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MAITREE

MARKET INTEGRATION AND TRANSFORMATION FOR ENERGY EFFICIENCY



Building Green

Approach & Insights for Market Transformation



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CONTENT

BUILDING'S ENVIRONMENTAL IMPACT

Buildings have a significant impact on our environment, both on a local and a global scale. Every stage of the building has a measurable environmental impact: the mining & transportation of materials to building site, the construction process itself, the waste removal and disposal process; and the continual use of natural resources such as energy, water for the entire operating life of the building. With a rapidly developing global economy, it is crucial that we transit towards reducing the impact of building design, construction and operation on the environment.

BUILDING GREEN

Green buildings, on the other hand; use natural resources such as water and energy efficiently, emphasize upon the use of sustainable building materials, recycle waste, prioritize the health and well-being of occupants, and create measurable benefits for all parties involved. Additionally, they provide inclusive opportunities for overall sustainable growth of cities and communities; and are key components of smart and green neighborhoods. Green buildings address the three pillars of sustainability, including people (social), planet (environment) and profit (economic).

There is a need to accelerate the adoption of green buildings keeping in mind pressing environmental, social, and economic issues in India. The same can be achieved through introducing and sustaining a series of calculated market interventions through different means such as policy revision, creation of deployment plans, and effective public outreach etc. When conventional building practices imbibe green as a norm, and the difference between “business as usual” and “green” ceases to exist; that then indicates an effective and complete market transformation of the building industry.

IDENTIFYING BARRIERS

As a first step towards transforming building practices; a study has been conducted to identify, characterize and rank market barriers for main-streaming green buildings and increase the green share of construction activity in the Indian context.

The approach, survey results and key takeaways of India's green building market transformation study have been discussed in this paper. It also details the challenges faced by project stakeholders and the potential high-level actionable items that could be instituted at regional and national level to address specific issues.

¹ Air Quality Life Index – India Fact Sheet

² World Energy Outlook (2014-15)

WHY ?

To identify market barriers for adoption & scale-up of green buildings

Particulate pollution shortens an avg. Indian's life expectancy by > 4 years. Only 20% waste is treated in India and 80% is being sent to landfills which increases air, water and land pollution and increases health hazards.¹ Energy use in India has almost doubled since 2000, although per capita consumption is only around a 3rd of the global average. 3/4th of its energy demand is met by fossil fuels.²

WHO?

BUILDING LIFE CYCLE

The building life cycle can be broadly categorized into three stages; design and planning, development and construction and; operation and maintenance. Through all stages of the building, different stakeholders (such as professionals, industry specialists, technology providers) intervene and contribute towards making decisions based on their responsibilities and area of expertise. These decisions and actions taken thereof can determine the level of impact a building has on the environment during its design, construction and operation stage. Incorporation and integration of resource efficient strategies at different stages of a building, has a potential to make it efficient, cost effective and healthy for occupants. This can further enable widespread acceptance of green building principles and strategies, eliminate hurdles, and lead to adoption of common sustainability goals.

A survey was designed for people involved through different stages of a typical building project; about the market barriers in adoption of efficient, sustainable and green strategies and technology. The expected outcome was to lay down a way forward to overcome barriers identified in the study.

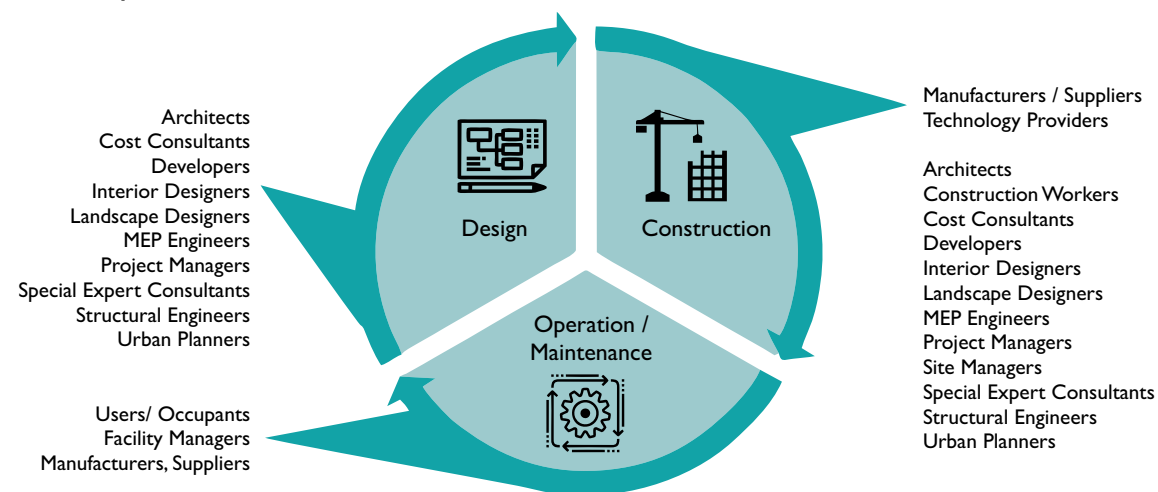
INDUSTRY SEGMENTS

People involved in the Indian building design and construction sector were categorized into three segments.

- **Professionals, owners, developers,** form an integral part of sustainable, resource efficient green building design and planning stage. The vision or goals of the project are set during nascent stages of the project.
- **Industry specialist, technology manufacturers, service providers** also play an equally important role during design & construction of a building. Integrating effective and efficient technologies and strategies into design and construction processes, can contribute towards better building performance and lower environmental impacts.
- **Occupants & facility management teams,** familiar with green features of building; contribute to efficient operation and maintenance of the building; resulting in lower operation costs. Raising consumer awareness on the tangible and intangible benefits of green features would help in accelerating market transformation of the building construction sector.

Respondent Profile

Visage Beauty & Health Care Pvt Ltd, Noida





WHAT ?

SUMMARY OF INDICATORS

The survey was designed to assess the perception of professionals and industry in the Indian building design and construction sector in adoption and scaling up of the following green building best practices:

- Integrated design approach
- Life cycle cost analysis
- Climate responsive design
- Green technologies
- Occupant behavior

A detailed survey was also designed to understand the occupant's level of familiarity with green building strategies and technologies.

