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EFFECTS OF MOTIVATORS & BARRIERS ON GREEN BUILDING INTENTION: ARCHITECTS' PERSPECTIVES

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ABSTRACT

Buildings are an integral part of human existence. We spend most of our time in buildings either residing or working. Buildings have a huge impact on the economy, environment, and human health. This realization has paved the way for creating sustainable buildings. Hence Green Buildings is a promise for the future to solve various problems like environmental pollution, global warming, and common man's problems like water shortage, waste disposal, high electricity price, and health concerns. The diffusion of green buildings in the built environment is crucial and the role of Architects as sustainability prophets is paramount. This study focuses on the Indian architect's intention to engage in green building activities and the influence of motivating factors and hindering factors associated with green building adoption.

Disciplinary: Green Architectures (Green Building Design) Sustainability Development, Green Management.

1. INTRODUCTION

Over the past few years, sustainable construction practices have become a global phenomenon because buildings cause a lot of environmental degradation and pollution. Wang et al. (2011) revealed that development activities in the construction industry consisting of high-end buildings aimed at improving human living standards have resulted in high resource consumption and pollution of the environment. 'Green Buildings' are sustainable buildings that outperform classical buildings in terms of design, utility, comfort, durability. A green building is constructed in a way that is environmentally friendly, giving prime importance to resource efficiency, water conservation, innovation, and indoor environmental quality. Bohari et al. (2015) highlighted that future of green building success is dependent on a proper vision of co-operation and collaboration among all the stakeholders involved in the construction industry. Hankinson & Breytenbach (2013) emphasised that Designers' and Architects' understanding of the concept and sustainable building values influence

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their overall attitude, probability of application, and behaviour in submission to the Building rules, policies, and mandates.

Stakeholders of the Construction Industry, especially in a rapidly developing economy like India can make a significant impact by adopting green buildings. Hence, this study revolves around the impact of barriers and motivators of green building adoption on Architects' intention to adopt green buildings.

2. LITERATURE REVIEW

Many researchers have studied the barriers and motivators associated with green building adoption in various contexts. Landman (1999) reported that lack of clients' interest or request for sustainable building, illiterateness in sustainable design education and training, and the higher costs (both real and perceived) of sustainable building options are the primary barriers to more widespread sustainable building practice.

Williams & Dair (2006) reported that Lack of consideration of sustainability measures, higher costs and Inadequate green awareness and policies, and insufficient green techniques as a major barrier towards green building adoption.

Pitt et al. (2009) stated Affordability, planning policy building regulations, lack of client awareness and demand, defect of business case understanding, scarcity of proven alternative technologies, deficiency of one labelling criteria, or measurement standard as barriers. Client awareness and demand, Investment, financial incentives, Building regulations, Planning policy, and Taxes or levies, Labeling, or measurement as motivators.

Ambec & Lanoie (2008) Motivators as picked out from the study are- Better access to specific markets, product differentiating strategy, Sale of pollution-control technologies, efficient risk management process, good external stakeholder relations, lower raw material and energy expenditure, reduced financial capital cost, budding and qualified employee attraction.

Zhang et al. (2011) stated that developers assumed that the execution of green technologies will lead to increasing their credibility, obtaining favourable prices, gaining new financial sources, and cutting back construction and operation charges. The major barriers are poor policy implementation attempts, overprice in relation to client’s demand, and high cost involved in designing green and energy-saving appliances.

Lertpocasombut et al. (2016) studied green building technology for the conceptual design of public restroom via Sketchup® platform by taking the criteria of the green label standard, green building for sanitary ware, and public toilet standards into account. Construction materials and sanitary wares have been chosen with certified environmental standards. With the green design, water consumption can save up to 80 % and monthly electric expenses go down by 60 %. The green restroom investment project will be rewarding after five years of usage. Despite the fact, the restroom cost with green building technology design is more costly compared to a conventional type, but it is important for environmental and sustainable concerns.

Darko & Chan (2017) found that cost, unavailability of information, the inadequacy of Green

Building mandates, the absence of incentives, and lack of interest and demand are the most reported barriers. All the studies reviewed emphasised that green building adoption is hugely impacted by the various barriers and motivators identified for specific regions and contexts.

3. RESEARCH METHODOLOGY

A descriptive and quantitative approach was followed by the researcher in conducting the study. Data were collected from 50 practicing architects from the state of Kerala, India. The purposive sampling method was used to select architects using the Architects Directory.

For data collection, a questionnaire was devised consisting of the variables- barriers, motivators, and intention and obtained Cronbach's alpha value of .778, .789, and .805 respectively along with general information of the respondents. Cronbach's alpha obtained is greater than 0.7 and hence the questionnaire enjoyed reasonable reliability and will obtain the reliable output. The collected data were analysed using SPSS® Amos 21.0. Statistical tests like one sample t-test and Structural Equation Modelling (SEM) was done.

