



Awareness about Green Residential Projects in Tier-II Cities of India based on Stakeholders Survey to Prevent Environmental Pollution

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ABSTRACT: The continued growth of the world's population is driving increasing demand for new buildings and infrastructure development. The building and construction industry has a major impact on human and ecological well-being across the globe. Green buildings that are designed, constructed, and operated to minimize environmental impacts have become an important avenue for promoting sustainability. In the present scenario of rapid urbanization, it is very much essential to follow the guidelines of sustainable development. Thus, in the construction industry, a new initiative called Green Building technology is gaining attention nowadays. However, due to limited research and knowledge of this field, a few stakeholders are only aware of this technology. Until and unless people are aware of this field, a revolution in the construction industry cannot be imagined. It is equally important to increase knowledge among the citizens so that they may understand the long-term advantages of living in a green-rated project (Singlex, Duplex, Flats, etc.). In India, we are still limited to very few registered green projects. To overcome this gap, we have surveyed the stakeholders i.e. residents of Tier-II cities of India to know the status of awareness amongst the citizens of the country about the green building initiatives and consequently, to gain the attention of the government officials to promote this initiative by offering subsidies and other relevant advantages to ones opting for green projects soon. This will increase the interest of buyers to purchase green residential projects which will save our mother nature.

Keywords: Green building technology, environmental sustainability, stakeholders' satisfaction, green residential projects, rapid urbanization.

INTRODUCTION

Green buildings have emerged as a critical part of the construction industry's efforts to promote environmental sustainability and combat climate change. By incorporating design principles like energy efficiency, water conservation, and use of renewable/recycled materials, green buildings can significantly reduce the negative environmental impacts associated with conventional building practices (Gogoi & Giri 2017). As the world's population continues its rapid urbanization, with projections indicating 70% of people will live in cities by 2050, providing sustainable and green options for new buildings and infrastructure is becoming an imperative. This is particularly true in developing countries like India which is experiencing the highest urbanization rates globally (Steinemann *et al.*, 2017). In India, the construction industry has started adopting green building rating tools like IGBC, GRIHA (Gupta *et al.*, 2019). However, research indicates there are still barriers hindering more widespread implementation of green buildings in the country. A key challenge identified is the lack of awareness

amongst the stakeholders. This research study investigates the critical relationship between client satisfaction, and the ability to successfully deliver green building projects in the Indian context (Li *et al.*, 2014). The overarching goal is to determine guidelines and recommendations for the procurement strategies that are most appropriate and likely to result in high client satisfaction for green buildings based on an analysis of construction industry perspectives and previous project cases (Luo *et al.*, 2022).

The specific research objectives were:

1. To assess the level of knowledge/awareness about green building systems among residents of Tier-II cities.
2. To identify whether the advantages of green building projects are known to people or not.
3. To examine whether there is a misalignment between recognized best practices of green projects and the traditional approaches being implemented on residential projects.
4. To understand the influence of procurement systems on achieving client satisfaction for green buildings.

The findings from this study can provide valuable insights for construction firms tendering on green projects, for client organizations in evaluating and selecting appropriate ways of promoting the green projects in Tier-II cities, and for policymakers/industry associations in promoting best practices. Ultimately, improving client satisfaction is critical for driving more investment into green buildings and enabling India's construction sector to support sustainable development goals (Li *et al.*, 2011).

Table 1: Age group of stakeholders participated in the survey.

Sr. No.	Age Groups	Remarks about stake holders w.r.t. Green projects
1.	less than 25 years	Futuristic prospects of green projects
2.	26-35 years	Planning to purchase in near future
3.	36-45 years	The most probable prospects
4.	46-55 years	Future investors
5.	Above 55 years	The most probable investors

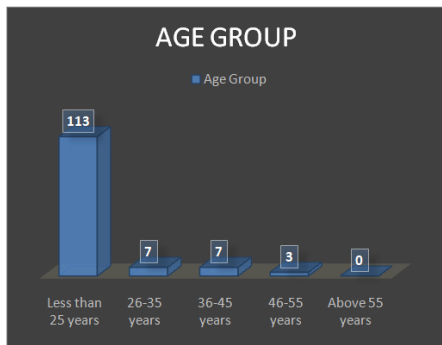


Fig. 1. Age group of the stake holders participated in the survey.

