

*Factor Analysis of Benefits Sought by Green Building
Customers*

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Abstract: *Green buildings come across as a viable ecological and economic solution in the resource hungry infrastructure sector. In spite of the multipronged benefits, the growth of Green construction is not matched by its share in overall construction sector. To increase adoption of Green Buildings and reduce the ecological footprint of the construction sector, while considering the innovative nature of the Green Building Market, Benefit Segmentation is deemed appropriate. Factor analysis of reasons of purchase indicated by Green building customers reveal factors which can form the basis of Benefit Segmentation. Factor analysis is also important as the foundation of cluster analysis to be used in Benefit Segmentation.*

Keywords: *Green Buildings, Benefit Segmentation of Green Building customers, Factor analysis of benefits sought by green Building Customers, Green Building Market, Green Building Customer Segmentation.*

I. INTRODUCTION

The upsurge in environmental disasters and ensuing disruption in human well-being as well as economic activity has led to a heightened concern for environmentally effective solutions across sectors. The Green Building phenomenon across the world is a classic example.

Green building (also known as green construction or sustainable building) refers to both a structure and the using of processes that are environmentally responsible and resource-efficient throughout a building's life-cycle: from siting to design, construction, operation, maintenance, renovation, and demolition.

The Indian Green Building Council (IGBC) is the leading Certifying body for Green buildings in India. The IGBC Rating System for Green Buildings is a set of rating systems for the design, construction, operation, and maintenance of green buildings. The IGBC Rated Green Building growth rate in India and the World reveals an encouraging trend. However, Green construction occupies 2-3% of all construction in India, which is on par with the US going by 2010 statistics (Pulla, 2010).

Effective marketing of the Green Building concept is key to widespread adoption. Yudelson in his work on Marketing green Buildings proposes Market Segmentation as an effective tool to reach likeminded groups of customers or segments which are accessible as well as profitable. Benefit segmentation in particular is deemed as an effective segmentation strategy given the innovative nature of the market and its stage in adoption.

Benefit segmentation would facilitate Green building marketers to make product concepts more effective, and promote using strategies targeted at the most receptive consumer segments. Before venturing into clustering, the factors based on which clustering is to be executed need to be identified. This paper focuses on Factor Analysis of benefits sought by customers of Indian Green building council rated Green Buildings and thus arriving at the benefit factors which could be used for Benefit Segmentation going further.

II. RELATED WORK

Haley suggests that, "it is easier to take advantage of market segments that already exist than to attempt to create new ones. Once a marketer understands the kinds of segments that exist in his market, he is often able to see new product opportunities or particularly effective ways of positioning the products emerging from his research and development operation." (Haley, 1968).

Benefit segmentation divides a heterogeneous population into homogeneous groups on the basis of product benefits consumers perceive as important (Chang and Chen, 1995).

In purchasing products, consumers try to satisfy particular needs and wants. They look for products that provide specific 'benefits' to satisfy these needs (Belch and Belch, 2006).

Benefit segmentation starts from the assumption that 'the benefits which people are seeking in consuming a given product are the basic reasons for the existence of true market segments' (Haley, 1968).

Benefit segmentation is widely acknowledged as one of the best ways to segment markets. Some of the benefits in the benefit dimension are: benefit segments are based on causal factors than descriptive factors and this is a method with great flexibility (Haley, 1968).

This approach provides a more direct measure of the differences in preferences among customers and offers a more action-oriented analysis for managers (Haley, 1968).

To satisfy the target consumer's needs, benefit needs and product attributes are the most popular variables for segmenting the market (Calantone and Sawyer, 1978, Dubow, 1992, Haley, 1995, Toombs and Bailey, 1995).

III. RESEARCH DESIGN

The exploratory study involves a sample of 82 IGBC Rated Green building customers to identify the possible reasons for consumption. On the basis of discussions with several Green Building customers, Owners, Green Building Facilitators and Consultants, an inventory of 19 possible reasons (perceived benefits) was prepared prior to the study which were included in the research instrument.

A structured questionnaire was used as research instrument. 5 point Likert scale type statements were generated to measure agreement to benefits sought as reasons for purchasing Green buildings. Certified projects were taken into account as the purpose was to investigate actual organizational buying behavior rather than perceived or potential organizational buying behaviour

Respondents were drawn from the Decision Making Unit as they are key to decision making regarding Green Construction. Sample was drawn from customers of the IGBC using the Random Sampling method. Respondents came from across IGBC Rating Systems, across Certification levels, across Geographic locations and from varied respondent characteristics.

IV. DATA ANALYSIS

Exploratory interviews were conducted on decision participants in Green Building Certification. Benefits relevant to this research were identified and used as variables to make a four - part questionnaire. Five variables were identified which are Concern for ecology; PR, Differentiation and related marketing aspects; Indoor environmental quality; Prestige, demonstration of commitment to stakeholders; Financial benefits over the buildings lifetime.