This study's objectives are to explore the major barriers and motivators associated with green building adoption and architects intention to adopt green building and to understand the relationship between barriers and intention to adopt green building and motivators and intention to adopt green building. Based on the objectives, researchers fixed two hypotheses for the study (Figure 1).

- H1: There is a significant relationship between Barriers associated with green building adoption and Intention to adopt green building.
- H2: There is a significant relationship between Motivators associated with green building adoption and Intention to adopt green building.

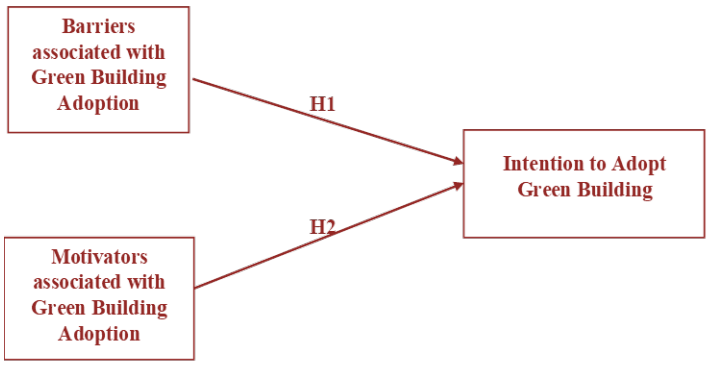

Figure 1: A proposed model for this study.

4. RESULT AND DISCUSSION

This study analyses the motivators and obstacles related to green buildings in the construction sector as perceived by Architects to understand its effect on intention. The demographic profile of Architects includes 31 males and 19 females. Among them, 29 architects fell in the experience group of 1-10 years, 15 architects in the experience category of 11-20 years, and 6 architects in more than 20 years of experience group. The results of the data analysis are discussed below.

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4.1 BARRIERS

The variable 'Barriers' in this study refers to any technical, financial, managerial, and behavioural hindrance or obstacle which makes the green building design and adoption difficult. Eighteen variables are used to assess the barriers. All variables were measured on a three points Likert scale where 1 indicates 'not at all barrier', 2 indicates 'minor barrier' and 3 indicates 'major barrier'. Table 1 shows the mean scores of respondents regarding barriers and significant differences from test value (2) by conducting a one-sample t-test.

Table 1: Barriers Associated with Green Building Adoption

Barriers	Mean	SD	t-value	Sig.	Barrier type
Lack of Expressed Interest from clients	2.56	.64	6.14	<.01	Major
Inadequacy of sustainable design and construction education and training	2.40	.72	3.88	<.01	Major
The high cost of constructing Green Building	2.16	.79	1.42	.15	Minor
Lack of technical know-how from sub-contractors part	2.36	.72	3.52	<.01	Major
Non-availability of Green Building materials locally	1.68	.71	-3.17	<.01	Not
Lack of information on sustainable building methods	2.12	.79	1.06	.29	Minor
Lack of Government regulations and incentives	2.40	.75	3.74	<.01	Major
Green certification is an elaborate and tedious process and has upfront costs	1.86	1.01	-.98	.33	Minor
Creativity stifling Building Byelaws	1.98	.89	-.15	.87	Minor
Corrupt Building Permit System and Regulatory framework	2.00	1.03	.00	1.00	Minor
Risks associated with the implementation of new practices	1.92	.77	-.72	.47	Minor
Lack of communication and collaboration between different stakeholders	2.00	.69	.00	1.00	Minor
Difficulty in quantifying immediate benefits	1.90	.90	-.77	.44	Minor
Personal Resistance	1.54	.81	-3.99	<.01	Not
Extra time commitment required for green buildings	1.68	.71	-3.17	<.01	Not
Resistance within my firm	1.22	.64	-8.51	<.01	Not
Resistance from client	2.24	.68	2.47	.01	Major
Lack of motivation on my part to incorporate sustainable green building practices	1.48	.81	-4.51	<.01	Not

Table 1, the mean scores of five variables belongs to barriers are significantly higher than the test value (2). Table 1 also reveals that the difference between the mean score and the test value of all the variables are significant at a 5 percent level in five cases. Among the variables, 'Lack of expressed interest from clients 'scored the highest mean score followed by 'Inadequacy of sustainable design and construction education and training' and 'Lack of Government regulations and incentives'. Eight variables are minor barriers and five variables are not at all barriers of green building.

4.2 MOTIVATORS

'Motivators' refer to the stimulus that persuades Architects to design and adopt green buildings. Seventeen variables are used to assess motivators. All were measured on a five-point Likert scale where 1 specifies 'strongly disagree' and 5 specifies 'strongly agree'. Table 2 provides one sample t-test result showing the mean scores of respondents regarding motivators taking test value as 3.