LITERATURE REVIEW

Green or sustainable buildings have emerged as a critical part of the construction industry's efforts to promote environmental sustainability and mitigate climate change impacts. The World Green Building Council defines a green building as "a building that, in its design, construction or operation, reduces or eliminates negative impacts, and can create positive impacts, on our climate and natural environment."

Key green building strategies include:

- Energy efficiency through thermal insulation, passive design, energy-efficient lighting/HVAC etc.
- Water conservation via low-flow fixtures, grey water reuse, rainwater harvesting etc.
- Use of renewable and recyclable materials like bamboo, recycled metals/plastic etc.
- Sustainable landscaping with drought-tolerant plants, permeable surfaces etc.
- Improved indoor environmental quality through daylighting, ventilation, low-VOC materials etc. (Ardente *et al.*, 2011).

Green buildings have been found to provide a host of economic and environmental benefits over conventional buildings, including reduced operating costs, increased

India being a developing country, lot of development even in terms of urbanization is going on in almost every state and cities. The entire cities of India have been divided into categories namely Tier-I, Tier-II and Tier-III cities. The prime focus of collecting this data is to check the level of awareness which the citizens of our country possess and to uplift this knowledge about green building concepts (Gehlot & Shrivastava 2022). We have categorized the stakeholders amongst the different age groups as described in the table below.

asset property values, improved occupant health/productivity, and significantly lower greenhouse gas emissions and resource consumption over the entire building life cycle (Satya *et al.*, 2016). Despite these advantages, the implementation of green buildings still faces several barriers worldwide, including higher perceived upfront costs, lack of public awareness/demand, institutional inertia within the construction industry, and lack of workforce skills/training in green design and construction practices (Jain *et al.*, 2020).

Client satisfaction is considered essential for the success of any construction project. A satisfied client is more likely to be a repeat client, provide positive referrals/publicity, and have a favourable perception of the construction firm. In contrast, dissatisfied clients can damage the firm's reputation, market share and profitability. Achieving client satisfaction requires understanding the client's needs/priorities upfront and ensuring those objectives are met through high quality project execution, effective communication and managing client expectations properly throughout the construction process (Kasthurba *et al.*, 2014).

Based on the literature, project characteristics like the integration of the project team can impact client satisfaction. Collaborative systems that bring key parties together earlier tend to perform better in meeting client needs versus fragmented systems with hierarchical relationships. For green buildings specifically, which have unique challenges like integrating sustainable designs across disciplines, studies indicate that clients tend to be more satisfied when using procurement methods that encourage integration and knowledge sharing among teams (Potbhare *et al.*, 2009). In summary, the literature suggests a strong relationship between construction procurement strategy and the ability to successfully deliver green, sustainable building projects that meet client expectations and satisfaction requirements. Examining this relationship within the stakeholders and green projects was the core focus of this research study (Srinivasan and Ganeswaran 2016).

Sustainable construction Practices. Construction industry is equally responsible for degrading the environment in terms of material consumption as well as producing the waste. This extensive urbanization in the country is knocking the door bells of technical officials and professionals of the construction industry to work on sustainable construction projects. So, there is an alarming situation to start working on the resistance factors of adopting the sustainable and green construction practices in our country (Srinivasan *et al.*,

2016). For reaching the root level problem, survey based on questionnaire was done on the industry professionals and experts working on the site. So based on the survey data filled by site engineers, project managers, planning engineers, supervisors, trainee students, results were revealed which influences the sustainable construction. The major findings included unavailability of skilled work force, unaware clients, and lack of knowledge amongst the industrial professionals related to green construction technologies. Hence researches are continuously indicating that the collective efforts of all the stakeholders will bring success (Castleton *et al.*, 2010).