Based on these reasons Likert scale type statements were generated and the responses were measured. The Cronbach's Alpha value was 0.762 indicating the relatively high internal consistency of the questionnaire.

Factor analysis was implemented to understand the inherent factors of the study using Unweighted Least Squares as an extraction method considering Varimax rotation. The Bartlett's test of Sphericity had an approximate χ^2 value of 658.085 which

is significant at 5% level of significance with p-value < 0.001 indicating that the sample inter-correlation matrix did not come from a population that has an identity matrix for inter correlation matrix. This means that dimension reduction was needed to discard some weak dimensions. The Kaiser-Meyer-Olkin measure of sampling adequacy was 0.721 indicating that the factors extracted account for a fair amount of variance.

TABLE I Factor Analysis

Communalities		
Variable	Initial	Extraction
Savings on energy (electricity), water, maintenance and other utility bills are a priority in this project	.370	.343
Conserving natural resources is one of the principal aims of the project	.698	.777
The opportunity to use material and equipment certified as eco-friendly is important for this project	.648	.624
Waste management practices are a key reason for adopting Green practices in this project	.639	.630
Enhancing occupant well-being and productivity (to reduce employee absenteeism and ensure employee retention) is a significant priority in this project	.435	.355
Integrated design process (reduces rework and save construction cost and time) is a strong reason for choosing Green Building Certification	.453	.271
The project chose Green Building certification as it involves Accredited professionals (who ensure best design and technology inputs)	.623	.999
This project went green because the payback period is attractive	.441	.296
Securing premium prices on sale and higher rents are key reasons for going green	.538	.589
Buyers/ tenants of this project demanded a Green Building	.528	.438
The project went Green as depreciation is lesser in Green Buildings than in conventional buildings	.469	.433
The project chose Green Building Certification to attract increased availability of funding	.523	.567
The project wants to benefit from government incentives (such as Extra Floor Area Ratio, Fast track clearance, Preferred status, Tax benefits, Subsidies etc) by securing Green Building Certification	.546	.563
The project chose Green Building certification for the advertising and marketing benefits attached	.653	.719
The project adopted Green Building Certification as competitors and peers have adopted the same	.647	.652
Green Building Certification is a matter of prestige for this project owner	.547	.532
Once Certified, the project would appear more trustworthy to Global and local clients	.689	.781
The project is a key opportunity to demonstrate environmental stewardship to stakeholders	.427	.419
The project owner's company policy makes Green Building Certification compulsory	.379	.306

The communalities presented above denote the proportion of each variable's variance that can be explained by the factors obtained from implementation of factor analysis.

TABLE III Total Variance

Total Variance Explained									
Factor	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	4.266	22.451	22.451	3.881	20.426	20.426	2.956	15.559	15.559
2	3.761	19.792	42.243	3.330	17.525	37.950	2.265	11.923	27.482
3	2.064	10.862	53.105	1.625	8.553	46.504	2.180	11.474	38.955
4	1.177	6.194	59.299	.815	4.288	50.792	1.550	8.157	47.112
5	1.108	5.830	65.129	.662	3.482	54.274	1.361	7.162	54.274

6	.972	5.114	70.243
7	.842	4.433	74.676
8	.769	4.049	78.724
9	.628	3.303	82.028
10	.602	3.168	85.195
11	.545	2.866	88.062
12	.473	2.488	90.549
13	.438	2.306	92.855
14	.318	1.672	94.527
15	.262	1.381	95.907
16	.221	1.162	97.070
17	.207	1.089	98.158
18	.182	.958	99.116
19	.168	.884	100.000

The above table titled “Total Variance Explained” summarizes the total variance explained by the 19 factors. “Initial Eigen Values” denote the variance explained by all possible factors. On the basis of Eigen values that are greater than one, there are five factors which explain 54.274% of the variance. Of these, the first factor explains 15.559% of variation, the second factor 11.923% of variation, the third factor 11.474% of variation, the fourth factor 8.157% of variation and the fifth factor 7.162% of variation.

The Eigen values are depicted in a scree plot where a steeper descent is observed after Factor 5 and the curve gradually goes parallel to the x-axis. This means that five factors significant in explaining the variance.