From Table 2, it is found that the mean scores of the majority of the variables are higher than the test value (3). Table 2 also pointed out the significant difference between the mean score and the test value of the majority of the variables since the p-value of all the components is less than 0.05. Among the variables, 'Enhance occupant comfort, health and productivity' had the highest mean score followed by 'Reduced water consumption', 'Reduced energy bills', 'Conserve natural resources' and 'Improve air and water quality'. While the variable 'Fashion' had the least mean score.

Table 2: Motivators Associated with Green Building Adoption.

Motivators	Mean	SD	t-value	Sig.	Motivator type
Social Obligation	3.98	.95	7.23	<.01	High
Government Imposition	2.84	.84	-1.34	.18	Not
Conserve natural resources	4.46	.70	14.62	<.01	High
Economic Motives	3.32	.86	2.60	.01	High
Professional Duty	4.16	.97	8.40	<.01	High
Fashion	2.66	1.09	-2.18	.03	Low
Business Interest/ Product Marketing strategy	2.76	1.06	-1.60	.11	Not
Financial Incentives and/or subsidies	2.74	.98	-1.86	.06	Not
Image	2.90	1.12	-.62	.53	Not
Corporate Social Responsibility	3.90	.90	7.00	<.01	High
Personal beliefs	3.84	1.14	5.16	<.01	High
Improve air and water quality	4.44	.78	12.94	<.01	High
Reduced energy bills	4.46	.78	13.10	<.01	High
Reduced water consumption	4.48	.76	13.72	<.01	High
Waste reduction	4.38	.87	11.11	<.01	High
Enhanced marketability	3.34	.87	2.75	<.01	High
Enhance occupant comfort, health, and productivity	4.50	.73	14.42	<.01	High

4.3 INTENTIONS

Intention towards green building relates to the likelihood of adopting green building utilizing designing and taking up green projects. For this, five variables were identified. Intentions were measured using a five-item scale. Table 3 discloses the result of one sample t-test regarding intentions taking test value 3.

Table 3: Intentions towards Green Building Adoption

Intention	Mean	SD	t-value	Sig.
I would favour to build a green building over an ordinary building.	4.26	.72	12.32	<.01
I plan to include green practices in my building projects.	4.16	.81	10.03	<.01
I would motivate colleagues to use green building practices	4.30	.67	13.56	<.01
I would motivate clients to use green building practices	4.30	.76	12.05	<.01
I would motivate clients to seek green certifications for their building projects	3.62	1.17	3.72	.001

It is clear from Table 3 that, the mean scores of all the variables belong to intentions are higher than the test value (3). The table also reveals that the difference between the mean score and the test value of all the variables are significant at a 5 percent level. Among the variables, 'I would motivate clients to use green building practices' and 'I would motivate colleagues to use green building practices' had the highest mean score followed by 'I would favour to build a green building over an ordinary building' and 'I plan to include green practices in my building projects'. Whereas the variable 'I would encourage clients to seek green certifications for their building projects' scored the lowest mean score.

5. STRUCTURAL EQUATION MODELLING

5.1 ASSESSING STRUCTURAL MODEL FITNESS

The model fit indices obtained shows a reasonable fit for the tested structural model, Table 4 and Figure 2.

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Table 4: Model Fit Indices

Indices	GFI	AGFI	NFI	RFI	CFI	TLI	RMSEA
Obtained	.94	.93	.92	.94	.91	.92	.042
Recommended	>.9	>.9	>.9	>.9	>.9	>.9	<.08

The model fit indices also provide a reasonable model fit for the structural model. The goodness of fit index (GFI) obtained is 0.94. The Adjusted Goodness of Fit Index (AGFI) is 0.93. The Normed fit Index (NFI), Relative Fit index (RFI), Comparative Fit Index (CFI), Tucker Lewis Index (TLI) are 0.92, 0.94, 0.91, 0.92 respectively. RMSEA is 0.042. Hence it is concluded that the proposed research model fits the data reasonably.

