



The Need for Evaluation and Literature Study on Evolution of International and Indian Green Building Rating Systems

*¹P.Kathiravan

Research Scholar, Faculty of architecture, Karpagam academy of higher education

Kathiravan7582@yahoo.com

²N.Balasundaram,

HOD, Civil engineering department, Karpagam academy of higher education

³Janani Venkatesh,

Assistant professor, Faculty of architecture, Karpagam academy of higher education

1.1. Abstract

The physiological properties of the planet are changing dramatically, as we can see from the vagaries of present climatic circumstances. This is mostly due to an increase in global temperature as a result of humankind's massive activities and interventions in the environment. As a result, glaciers have melted and global sea levels have risen. Because of the significant impact on the environment in the last decade, the construction sector's consumption of major environmental resources has resulted in a massive depletion of natural resources, and the contamination generated by buildings has further increased the need for a development that is very sustainable in nature. Sustainable green construction solutions have become the need of the hour in order to lessen the harmful influence on the environment and to improve the health of the residents. Green building evaluation systems have been implemented in many countries around the world to aid in the implementation of green building strategies by controlling energy consumption, careful use of building materials, creating a pleasant microclimate, minimizing natural resource use, and reducing emissions. Nonetheless, there is few indications that the stakeholders, particularly in India, have grasped the concepts and put them into practice. As a result, the article examines the fundamental literature study on international and Indian green building rating systems in order to begin a study on the effectiveness of rating system implementation.

1.2 Background

The exponential rise of emerging nations such as India has resulted in a massive increase in the built environment, thus now is the time for stakeholders to accept and follow the green construction principles to the letter. Various nations have contributed to the green building movement on different schedules and based on different factors, but successful implementation can only be achieved if the green building assessment system's framework is properly set up. Experts in this field believe that environmental concerns are more essential than social and economic aspects of sustainability in designing new structures. As a result, a research on the evaluation of the international and Indian green building grading systems is essential. (2019, Mohammed Ali Berawi)

1.3 The Importance of Green Building Rating Systems

"The unprecedented rise in economic activity around the world is putting a lot of strain on the natural and environmental resources." There is rising evidence that the activities of humans is wrecking the planet and is creating an irreparable harm on the global environment and ecosystem, which will have an influence that is very negative on the future generations' quality of life." [1] BhagirathBehera (BhagirathBehera, 2011).

Since the mid-twentieth century, global warming has been defined as an increase in average observed temperatures of the atmosphere and ocean near the Earth's surface. World warming

has the potential to cause a 20% drop in global GDP, since it raises the chance of natural disasters that alter global GDP. In the coastal environment, glacier ice may melt, raising sea levels and wreaking havoc. Greenhouse gases (greenhouse gases) created and emitted by human activities are understood to be the cause of global warming. The goal of the Green Building Movement is to reduce resource and energy consumption, enhance renewable energy usage, reduce environmental degradation and waste output, and improve people's health and comfort. Sustainable building has several economic, social, and environmental benefits, and increased development and usage are significant aspects in sustaining the planet's health. Buildings all throughout the world are now bearing the brunt of decades of ecologically harmful expansion and development trends. We can see these repercussions immediately in the loss of open space, the shortage of water supplies, the rising dependency on non-renewable energy and power, the degradation of the city core, and the accompanying negative health effects of the continued suburban development. Many nations have recently embraced sustainability as a solution and a long-term approach to continuing growth, with 'green' or environmentally-appropriate building as a critical component.

Green building principles embrace all areas of sustainable development, allowing buildings to comprehend and manage their influence on land usage, water, energy, air quality, material resources, and human health at various scales. As a result, the need for a grading system to assess the environmental impact of development has become unavoidable. Furthermore, it is vital to investigate the efficiency of the various grading systems now in use.

2.1 Definition- What is a Green Building?

“When you enter a Green building, you should feel delighted, calm and serene when you're inside, and sad when you leave.” - In the book [‘Natural Capitalism,'] this is one of the most inspirational definitions of a Green building.

In other words, as compared to a method of construction that is very conventional, a green building uses minimal water, maximizes energy efficiency, protects natural resources, creates less waste, and provides healthier environments for inhabitants.

What exactly is a sustainable structure?

