A Study on Green building: Market opportunities and challenges

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Abstract: Sustainability has become a necessity in the building industry. In recent years, as the general public is more informed and aware of sustainability related issues, they are becoming major players in the decision making process regarding their built environment. India is a country where infrastructure is the main hurdle for the growth of Indian businesses. In today's scenario, buildings which are present already are contributing 45 % of worldwide energy use. Our demand on natural and finite resources such as energy, water and building materials can be reduced, and our contribution to environmental quality can also be enhanced by incorporating green building principle into the design, construction and renovation. The aim of a green building design is to minimize the demand on non-renewable resources, maximize the utilization efficiency of these resources, when in use, and maximize the reuse, recycling, and utilization of renewable resources.

IndexTerms **- Green building, Sustainable development, Renewable resource.**

I. INTRODUCTION

A sustainable building, or green building is an outcome of a design which focuses on increasing the efficiency of resource use — energy, water, and materials — while reducing building impacts on human health and the environment during the building's lifecycle, through better sitting, design, construction, operation, maintenance, and removal. It is evident that in a multi-criteria decision-making problem, such as evaluating green buildings from various aspects, it is also important to determine how those criteria are weighted in the evaluation of various attributes.

It maximizes the use of efficient building materials and construction practices; optimizes the use of on-site sources and sinks by bio-climatic architectural practices; uses minimum energy to power itself; uses efficient equipment to meet its lighting, air-conditioning, and other needs; maximizes the use of renewable sources of energy; uses efficient waste and water management practices; and provides comfortable and hygienic indoor working conditions.

This paper demonstrates a methodology to determine the occupant or public perception of green buildings. The Leadership in Energy and Environmental Design (LEED), BREEAM, GRIHA and GREEN STAR systems are utilized as an example in this paper.

II. CRITICAL LITERATURE REVIEW

The following are the previous research review based on market opportunities and challenges of Green Building.

Durmus et al. (2010) stated that green building was the solution to many problems from local to global scale, from environmental to financial, from community to industrial. The future of green building would be carbon neutral and zero emission buildings, which could also be called "next generation", green building. (2)

Hwang et al. (2012)conducted survey and results from the survey had revealed the top 5 challenges in managing green building construction projects and they were: (1) Increase of Project Cost; (2) Lack of Communication and Interest among Project Team Members; (3) High Implementation Cost of Green Practices; (4) Lack of Credible Research on Benefits of Green Buildings; and (5) Lack of Interest from Clients. (7)

Pawar et al. (2012) found that the green building experiences in India had been exciting and challenging as well. This would ultimately serve to improve not only the energy performance of buildings but would also assist the country conserve energy and natural resources by spurring increased recovery and recycling of building materials. (6)

Vaishampayan et al. (2012) indicated that a green building was one where the qualities of both indoor and outdoor environment had been considered and protected during its design construction, maintenance and use.There should be stringent rules and legal regulations for adaptation of EMS. (15)

Khese et al. (2012) study has shown that presented a complete and detailed comparative review of four well-known sustainable green building rating systems.We should give preference for selection of green building rating system in following manner LEED, BREEAM, GHRIHA and GREEN STAR. (19)

Attaran et al. (2013) identified that the client and the occupants were the first step in the development of responsible, efficient, healthy, and functional projects. LEED-certified buildings created less waste; use less energy, water and natural resources; and were overall healthier and more comfortable for occupants. (20)

Cheng et al. (2013) stated that there was a moving trend in tenant participation and material selection in green building design and construction. Standards had evolved quickly addressing multiple building types and specific building related energy and occupant issues. However, a common benchmark could be set for easy comparison and adaptability. (10)

Ahankoob et al. (2013) found that moving towards sustainable building made the integration between different communities to create a stable environment. This would encourage countries to recruit legislations which run similar to other countries. (4)

Sentman et al. (2013) concluded that there was a considerable degree of commonality between different Rating Systems which had presented in this paper (BREEMGBCA-GPRS-GRIHA-LEED), in terms of their aim, approach and structure, but there were significant differences in terms of scope of the environmental issues addressed, metrics and performance standards. Thus, it was necessary that the selection of suitable rating system according to its categories which were generally considered the most significant measure in building sustainability assessment. (18)

Khan et al. (2013) in his research stated the application of codes like ASHARE / ECBC as a benchmark could help in designing high performance buildings. There exist tremendous opportunities to introduce new materials, equipment and technologies which can help enhance energy efficiency of buildings. (16)

Yahya et al. (2014) carried out study on the green potential rating tool which was developed by modifying the indicators of the existing green building rating tools due to lack of existing tools for green potentials. The next step of the research was to test the GPRT on selected conventional buildings in a large building stock such as a small township or a university campus. (21)