In an integrated design approach, variables that affect another are considered at the onset and through the project lifecycle for optimal solutions. It is a holistic design process that looks at the entire building as an entity, and emphasis is on integrating the different aspects of the building design and services.

This approach is one of the indicators for green building market transformation.

INTEGRATED DESIGN APPROACH



Integrated design is a comprehensive approach to design which brings together specialist fields which are usually considered separately. Building design and construction considers architecture, engineering (structural, mechanical, electrical, plumbing, acoustics), project management, landscape, interior design, etc.

The approach integrates building life-cycle management and a greater consideration of the occupants of the building. The aim of integrated building design is to optimize design with respect to performance during operation and have lower environmental impact often without increasing capital cost.

LIFE CYCLE COST ANALYSIS



Life cycle cost (LCC) analysis is a method of conducting economic evaluation of various green building measures over the lifespan of the building over a defined period. For example, a strategy to optimize window percentage on the building facade in hot tropical climates, would not only result in initial costs for installation of high-performance glazing, but also contribute towards lower energy cost of running air-conditioning. Similarly, shading of openings, a one-time investment; would contribute to recurrent savings on energy bills for the entire life of the building.

Life cycle cost analysis has been considered as an important indicator for green building market transformation; since it is best used during building design and planning stage. As opposed to more commonly used Return on Investment (ROI) based calculations, LCC allows projects to make strategic decisions based on long-term costs and savings, keeping in mind the fact that they are interconnected.

Indicators for Market Transformation

CLIMATE RESPONSIVE DESIGN

Climate responsive design, also referred to as passive design considers local climate, natural materials, has no or minimal mechanical systems and requires minimal maintenance. Some of the passive design strategies include:

- Design: daylight, natural ventilation, orientation, shading
- Cooling: comfort cooling, active mass cooling, nocturnal ventilation, spraying roof with water, earth sheltering, earth coupling.
- Solid waste management: phytoremediation, composting, wetlands, DEWATS (decentralized wastewater treatment systems)
- Water management: rainwater harvesting & storage
- Construction materials & technology - local and natural materials, low energy construction (bamboo/ timber, stabilized compressed earth blocks, fly-ash blocks, rat trap bonds as walling technique, filler stabs, etc.)
- Indoor air quality: plants, water-based paints, natural housekeeping chemicals.

Integrated passive strategies in building design is yet another indicator for assessing market transformation. Projects incorporating passive design principles result in designing climate responsive buildings that are both efficient and comfortable.

GREEN TECHNOLOGY

Green or low environmental technologies; are those that contribute towards further enhanced performance of buildings. Some of the strategies include:

- High performance building envelope strategies – insulated walls and roof, double / triple glazing, photochromatic glazing.
- Cooling: solar cooling, radiant cooling, geothermal, evaporative cooling, energy efficient cooling appliances, VAM, etc.
- Solid waste management: sewage treatment plants.
- Water management – low flow fixtures, sensors, hydro-pneumatic systems, etc.
- Construction materials & technology – precast, post tensioned, etc.
- Lighting – efficient lighting, controls – daylight / occupancy, etc.
- Indoor air quality – air purifying technologies (air filters), low VOC (volatile organic compounds) paints, adhesives, carpets, etc.

Integrated green technology in building is an indicator for assessing market transformation. Projects incorporating active design technologies result in high performance buildings.

OCCUPANT BEHAVIOR



Occupant behavior has great impact on resource use and operation of green building. Occupant behavior modification implies the level of change demonstrated in users' resource usage patterns and actions. Building designers have the potential to influence occupant behavior.

For example; designing easily accessible, visible staircases with natural light and ventilation encourage occupants to use the staircase in lieu of an elevator. Similarly, integrating management systems that analyze occupant requirements, their behavior and operate systems for optimized performance is another feature of high-performance buildings.

Interactive systems that inform the occupant of their real time energy use and strategies to optimize performance and enhance experience are some of the approaches towards influencing occupant behavior.

Influencing occupant behavior is an important strategy toward operational efficiency of a building. It is also an indicator of a transformed market that understands occupants as integral elements for an overall low environmental impact through the building operation stage.

TECHNOLOGY PENETRATION

One of the keys to market transformation is increased demand from the end-user for environmental features. End-user awareness can be assessed through analyzing their level of familiarity with existing as well as cutting-edge eco-friendly technologies.

Indicators for Market Transformation



HOW?

Visage Beauty & Health Care Pvt. Ltd, Noida

This study uses a market transformation methodology² to identify and characterize the market barriers for energy efficient and environment-friendly products and services within the Indian green building market. Each market barrier has been assessed against the five “A”s, each of which represent a critical aspect of the market adoption path for a new technology.

This framework considers all the steps a service follows as it moves from the project proponent to the end-user.

²Five A's: Barrier Classification and Market Transformation Program Design for Energy Efficient Technologies; Katherine N. Delve & Anne Wilkins, Office of Energy Efficiency, Natural Resources Canada Federico Garcia-Lopez & Michael J. Scholand, Navigant Consulting, Inc.

AVAILABILITY

To assess the availability of green strategies & supporting elements, such as professional expertise, information, analysis tools.

1

AWARENESS

To evaluate the penetration of awareness amongst the end-user on the benefits of eco-friendly strategies and existing channels for creating awareness.

2

ACCESSIBILITY

To identify barriers in access to subject matter experts, tools, demonstration projects that can aid implementation of green strategies.

3

AFFORDABILITY

To evaluate user perception of additional time & effort in implementing “green”. To evaluate the existing policy environment towards making “green” affordable.