A building designed to be environmentally friendly and resource efficient throughout its lifespan (from initial planning, construction, operation, maintenance, refurbishment, demolition) is usually called a green building. Classic building design issues such as economics, practicality, durability, and comfort are expanded and supplemented by this method. (2019, LaxmanJadhav)

2.2 What does a green building grading system entail?

The Green Building Rating System is a mechanism for assessing a building's environmental performance across its whole life cycle. It generally comprises of multiple criteria that encompass various aspects of eco-friendly building design, construction, and operation. (Greenbuilding-environment-ecology)

Each criterion has predetermined points and establishes largely quantitative performance standards and objectives. If the project fits the criteria, it earns points. The project's ultimate rating is determined by the summing up of the points it has received. The scoring method necessitates independent third-party project scoring and provides a number of mechanisms to ensure that the project is scored fairly. Green building grading systems are primarily voluntary over the world and have played an essential role. (2019, LaxmanJadhav)

In the construction industry, two separate assessment systems have been established. The first category of tools consists of those that are solely based on a set of standards. The Life Cycle Assessment (LCA) technique is used by the second category of instruments and tools. Criteria-based means may be characterized as a

system in which a set of parameters is given a score on a scale ranging from "high" to "low" in terms of environmental effect [9]. These tools are regarded as a full-fledged environmental monitoring system. BREEAM (UK) and BREEM (US) are examples of criteria-based tools (2005). LEED (USA) USGBC; GBTool (Canada) IISBE (2005) (2005). Hikmat H. Ali (Hikmat H. Ali, 2009). Hikmat H. Ali (Hikmat H. Ali, 2009)

2.3 The Global Evolution of Green Building Systems

At the Crystal Palace in London, the western world utilized passive measures to reduce air pollution already in the industrial age, in the mid-19th century. The current green building movement began in 1990, when the United

Kingdom created the Building Research Establishment Environmental Evaluation Method (BREEAM), the first formal worldwide green building assessment system. The US Green Building Council was founded in April 1993 with the mission of providing industry-standard design rules, political views, conferences, and instructional materials to aid in the adoption of sustainable design and construction methods. The World Architects Conference in Chicago in June 1993, "Architecture at the Crossroads [8]: Designing a Sustainable Future," was a major game changer in the history of the Green Building Movement. For the first time, it was to be a unique experience. Figure 1 depicts the geographical distribution of a worldwide rating system complex.

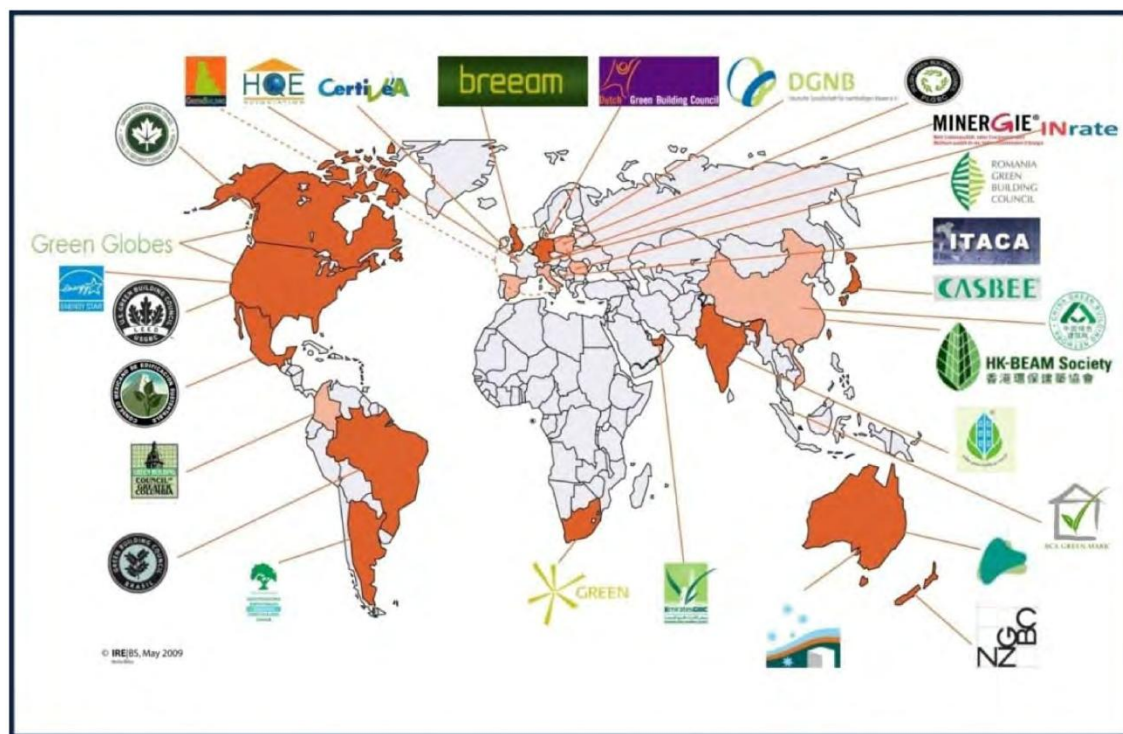


Figure 1 geographical distribution of a worldwide rating system

The establishment of the green grading system "Leadership in Energy and Environmental Design" was a watershed moment (LEED). In August 1998, the USGBC Membership Summit kicked off the LEED Version 1.0 Pilot Program. In March 2000, twelve projects completed the

application procedure and were named the first LEED certified pilot project.