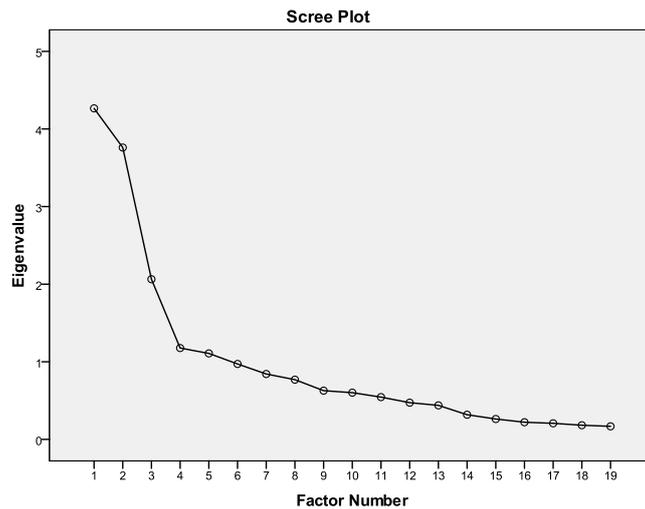


Fig. 1 Scree Plot depicting Eigen values

TABLE IIIII Rotated Factor Matrix

Rotated Factor Matrix					
	Factor				
	1	2	3	4	5
Savings on energy (electricity), water, maintenance and other utility bills are a priority in this project	.574	-.104	.001	-.043	-.016
Conserving natural resources is one of the principal aims of the project	.826	-.048	.142	-.240	.121
The opportunity to use material and equipment certified as eco-friendly is important for this project	.736	-.146	.028	.009	.244
Waste management practices are a key reason for adopting Green practices in this project	.723	.047	.023	-.059	.317

Enhancing occupant well-being and productivity (to reduce employee absenteeism and ensure employee retention) is a significant priority in this project	.540	-.016	.194	-.121	.104
Integrated design process (reduces rework and save construction cost and time) is a strong reason for choosing Green Building Certification	.318	.093	.044	-.114	.382
The project chose Green Building certification as it involves Accredited professionals (who ensure best design and technology inputs)	.384	-.059	.044	.102	.923
This project went green because the payback period is attractive	.069	.341	.158	-.071	.381
Securing premium prices on sale and higher rents are key reasons for going green	-.195	.720	-.054	.157	.074
Buyers/ tenants of this project demanded a Green Building	-.104	.635	-.001	.154	.013
The project went Green as depreciation is lesser in Green Buildings than in conventional buildings	.017	.545	.317	-.152	.104
The project chose Green Building Certification to attract increased availability of funding	.059	.705	-.014	.256	-.029
The project wants to benefit from government incentives (such as Extra Floor Area Ratio, Fast track clearance, Preferred status, Tax benefits, Subsidies etc) by securing Green Building Certification	-.020	.491	.103	.557	-.025
The project chose Green Building certification for the advertising and marketing benefits attached	-.177	.142	.413	.705	-.003
The project adopted Green Building Certification as competitors and peers have adopted the same	-.334	.254	.212	.655	-.048
Green Building Certification is a matter of prestige for this project owner	.005	-.085	.709	.117	.092
Once Certified, the project would appear more trustworthy to Global and local clients	.011	.146	.843	.223	.018
The project is a key opportunity to demonstrate environmental stewardship to stakeholders	.179	.020	.618	.062	.028
The project owner's company policy makes Green Building Certification compulsory	.323	.171	.409	.059	.048
Extraction Method: Unweighted Least Squares. Rotation Method: Varimax with Kaiser Normalization.					
a. Rotation converged in 8 iterations.					

In the above table, the values in bold font indicate that the variable belongs to that particular factor. Also, questions belonging to the same factor are highlighted in same colour.

Eventually, five factors were arrived at.

V. CONCLUSION

The first factor consists mainly of environmental aspects. The second factor consists of the technological aspects of Green building Design such as Integrated Design and Presence of Accredited Professionals. The third factor evidences financial concerns associated with green buildings such as premium pricing, depreciation and such. The fourth factor consists of advertising and marketing benefits and the fifth factor reveals interests in demonstration of environmental commitment to stakeholders.

Based on these observations, factors need to be named to be able to quickly identify and understand the nature of each. The names suggested for the factors are:

TABLE IVV Factor Names

Factor	Name
Factor 1	Environmental concern
Factor 2	Financial Appeal
Factor 3	Trustworthiness
Factor 4	Marketing Mileage
Factor 5	Green Design Efficacy

These factors give an overview of what is important for Green building Customers. These unique factors are important to make sure that the dimensions which form the basis for cluster analyses are unique and do not skew cluster analysis.

VI. ACKNOWLEDGEMENT

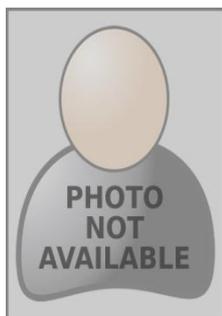
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Kranti Chintakunta, received the MBA in Marketing and Environmental Management from School of Management Studies, University of Hyderabad in 2004. She has an MBA in Marketing from Pondicherry Central University in 2011. She possesses 11 years of experience in Corporate Communications especially in the arena of Environmental Marketing.