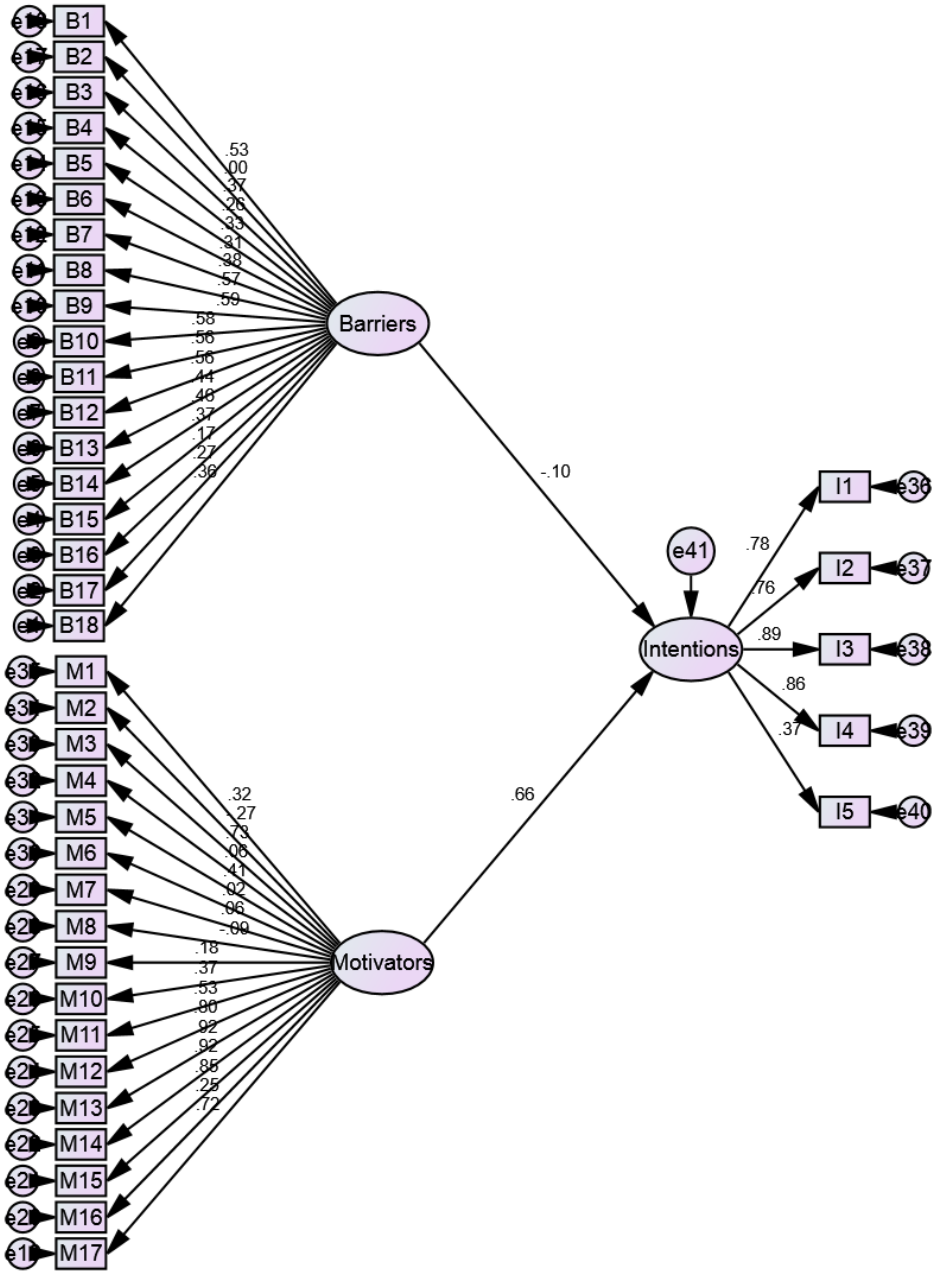

Figure 2: Structural equation model for the study.

From the tested structural equation model (Figure 2), the path value from barrier to intention is -0.10 that is significant at a 5 percent level. The nature of the relationship between the variables is negative indicating that every 1-unit increase in barriers would result in a 10 percent decline in

intentions. In the case of motivators, the path beta value is 0.66 which is significant at a 5 percent level. The nature of the relationship is positive indicating that every 1-unit increase in motivators would result in a 66 percent increase in intentions.

Table 5: Testing of Hypotheses

Hypothesis	Path Coefficients (β Value)	p-value	Positive/ Negative	Accept/ Reject
H1	-0.10	<0.05	Negative	Accepted
H2	0.66	<0.05	Positive	Accepted

6. CONCLUSION

This study examined the various motivators and barriers associated with green buildings and how these affected architects' intention to engage in green construction. The results showed that lack of interest exhibited and resistance from clients, the inadequacy of education and training in sustainable methods in construction, and lack of proper Government regulations and incentives were the major barriers as perceived by Architects. The major motivators were occupant comfort, health and productivity enhancement, reduction in energy bills, natural resource conservation, and air and water quality improvement along with Architects' social obligation and their sense of professional duty. From the study results, it was confirmed that there is a significant relationship between barriers associated with green building adoption and intentions to adopt green buildings and between motivators associated with green building adoption and intentions to adopt green buildings. These findings throw light on the need for Government intervention to lower the barriers by imparting sustainable construction knowledge to various stakeholders and devising a good incentive plan and strict rules and regulations.

7. AVAILABILITY OF DATA AND MATERIAL

Data can be made available by contacting the corresponding author.

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