4

ACCEPTANCE

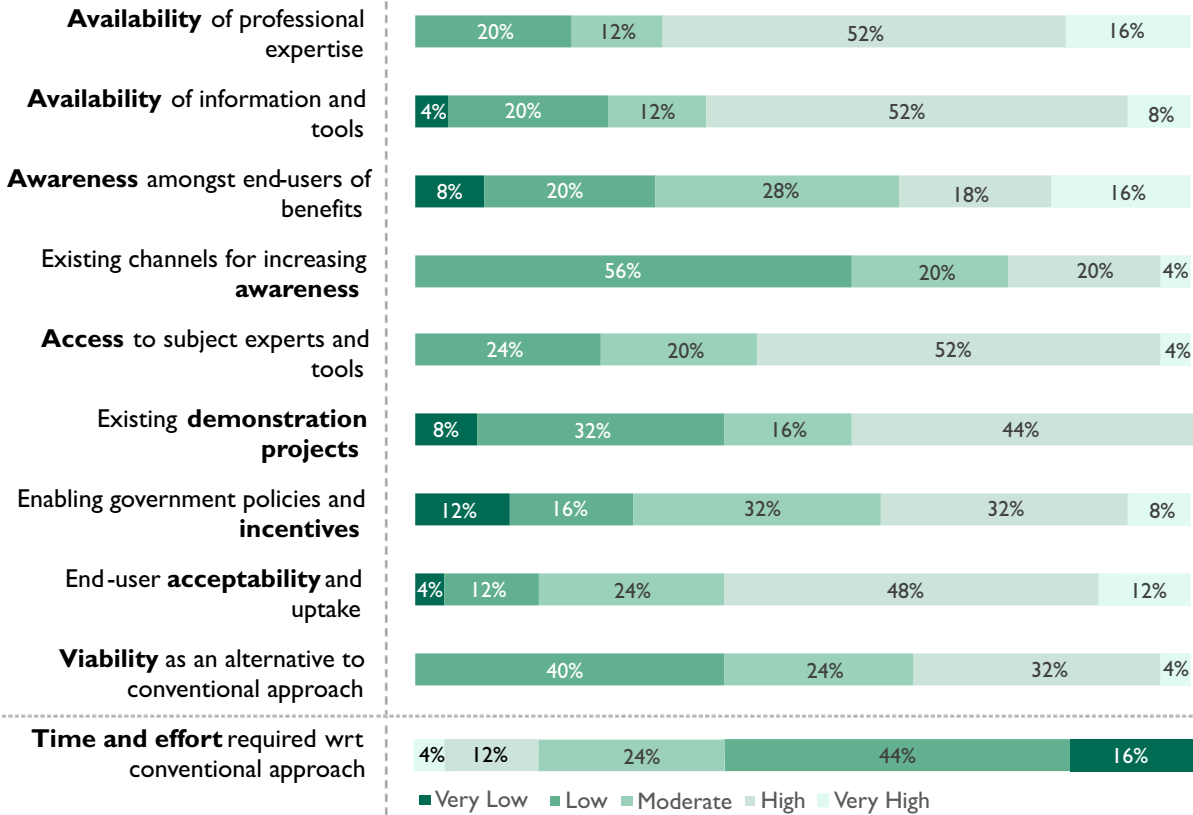
To understand user perception for accepting green strategies as a viable alternative to conventional approach.

5

5A Approach for conducting Barrier Analysis



INTEGRATED DESIGN APPROACH



OBSERVATIONS

A significant portion (60-68%) of the respondents said that there exists a widespread availability of the strategy through professional expertise, tools and information.

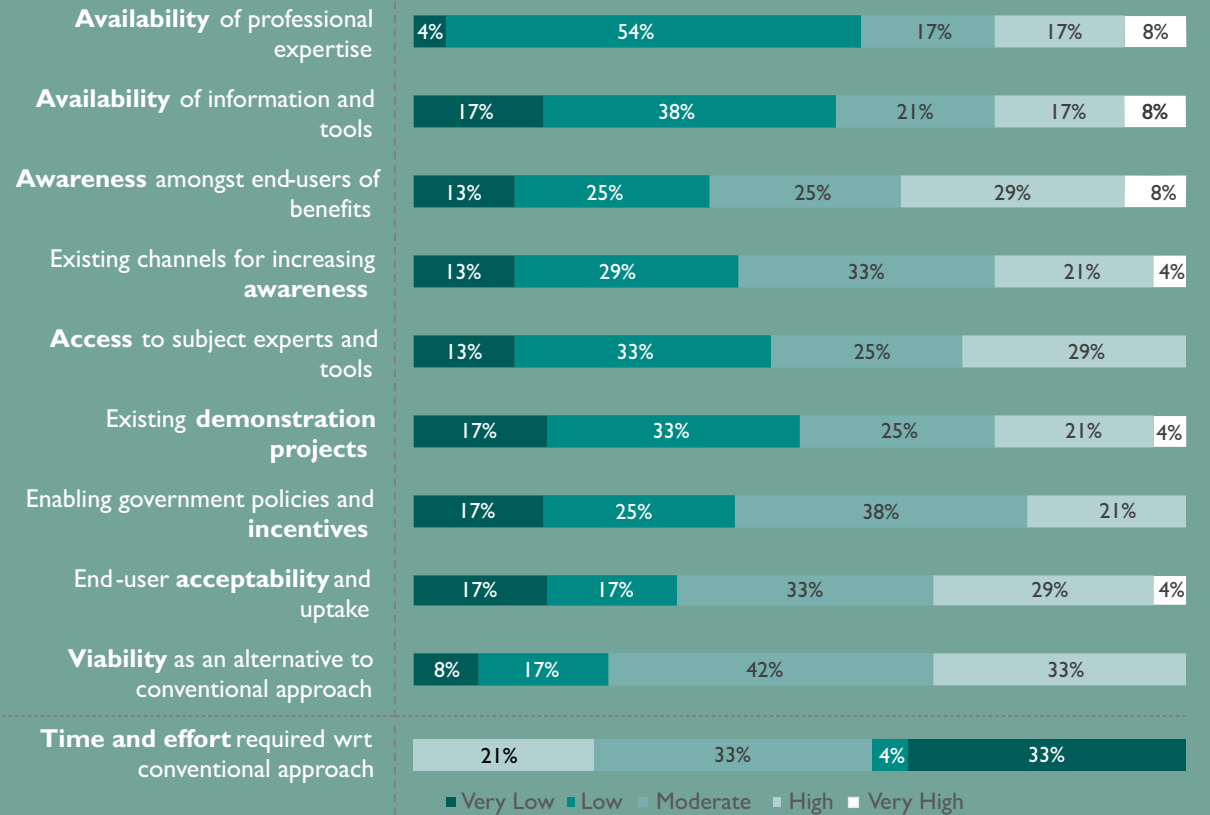
However, majority of the respondents (56%) also pointed out to the fact that there are not many awareness dissemination initiatives around the strategy.

The respondents (40%) also indicated that a stronger intervention is required in making the strategy accessible to the stakeholders through demonstration projects

In general terms, the barrier analysis showed that a range of strategic interventions are required catering to awareness and accessibility on integrated design approach.



