the new building perspective. Only few studies have been done on retrofitting existing buildings to green buildings and in Indian context. The researcher would like to fill the gap by way of studying the factors affecting the eco-friendly building management with respect to feasibility of implementation.

IV. Project Research Model

The study is approached with the following proposed research model



V. Objectives

This study is confined with the following objectives

- To identify the various critical factors affecting the feasibility of implementation
- To measure the impact of eco-friendly building concept among the population.

VI. Project Hypothesis

H_0: There is no significant impact on public interests.
H_1: There is significant impact on public interests.
H_2: There is no significant impact on environmental impacts.
H_3: There is significant impact on environmental impacts.
H_4: There is no significant impact on economy.
H_5: There is significant impact on economy.
H_6: There is no significant impact on material management.
H_7: There is significant impact on material management.
H_8: There is no significant impact on water & energy efficiency.
H_9: There is significant impact on water & energy efficiency.

VII. Methodology

7.1. Scope

The scope of the study is confined to the people's view on eco-friendly building management practices in Kochi.

7.2Period of study

The period of study was conducted during the period of October 2016 to February 2017.

7.3Data Collection Methods

Primary data collection was done through questionnaire method. The first part of the questionnaire consists of demographic profile of the respondent. The second part of the questionnaire was relating to the initiators for eco-friendly building management. The third part of the questionnaire points to the barriers in the field.

7.4Questionnaire Formation

The variables relating to the present study is drawn from the previous works done byBo Xia (2016), Gündoğan, Handan (2012), Dr.Manoj P.K (2013). Suitable modifications were made in the existing questionnaire to suit the requirements of the current study.

7.5Descriptive Statistics

The demographic profile in the questionnaire features their occupation, locality and income status. The total survey was conducted in 500 out of whom only 487 questionnaires could be collected. The response rate of survey was 97.4%

VIII. Analysis And Discussion

8.1Measure Construction

One of the objectives of the research was to construct a scale that measure the feasibility of implementation of eco-friendly building management.

8.2. Specification of domain and generation of sample items

In this step, the domain of interest i.e. "Eco-friendly building management" was clarified and a total of 35 items were generated. Literature review and discussions with experts. More over content analysis were carried out with accredited professionals.

8.3First data collection and measure purification

The items were measured on a five point Likert scale and were included in the questionnaire collected by personal interviews. Data collection is used in order to purify measure. Measure purification generally includes basically the elimination of those items that do not correlate highly with the total score of overall measure. Cronbach's α calculated at this point was initially foundto be rather satisfactory (0.924). (Nunnally 1978, Hair et al., 1998)

8.4Reliability Analysis

There is a number of methods towards assessing the reliability of a scale. In this study, the method employed is Cronbach's reliability.

8.5Determination of a successful feasibility of implementation

In order to identify some broad determinants of success in feasibility of implementation, factor analysis was utilized on 35 variables created as mentioned previously. Kaiser-Meyer-Olkin Measure of Sampling Adequacy was of an acceptable magnitude (KMO 0.857). More over Bartlett's Sphericity test gave a significance level of 0.000. (Table 1). Hence all assumptions for carrying out factor analysis are met. The extraction technique chosen was principle component and the rotation method was varimax.

Table 1 KMO and Bartlett's test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.	.857
Approx. Chi-Square	21053.854
Bartlett's Test of Sphericity df	630
Sig.	.000

Initially all the 35 variables were used. After rejecting those items that have insufficient loadings, we deduced to six factors. Factor analysis converged after nine iterations. The cut-off point for accepting sufficient loading was 0.4. The factor names are as follows:

(1) Public Interests
(2) Environmental Impact
(3) Economy
(4) Material Management
(5) Water and Energy Efficiency

The first factor labelled "Public Interests" includes concept relevance, choice conversion, preference concept awareness, media attention, client demand, unwillingness to pay, insufficient consultants & education programs, professionals worker's shortage, resistance to change, lack of awareness on existing building. The second factor labelled "Environmental Impact" consists of environmental emission cost, health & comfort, quality of life, reducing negative impact, control climatic change, water & air quality and landscaping. The third factor labelled "Economy" includes the notations such as affordability, investment returns, rental & sale values, economic life, tax abatements and govt. incentives and repair & maintenance costs. The fourth factor labelled "Material Management" contains the aspects of affordability of materials and their availability. The fifth factor labelled "Water & Energy Management" includes the critical areas like water & energy costs and waste disposal.

IX. Hypothesis Testing Of Proposed Model

This section focuses on the investigation of possible relationship between feasibility of implementation and the identified factors for feasibility of implementation. Based on the discussion it is expected that the project cost directly affects the viability of execution of green projects. Since majority of the people in Kochi belongs to middle class, the economy in construction dictates over their interests.