In terms of the worldwide extension of the green building movement and the development of alternative methods for assessing green construction in different nations that have

completed this task, the subsequent growth has been impressive. There's something there. Many nations have now implemented some type of formal green building grading system. The various rating systems used in each nation are summarized in Table 1.

2.4 Justifications for pursuing a green building Endeavour

Green building is the design and construction of environmentally friendly and resource-efficient buildings throughout the facility's life cycle, including planning, construction, operation, maintenance, refurbishment, and demolition. Classic building design issues such as economics, practicality, durability, and comfort are expanded and supplemented by this method. Green buildings are sometimes known as high-performance or sustainable structures.

The philosophy of developing structures that are in harmony with natural circumstances and the environment as a whole is one of the most appealing aspects of green architecture. In order to design a sustainable structure, there are numerous key procedures to take. Reduce load, optimize systems, and create renewable energy in the field by using "green" building materials sourced locally [7].

Green construction is a method of reducing the environmental effect of new structures. The majority of land usage, energy and water use, and air and atmospheric changes are caused by buildings. This method is to safeguard natural resources and reduce environmental damage by constructing green buildings at the grassroots level [7]. Individual green building technologies can be used in conjunction with proper synergistic designs to achieve higher cumulative impacts.

Table 1 various rating systems used in each nation chronologically

2.5 Realities and Perceptions

2.5.1 Perception #1: Expensive [7]

Buildings that are environmentally friendly are more costly.

Reality: The cost effectiveness of green buildings has been well researched and analyzed. The cost may be slightly more than that of a typical structure. However, this must be viewed from a different perspective. The problem is determining how to compare expenses. For all comparisons to be comparable, a baseline cost range is necessary. Incremental costs are always relative, and they are determined by the number of green elements already included in the plan. If the initial design already includes certain eco-friendly elements, the additional cost appears to be little. It would appear enormous if the fundamental design did not take into mind the green concept.

The evaluation of additional expenses related with life cycle costs is the second and more essential paradigm. An approach like this may be effective. Who knows, maybe the structure may survive 50, 60, or even 100 years! Operating expenses account for 80 to 85 percent of overall costs over the course of a product's life cycle, whereas one-time extra expenditures account for just 8 to 10 percent of total costs. The additional expenses have been decreasing over time. This tendency will continue, and we all look forward to the day when green building prices are comparable to standard building expenses.

2.5.2 Second Perception: Air Conditioning [7]

Air conditioning is required in green buildings.

The Green Building idea may be used in buildings that do not have air conditioning. The IGP office in Kalaburagi, the Royal Engineering College in Hyderabad, and the LIC headquarters in Shivamogga all fall within this category. Such structures employ the same cooling system in

both the baseline plan and the proposed design when doing energy analysis utilizing software tools. This enables the building to be recognized for all of its other energy-saving features, such as lighting and insulation.

2.5.3 Perception3: Give yourself extra time [7]

Green buildings take longer to design and construct.

Reality: There is a widespread belief that the Green Pass will have an impact on the project's timeframe. When the green building evaluation technique was originally employed in the country, this might have been the case with the CII Godrej GBC building. The design took around a year and a half in this example, while the building took only 9 months!

This country is now undergoing significant capacity development. The time it takes to construct a green building is no longer different from the time it takes to construct a conventional one. The evaluation timetable and the construction schedule can be coordinated. This is evident in structures such as Wipro's in Gurgaon and Grundfos' in Chennai.