Ntshweneet al. (2014) stated that knowledge and awareness of users in Botswana was adequate for the introduction of an environmental building assessment tool. The assessment tool might further enhance that awareness and knowledge and result in transformation of green building practices in the Botswana built environment. (11)

Varmaet al. (2014) stated that creating green buildings was an important focus of building owners and even governments worldwide. In India some world class Green Buildings had been constructed in past few years, but still the concept of green buildings for general masses was in infancy stage. (12)

Bai et al. (2014) stated that through educating, making environmentally products more readily accessible and reliable, and by providing government incentives it was possible to encourage more people to adopt green building and all of the benefits that come along with it.(22)

Nangare et al. (2014) studied Building an energy efficient home required dozens of decisions by home designers, builders, and subcontractors. Many decisions affected the cost of construction and the profitability of the project. (14)

Herceg et al. (2015) found that in the near term, we expect technology developers to introduce novel sensors, and global RE companies to produce data sets to prove the case decisively that green buildings result in measureable gains in performance and occupancy well-being.(3)

Tathagat et al. (2015) stated that the payback period for existing green buildings range from two to seven years, depending upon their certification level. The key challenges for the development of green buildings in India are mostly in the lines of awareness on the benefits of green buildings, green materials and technology. (8)

Kumar et al. (2015) studied that the final rating system for small residential building shows that people are mainly focused towards conservation & reuse of water and energy optimization because it is directly related to their daily usage and cost of living. (9)

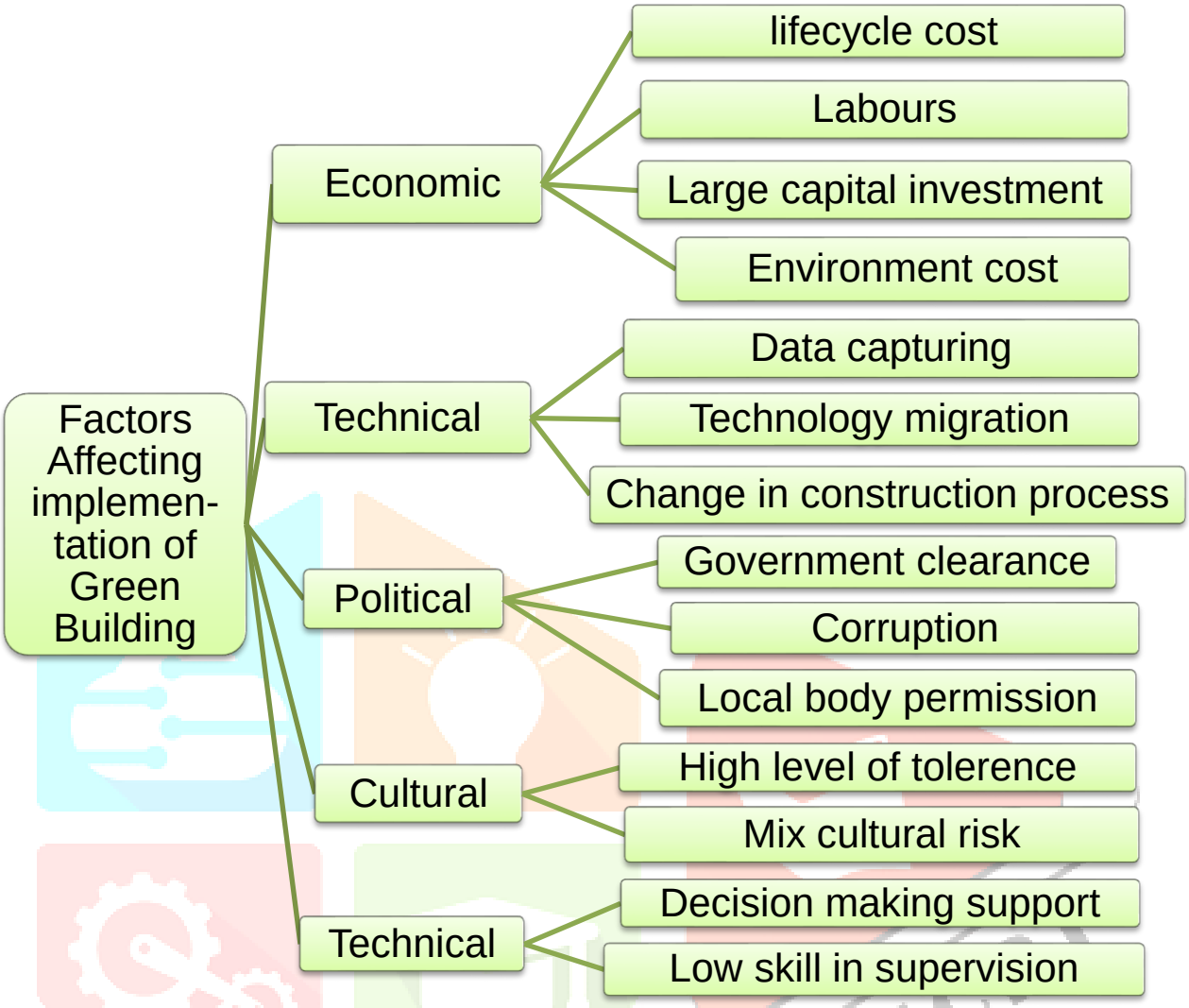
Mokalet al. (2015) studied that green construction material reduces side effects on environment. To make efficient sustainable structure as well as will lessens the environmental pollution content, and like greenhouse gas emission, resource depletion, soil pollution , health hazards , ozone depletion etc. (1)