An investigation of Green Buildings in India. Green buildings are reducing negative environmental effect by neglecting the use of fossil fuels in development. They also improve the quality of life of the residents by environment friendly initiatives. Although limited research has been done in this field, but still it can be concluded that there is significant growth in this field (Trivedi and Sharma 2017). Researchers have tried to make conclusions by collecting data of the city like Delhi, the capital city of India. They have bifurcated the results based on age, sex, income, education level etc. This helps in achieving accurate results about the growing use of green infrastructures. It has been proved that knowledge and awareness among the stakeholders is the key reason in promoting green buildings in India (Sheth, 2016).

RESEARCH METHODOLOGY

This study utilized a mixed-methods research approach, combining qualitative and quantitative techniques, to comprehensively investigate the research questions. The overall methodology comprised of these main components:

1. Comprehensive literature reviews: An extensive review of scholarly articles, industry reports, guidelines and case studies related to green buildings, procurement systems, client satisfaction and their interrelationships was conducted. This allowed establishment of the theoretical framework and identification of key themes/variables for further data collection and analysis.

2. Survey questionnaires: A structured questionnaire was designed and administered to several people. The survey aimed to capture respondents:

- Background information and experience levels.
- Familiarity/knowledge of different aspects of green buildings.
- Perspectives on which systems are most/least appropriate for green buildings.
- Views on what impacts in achieving client satisfaction for green projects
- The analysis of the conducted survey has been explained.

a) 71.5% of stakeholders were male and 28.5% were females.

b) 81.5% surveyors were from non-metro cities and 18.5% were from metro cities.

c) 78.5% surveyed people has their own homes while

21.5% lived in rented houses.

d) Maximum 73.1% surveyed people were trainee students and 16.9% were working professionals

e) 83.8% stakeholders were undergraduates

f) 99.2% believed that Environment consciousness is very important now a days

g) 87.7 stakeholders were aware about green buildings/ Eco friendly buildings/ Sustainable building concept

h) 72.8% stakeholders assumes that the green rated projects are costlier than the traditional residential projects

i) 64% stakeholders believe that Green rated projects (Singlex/Duplex/Flats) are environmentally friendly?

j) 92.1% surveyed participants are planning to buy a green residential project (Singlex/ Duplex/Flat)

k) 75.4% participants prefer to pay extra cost for the project, if it is environment friendly

RESULTS

1. Out of the total respondents participated in the survey, 71.5% respondents were males and remaining 28.5% respondents were female.

2. 86.9% respondents belonged to age group less than 25 years who are the probable purchasers of residential projects in the near future, 5.4% respondents belonged to the age groups 26-35 years and 36-45 years, remaining 2.3% respondents belonged to age group 46-55 years.

3. The respondents included trainee students, business owners, home makers, working professionals, construction site engineers and site supervisor.

4. Overall, 87.7% respondents are aware about Green Buildings, Eco friendly buildings or Sustainable buildings concept, whereas 12.3% respondents are still unaware about the same.

5. As per the survey 72.8% respondents agree to the fact that the green rated projects (Singlex/Duplex/Flats etc.) are costlier than the traditional residential projects, 14.9% respondents strongly agree to this fact whereas only 12.3% respondents have denied to the fact.

6. 64% of the Indian respondents agree to the fact that green rated projects are environmentally friendly, while 30.7% respondents strongly agree to this fact. Only 5.3% respondents have denied to this fact.

7. 92.1% respondents (105 out of 130) are willing to buy a residential project unit from the green rated projects soon.

8. Out of 130 respondents, 75.4% are ready to pay extra amount for purchasing green building in the residential project, 18.4% respondents are in dilemma whether to pay extra amount or not, while 6.1% respondents have denied to pay extra amount in the future.

9. The above-mentioned data states that the level of awareness related to green building is increasing gradually among the stakeholder's but still efforts need to be done to promote the advantages of green buildings. For this government shall take a step forward by providing subsidies and encouraging people to purchase green rated projects.

CONCLUSION

The following data were collected for increasing the awareness about the green residential projects. The respondents were to answer certain questions which helped in determining the level of awareness among them. The survey also helped the respondents to share their knowledge about the green buildings with their neighbor's, colleagues, and relatives.

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