LIFE CYCLE COST ANALYSIS



OBSERVATIONS

Life cycle costing analysis is a little-known and fairly new approach to budgeting for a building project.

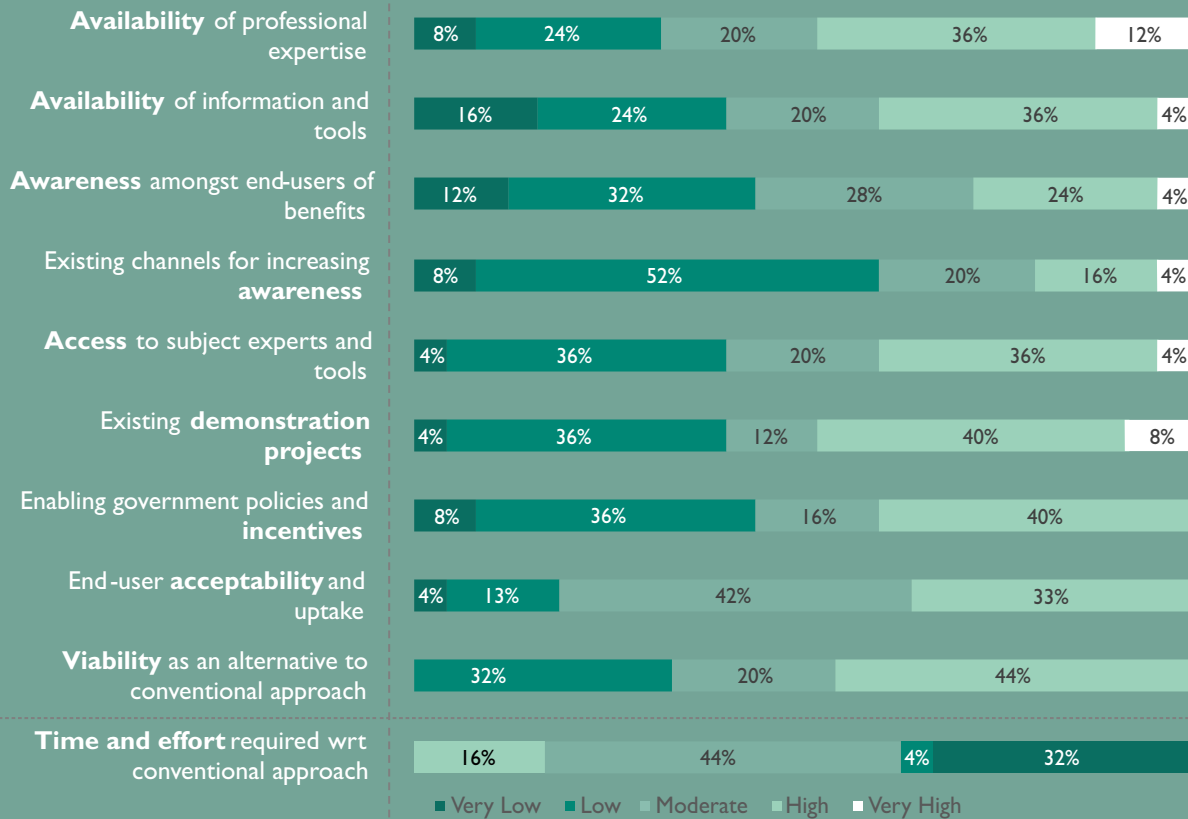
Respondents surveyed pointed to a general lack of availability (55-60%), accessibility (45-50%), affordability (40%)

and awareness (38-42%) of this approach among stakeholders of the building industry. It is clear that there exists a need to push for availability, accessibility, awareness and affordability of this approach in the near future.

RESULTS



CLIMATE RESPONSIVE DESIGN



OBSERVATIONS

48% of the respondents concurred that there exist demonstration projects and 44% concur that climate responsive design is a viable alternative to conventional approach.

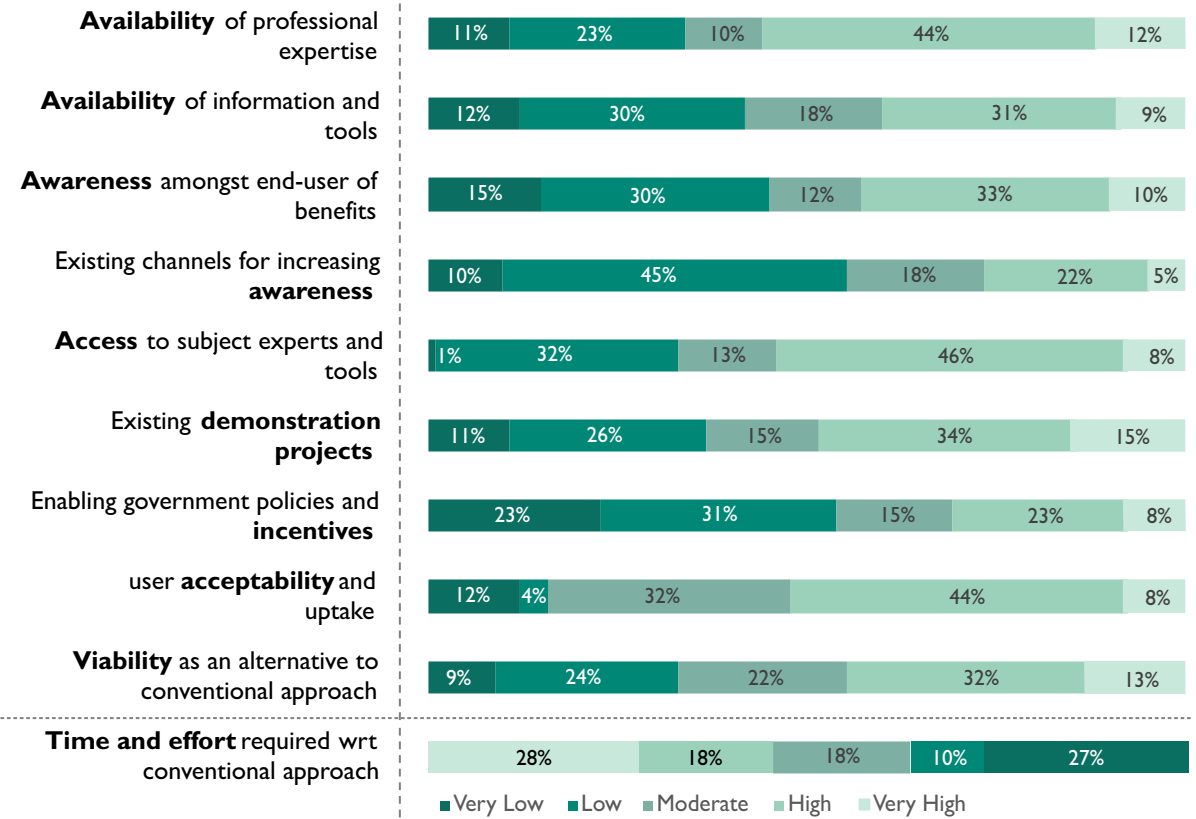
Further, 36% of the respondents consider climate responsive design approach is less time and effort intensive when compared to conventional approach.