Jha et al. (2016) stated that Green buildings will be helpful to make the construction industry environmental friendly reducing environmental degradation and conserving resources for the future generation and thus achieving sustainable development. (7)

Khoshbakht et al. (2016) provided the lack of clear and systematic research studies of building costs have resulted in the ambiguity of green building cost-benefits. It is then recommended that tools like BIDS, which is a tool based on the meta-analysis of several trusted and empirical studies, to be developed to accumulate the production of the large sample pool of validated database. (13)

Chattaraj et al. (2016) surveyed that green building reduces energy consumptions in numerous ways. Decrease embodies energy of the building through efficient design, use of recycled and local materials and recycling construction waste. Green building design reduces energy consumption over its lifetime. Strategically placing windows and skylight can eliminate the need for electrical lighting during the day. High quality insulation reduces temperature regulation costs in both summer and winter. (17)

III. MAJOR FINDINGS OF THIS LITERATURE REVIEW:



IV. List of challenging factorsaffecting green building in research papers

REPRESENTATIVE REFERENCES	FACTORS
Alev Durmuset al. (2010)	Lack of implementation of green building standards.
Bon-Gang Hwang et al. (2012)	Lack of professional approach towards green building.
Avinash Shivajirao Pawar et al. (2012)	Awareness programs are not carried out.
Prof. Mrs. Gayatri Rajendra Vaishampayan et al. (2012)	Improper rules and regulations.
Sharad R. Khese et al. (2012)	Irresponsible management from various

	agencies.
Shamiran Attaran et al. (2013)	Poor observation.
Jack C. P. Cheng et al. (2013)	Comparison of green building rating system has not been studied properly.
Alireza Ahankoobet al. (2013)	Planning, implementing and reviewing, control of work and manpower is weak.
Shannon D. Sentmanet al. (2013)	Selection of proper rating system is not done by the experts.
Emran Khan et al. (2013)	Not implementing ASHARE /ECBC as a benchmark which can help in designing high performance buildings.
Syed Yahya et al. (2014)	Lack in modification of the indicators of the existing green building rating tools.
Keneilwe Ntshweneet al. (2014)	Inadequate knowledge and awareness in people.
Kushagra Varma et al. (2014)	The concept of green buildings for general masses is in infancy stage.
Vinutha Bai et al. (2014)	Less government incentives.
Priyanka Nangare et al. (2014)	Ineffective decision making process makes it hard to implement.
Alex Herceg et al. (2015)	Obsolesced technology.
Akshay B. Mokalet al. (2015)	Unavailability of green construction material.
Bhavesh Jha et al. (2016)	Improper implementation of planning.
Khoshbakht et al. (2016)	Lack of clear and systematic studies & research.
Shamik Chattaraj et al. (2016)	Less awareness towards energy conservation.

CONCLUSION:

From the above literature review we can conclude the following things:

1. Marketers should play crucial role since they have the responsibility to make the consumers understand the need for and benefits of green buildings as compared to non-green ones. In these times, Green building assumes even more importance and relevance in developing countries like India.
2. Along with Private sector, Government initiatives are most important, intense efforts should be made by Government for following these practices for wellbeing of next generations.
3. Proper implementation of standards of various rating systems i.e. LEED, BREEAM, GRIHA and GOLD STAR should be monitored by experts.
4. Firms should give best vendor award for initiation and implementation of green marketing practices.
5. Study reveals that government regulations and competitors forces plays crucial role in green endeavors, so government should spend some more amounts on research and development for innovating eco-friendly technologies, and should give subsidies those who are practicing.
6. Since the bigger challenge will be in the public sector, voluntary efforts alone will not solve the country's environmental problems. The efforts of leading businesses need to be complemented with enforcement to improve laggards, and a firm commitment to the rule of law.
7. Companies should follow a more holistic approach. They should not just focus on being energy efficient, but they should shine when it comes to social responsibility and sustainability.
8. There should be more institutes established for the assessment of green activities its outcomes in respect to construction as well as other sectors.

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