Table 2: Hypothesis Testing of Proposed Model

Factor	**Unstandardized Coefficients**		**Standardized Coefficients**	**t**	**Sig.**
	B	**Std. Error**	**Beta**		
Public Interest	**.869**	**.106**	**0.342**	**8.177**	**.000**
Concept Relevance	.032	.031	.091	1.026	.306
Choice Conversion	.060	.035	.140	1.685	.093
Preference	-.062	.040	-.129	-1.535	.125
Concept Awareness	-.017	.035	-.033	-.493	.622
Media Attention	.021	.034	.042	.605	.546
Client Demand	.005	.032	.009	.145	.885
Unwillingness to pay	.037	.040	.089	.919	.359
Insufficient consultants& education Programs	.051	.041	.135	1.242	.215
Professionals workers' shortage	-.052	.033	-.120	-1.596	.111
Resistance to change	.054	.033	.135	1.629	.104
Existing building awareness lack	-.007	.035	-.016	-.193	.847
Environmental Impact	**1.228**	**.081**	**-0.038**	**15.250**	**.000**
Environmental emission cost	-.047	.024	-.107	-1.986	.048
Health & Comfort	.020	.056	.044	.357	.721
Quality of life	-.062	.061	-.126	-1.017	.310
Reduce negative impact	.093	.044	.209	2.104	.036
Control climatic change	-.021	.041	-.054	-.516	.606
Water air quality	-.041	.037	-.102	-1.115	.265
Landscaping	.038	.021	.098	1.786	.075
Economy	**.739**	**.114**	**0.423**	**6.464**	**.000**
Affordability	.126	.031	.283	4.061	.000
Investment return	-.051	.031	-.119	-1.646	.100
Cost of maintenance low	.005	.029	.011	.169	.866
Rental sale value high	.030	.043	.063	.702	.483
Longer Economic life	-.100	.052	-.178	-1.923	.055
Tax abatements	.030	.027	.058	1.089	.277
Govt. incentives not enough	-.012	.030	-.027	-.402	.688
High operation repair maintenance cost	.037	.025	.097	1.500	.134
High payback period	.098	.025	.236	3.909	.000
Material Management	**.803**	**.070**	**0.331**	**11.511**	**.000**
Affordability solar equipment	.011	.022	.026	.489	.625
High cost green materials	-.059	.027	-.126	-2.195	.029
Difficulty finding recycled material	.182	.019	.430	9.440	.000
Water & Energy Management	**1.067**	**.081**	**-0.007**	**13.123**	**.000**
Waste disposal cost	-.046	.038	-.086	-1.227	.220
Energy from waste	.134	.054	.272	2.468	.014
Minimum water availability	.014	.051	.032	.285	.776
Rain water harvesting	-.059	.052	-.139	-1.129	.259
Incorporation of solar energy	-.003	.035	-.007	-.096	.924
R Square	.261				
F statistics	4.558				
Significant level	.000				

X. Conclusions

This study identified five dimensions of eco-friendly building management with respect to feasibility of implementation. These are public interests, environmental impact, economy, material management and water and energy management. Based on factor analysis classification multiple regressions have been administered. The results of different dimensions of quality management practices in the construction of metro rail project indicates that R square = 0.261. This indicates that 26.1 percent of variance in different dimensions of feasibility of implementation of eco-friendly building management is explained by independent variables. The result shows that economy in construction has a significant impact along with public interests, environmental impacts and material management. This also confirms that water and energy management has no significant impact on feasibility of implementation.

References

[1]. Arpad Horvath(1999) "Construccction for Sustainable Development - A Reserch and Educational Agenda" Berkeley-Stanford Construction Engineering & Management Workshop: Defining a Research Agenda for AEC Process/Product Development pp.1-7

[2]. Bo Xia (2016)"Sustainable Construction Trends in Journal Papers"Research Gate pp.1-10

[3]. Katherine S. Dewlaney(2012)"Safety Risk Quantification for High Performance Sustainable Building Construction" Journal of Construction Engineering and Management pp.964-971

[4]. J.K Yates (2014) "Design and Construction for Sustainable Industrial Construction" Journal of Construction Engineering and Management pp.1-14

[5]. Manoj P K(2013) "Prospects and Challenges of Green Buildings and Green Affordable Homes-Concept: A study with Reference to Ernakulam, Kerala." Global Research Analysis Volume 2 pp.45-49

[6]. Patrick T.I Lam, Edwin H.W Chan, C.S Poon, C.K Chau, K.P. Chun (2010) "Factors Affecting the Implementation of Green Specifications in Construction" Journal of Environmental Management 91 pp. 654-661

[7]. Rodolfo Valdes-Vasquez(2013) "Social Sustainability Considerations during Planning and Design: Framework of Processes for Construction Projects" Journal of Environmental Management pp.80-89

[8]. Rupali Kapure, Dr. R.K. Jain(2014) "Parameters of Upgrading Existing Building into a Green Building" Int. Journal of Engineering Research and Applications Volume 4 pp.19-23

[9]. SathyanarayananRajendran, John A. Gambatese, Michael G. Behm (2009) "Impact of Green Building Design and Construction on Worker Safety and Health" Journal of Construction Engineering and Management Vol.135 pp.1058-1066

[10]. Sunitha Bansal, S.K.Singh, Sriji Biswas (2015) "Green Quotient Evaluation of Existing Buildings: A Case Study" International Journal of Advanced Research Vol 3 pp.1262-1269