However, the survey results (60%) also pointed to a lack of awareness of this strategy among building stakeholders.

Additionally, the respondents (44%) suggested that there should be more enabling governmental policies and incentives to increase uptake of this approach.



GREEN TECHNOLOGY



OBSERVATIONS

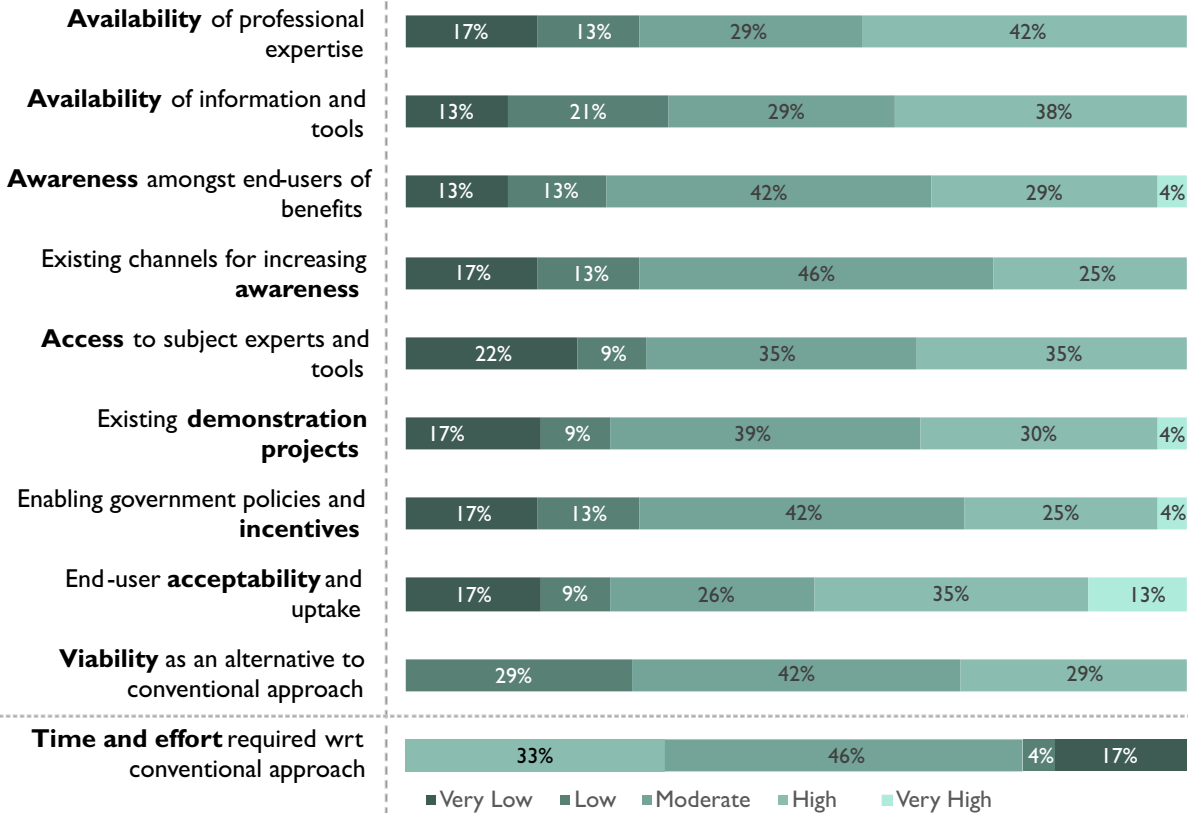
45-55% of the respondents indicated a low level of awareness of the benefits of green technologies.

The respondents (54%) also suggested that new government initiatives and policies need to be instituted to ensure greater uptake of the technologies.

Also, intervention is required towards increasing availability (42%) of the information and tools regarding the technology as many of the technologies are still perceived as nascent, and not as robust or less effective or sub-standard as its conventional counterpart (33%).



OCCUPANT BEHAVIOR



OBSERVATIONS

The survey results did not give a clear picture on the market barriers as most respondents tended towards taking a neutral stand on the survey regarding occupant behavior and control.

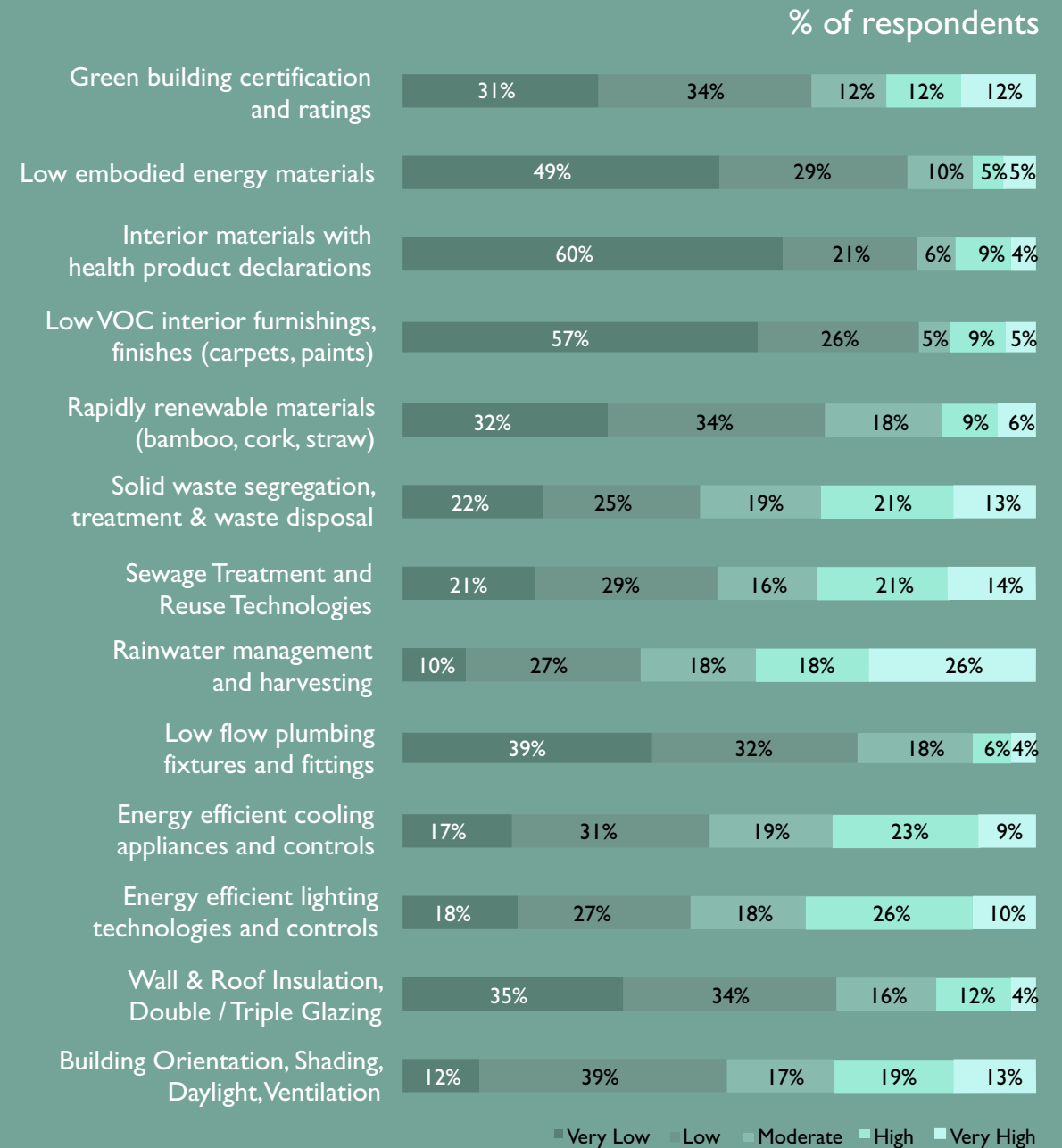
This might be due to lack of awareness of the strategy.

USER FAMILIARITY

Respondents were generally more aware of solid waste and wastewater technologies, rainwater harvesting, and energy-efficient technologies compared to other green building technologies.

Conversely, users (75-85%) were not much aware of low-VOC materials and finishes (83%), health product declarations (HPDs)(81%), low-embodied energy materials (78%), and low-flow plumbing fixtures (71%).

USER FAMILIARITY : SPECIFIC GREEN STRATEGIES AND TECHNOLOGIES



Perception of Barriers

> **60 %**

Respondents feel the need for more channels to create awareness on integrated design approach, life cycle cost analysis and green technologies.

> **50 %**

Respondents feel that there is a lack of professional expertise and there is a need of pilot projects in the field of life cycle cost analysis.

> **45 %**

Respondents feel the need to have enabling policies to incentivize climate responsive design and green technologies.

> **40 %**

Respondents find integrated design approach time consuming.

> **30 %**

Respondents do not consider integrated design process, climate responsive design and green technology as a viable alternative.

> **25 %**

Respondents have maintained a neutral stance on occupant behavior. This indicates lack of awareness in this domain.

Awareness & Affordability

are the key barriers across most strategies.

	Integrated Design Approach	Life Cycle Cost Analysis	Climate Responsive Design	Green Technology	Occupant Behavior
Availability		●			
Awareness	●	●	●	●	●
Accessibility		●	●	●	
Affordability	●	●	●	●	
Acceptance	●				●



Summary of key barriers

WHAT NEXT ?

Addressing Barriers



AVAILABILITY

Organizations can provide incentives for new professionals to take training on climate responsive design, and life cycle cost analysis. The training environment can facilitate opportunities for professionals to be engaged on pilot projects.

Regional and national database of technical expertise and tools can be hosted on government / non-government organization website.

Introducing credential maintenance programs for existing professionals focused on life cycle cost analysis, can increase the availability of LCCA experts. Engaging institutions to increase availability of analysis tools and software.

AWARENESS

Non-government and government organizations can engage with media partners to create awareness amongst the public at large about incentives and tax benefits. Regional programs can be undertaken that focus on local issues and strategies.

Within a construction project, more emphasis should be placed on educating occupants of the tangible and intangible benefits of ecofriendly materials and use of low flow plumbing fixtures.

Green technology providers and building material manufacturers can work on branding strategies focused towards sensitizing users on paybacks and benefits.

ACCESSIBILITY

For existing pilot projects, site visits can be organized. Papers, case study documents and articles demonstrating performance results

can be published and made available.

Government organizations can create an enabling environment for municipalities to implement pilot projects. These pilots would be accessible for end-users to witness implementation.

Fostering partnerships with institutions and municipal corporations can enable increase of accessibility for users.

AFFORDABILITY

Fostering partnerships with non-government organizations / institutions and funding organizations that provide such services can help towards making green strategies affordable.

Draft government policies that include green building strategies. The policy framework can incentivize strategies based on regional issues.

Research papers, case studies, articles and pilots with focus on co-relation of effort (time and cost) and performance of green strategies.

ACCEPTANCE

Project teams can publish case studies of completed projects addressing viability of alternative strategies.

User satisfaction surveys or post occupancy surveys can be conducted and published to facilitate acceptance of green strategies and technologies.

Organizations promoting green building strategies can conduct focused training programs, addressing viability of integrated design approach and life cycle cost analysis.

TRAINING & CAPACITY BUILDING POLICY IMPROVEMENTS

Developing skills for architects, engineers, project managers and contractors, in the areas of integrated design, lifecycle-based decision making, and adoption of emerging technologies is of key importance for accelerating the Indian green building market. This is seen as a fundamental requirement and it addresses the market barriers related to Availability, Awareness, Accessibility and Acceptance.

There is a perceived lack of expertise, especially in the field of life cycle cost analysis. Introducing credential maintenance programs for existing professionals focused on life cycle cost analysis, can help address this barrier. A multi-pronged approach to increase up-take of green strategies involves

- Focused discussions with building professionals such as architects, engineers, project managers, contractors, etc. Consultation workshops to invite feedback, identify technical barriers and skill training requirements of professionals.
- Making available local and national database of technical expertise and tools on public platforms.
- Customized training programs for specific target groups to bridge the gaps in skills.
- Multidisciplinary training programs for creating awareness and equipping professionals with know-how on benefits and paybacks of green strategies.
- Institutional partnerships to provide training on latest analysis tools.

Creating an enabling policy environment to encourage up-take and use of green technologies is a key for market transformation. The policy and program implementation framework should be focused to increase awareness, improve accessibility and accelerate acceptance of green strategies and technologies. One of the strongest barriers is a perception of lack of enabling policy environment and a disconnect in efforts of government and non government organizations. Public-private partnerships (PPPs) can be leveraged to make relevant policy improvements in the building sector. Through PPP, following initiatives can be undertaken:

- Enable local municipalities to undertake programs at state, district and block level.
- Skill development of government officials, to be able to effectively implement policies.
- Green knowledge platform with database of professional expertise, tools, can be hosted on a government platform to increase awareness and acceptance.
- Integrate green strategies and technologies in rebates and incentives such as green loans, regulatory fee waivers, sustainable design bonuses, energy and other resource conservation grants, subsidized performance monitoring, etc.

WHAT NEXT?

Way-forward

Nirlon Knowledge Park, Mumbai

PILOT IMPLEMENTATION

Implementing and monitoring pilots to demonstrate benefits of green strategies such as climate responsive design and energy efficiency has also been identified as a key to address the barrier of affordability and acceptance. Pilot projects should be representative of the majority of typology of buildings being constructed. Hence, they should demonstrate affordability based on life cycle cost. It is very important that there is transparency in data and cost-benefit study of pilots. Performance data of pilot projects should be easily accessible. The following steps can be taken :

- Develop a streamlined approach to identify strategic pilot projects. For example, there is a huge potential in the existing government and public buildings.
- Identify regional projects that have already used green strategies as demonstrated projects open to public. Research, document and make available the performance data and cost-benefit analysis of the projects. Site visits for these projects can be arranged.
- Create a national and regional platform for benchmarking, monitoring pilot and demonstration projects.
- Fostering partnerships with national laboratories and research agencies to monitor pilot projects.

OUTREACH & MEDIA

Outreach programs for occupants and end-users is required to address all the market barriers. A bottom up approach which drives demand for green strategies is the fastest way for market transformation. Concentrated efforts from organizations and government is required to create awareness and acceptance amongst end-users. The following initiatives can help towards addressing barriers:

- An integrated media strategy that includes training programs, policy improvements and pilot implementation; in addition to, increasing user awareness and acceptance.
- Publication of research and development initiatives can improve acceptance and uptake of strategies. This is especially required in the domain of life cycle cost analysis and green technologies.
- Research papers, case studies and articles with focus on co-relation of effort (time and cost) versus performance of green strategies is required to address the perception of affordability as a barrier.
- Enrolling media partners to create awareness amongst the public at large of benefits of green strategies, policies and programs. This can be carried out both at national and regional level.

Way-forward

Shift In Perception

Relevance of Green Buildings



POST COVID-19

Nirlon Knowledge Park, Mumbai

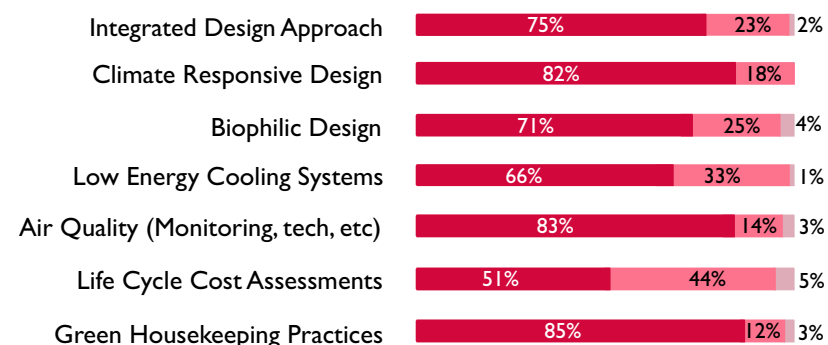
PERCEPTION: POST COVID-19

A follow-up survey on post COVID-19 scenario was conducted. The responses have been analyzed in relation to the pre COVID-19 responses. As per the previous survey, 36% of the respondents conveyed a basic level of awareness regarding Green Building Ratings. The recent survey highlights that

68% of the respondents consider green building ratings important towards accelerating scale-up of greener and healthier buildings. Further, the existing channels for increasing awareness were analyzed as insufficient across all indicators in the pre-COVID survey. Programs to increase awareness amongst end-users as well as implementation of pilots is emphasised in post-COVID scenario.

% of respondents

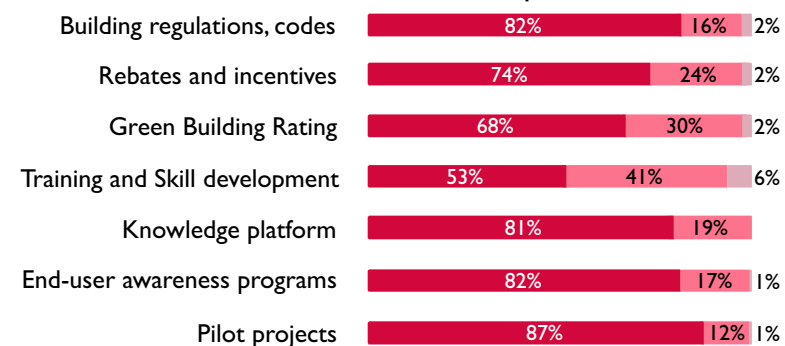
Relative importance of strategies post COVID-19



40% of respondents previously considered **integrated design approach** as a time and effort consuming activity,

75% of respondents have emphasized on the importance of **Integrated Design Approach**.

Instruments for accelerating green and healthy buildings post COVID-19

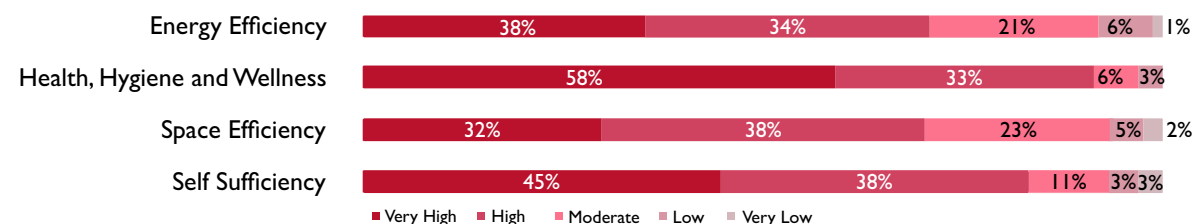


A large swing towards realizing the importance of **Climate Responsive Design** is observed.

82% of the respondents have highlighted the increased importance in climate responsive design post COVID-19.

■ More Important ■ Same as before ■ Less Important

Prioritization in future built environments



■ Very High ■ High ■ Moderate ■ Low ■ Very Low

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USAID MAITREE

United States Agency for International Development (USAID) led Market Integration and Transformation Program for Energy Efficiency (MAITREE) is a four-year bilateral program with the Ministry of Power. MAITREE aims at uptake of cutting-edge technology, innovative business models, and end-user engagement, to accelerate adoption of energy efficiency strategies and technologies at scale. MAITREE works with a range of public sector, private sector and international partners.

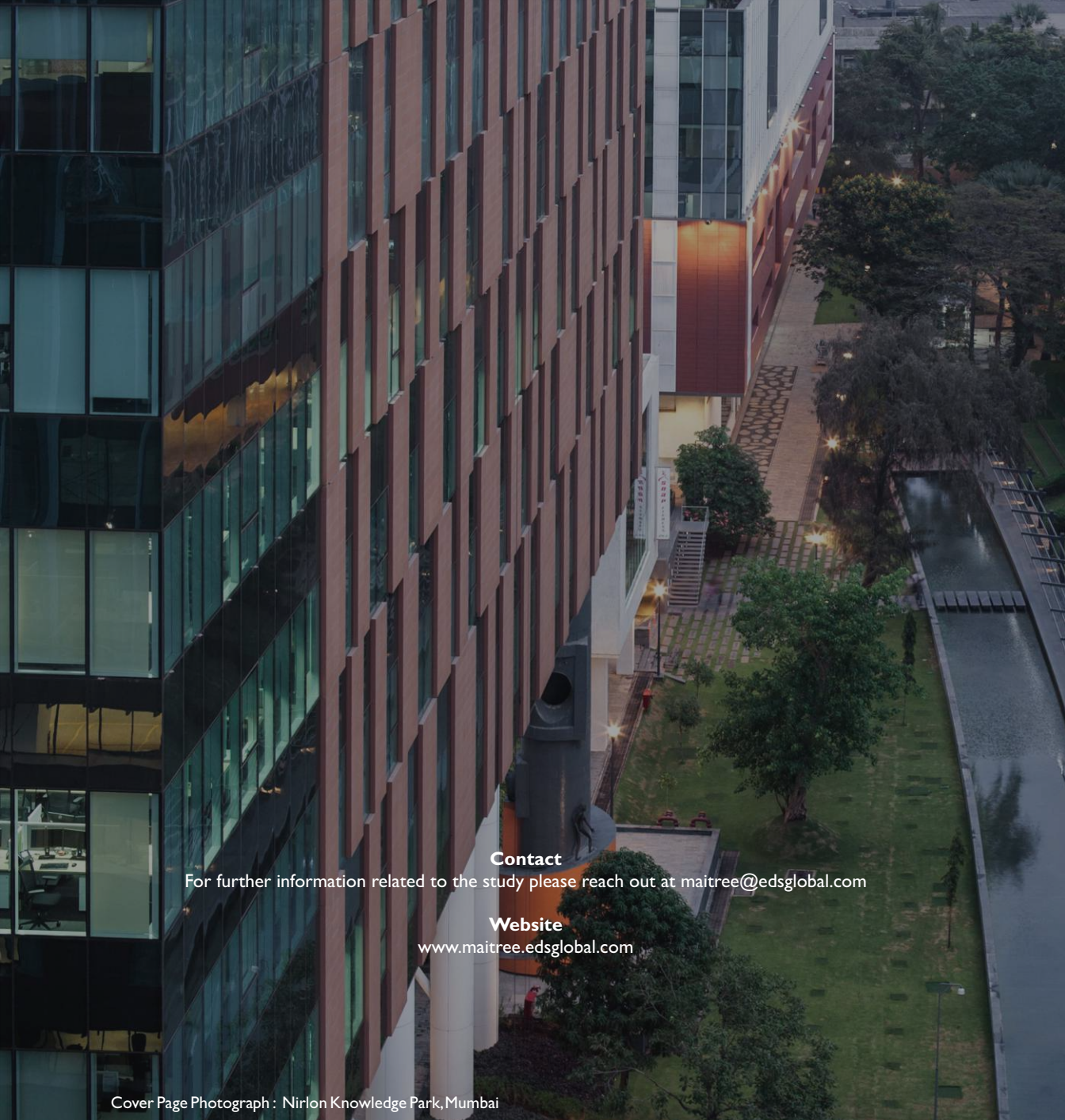
USGBC

The U.S. Green Building Council's LEED (Leadership in Energy and Environmental Design) green building certification system is the foremost program for the design, construction, maintenance and operations of green buildings. Every day, more than 2.6 million square feet of space is certified using LEED. Nearly 102,000 projects are currently participating in the commercial LEED rating systems, comprising more than 22.6 billion square feet of construction space in 178 countries and territories. In addition, there are more than 2 million registered and certified residential units. Learn more at www.usgbc.org.

EDS

Environmental Design Solutions Pvt. Ltd. [EDS] is a sustainability advisory firm focusing on the built environment. The diverse milieu of the team converges on climate change mitigation policies, energy efficient building design, building code development, energy efficiency policy development, energy simulation and green building certification. EDS' work supports the global endeavor towards a sustainable environment primarily through the following broad categories: 1. Sustainable Solutions for the Built Environment, 2. Strategy Consulting for Policy & Codes, and Research 3. Outreach, Communication, Documentation, and Training.

Participants



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