3.National assessment

3.1 The growing green Building trend in India

Government measures to promote social sustainability and commercial adoption of green building principles may be at the root of India's green building movement [25]. Unlike in the United States, where government policy was largely impacted by public pressure from environmental groups, international events such as OPEC's oil embargo, the Brunt land Commission, and the Second Earth Summit influenced significant political choices in India. It was a response to what had happened. . [25] The green construction movement in India may be split into three stages: In comparison to the worldwide system,

3.1.1 Government Establishment of Institutions to Promote Sustainability in India: Phase I (1974-1996)

The government has adopted capacity-building initiatives to promote the long-term viability of Indian society in this initial phase. These capacity-building initiatives might be linked to the government's response to the energy crisis triggered by the OPEC oil embargo in 1972 [25]. The events in this phase are scheduled as follows: [25]:

- (1) TERI (The Energy and Resources Institute) was founded. The institute's aim was to solve challenges related to energy, the environment, and future growth (1974).
- (2) The National Hydroelectric Power Corporation (NHEC) was founded (1975).
- (3) The National Institute of Ecology was established with the goal of improving the environment and conservation via teaching and research (1976).
- (4) Parliament enacted the Environmental (Protection) Act (1986). Every year, December 14th will be celebrated as "National Energy Saving Day" (1991) by the "Ecomark" headed by the Ministry of Environment, Forest and Forestry (MoEF) and the Central Pollution Control Committee (CPCB) and the Government of India. The Construction Sector Development Council was established to act as a liaison between the government and the construction industry in order to address issues such as education, environmental awareness, and law enforcement (1996).

3.1.2 Phase II (2001-2003): Identification and training of key policymakers and support organizations (Bhatnagar 1999, IGBC 2007, TERI 2007):

The India Green Building Council (IGBC), TERI-Business Council for Sustainable Development (BCSD), and the Energy Efficiency Bureau will be established during this

phase (BEE). These organizations were in charge of hastening the implementation of green construction norms across the country [25]. According to LEEDNC v. 2.2, this phase is also the US GBC's first platinum rating achievement for the CII Green Business Center (IGBC 2007). The events of this phase are listed below in chronological order.

The Green Building Council of India was formed to represent governments, corporations, architects, product producers, and other organizations (2001). The United Nations has initiated an energy efficiency programme in three nations. The project's major goal was to give technical help in the creation of financial intermediary systems for energy efficiency in India. Started as a World Business Council partner for. The TERI BCSD is in charge of the TERI Green Assessment for Integrated Habitat Assessment and the Energy Efficiency Bureau (BEE). BEE is a self-governing organization tasked with increasing the country's energy efficiency (2002). The United States created the CII Godley Green Business Center. The Green Building Council achieved a platinum grade under LEED v. 2.0 (2003).

3.1.3 Introducing LEED India and TERI-GRIHA (IGBC 2007, TERI 2007): Phase III (2004-2007):

Two green building criteria, TERI-GRIHA 2005 and LEED-India 2007, were introduced during this time of Indian culture. The quick growth of green building rules is also owing to worldwide pressure on India's government to address the country's sustainability, as well as LEEDNC's rapid adoption in the Indian enterprise sector. In 2005, the inaugural Indian Green Build Conference was conducted with the goal of increasing awareness, bringing together stakeholders, and creating a forum for exchanging information and best practices in the field of green construction. It took place. This phase's development timetable is as follows: (1) During the 4th Green Build Conference, the USGBC signed a LEED License Agreement

with India on the Georgia / ITC Green Center Project, and Gurgaon obtained a platinum rating under the LEED, ITC Green Center. It is now the world's largest platinum-rated structure. As a consequence, India now possesses two of the world's seven platinum-rated skyscrapers (2004). The TERI GRIHA grading system was created with the goal of making better use of resources, increasing resource efficiency, and improving building quality of life. In September 2005, the IGBC hosted the first Indian Green Build Conference in Delhi (2005). IGBC has certified LEED 1.0 for newly constructed buildings, and the Government of India, with the support of BEE, has created the Energy Saving Code for Commercial Buildings (2007).

3.2 LEED India

The LEED INDIA Green Building Assessment System for Energy and Environmental Design is widely regarded as a benchmark for the operation of high-performance green structures. Building owners, architects, consultants, developers, facility managers, and project managers can use this organization's resources to design, create, and run green buildings. Green buildings have several fundamental qualities, such as effective use of soil and landscape, conservation of water resources, energy efficient and environmentally friendly equipment, operation and building management systems, and the use of renewable energy. It is made of recyclable or compostable materials and, most significantly, enhances internal air quality and circulation for health and comfort.

3.2.1 The Indian Green Building Council (IGBC) is a non-profit organization that promotes green building in India.

The Indian Green Building Council (IGBC), which is part of the CII Godrej Green Business Center, is aggressively promoting India's green building movement. All players in the building sector are represented on the council, including corporations, governments and their agencies, architects, product manufacturers, institutions, and more. The council's goal is to act and exist as a single-source provider of solutions.

Under a licencing agreement with the USGBC, the India Green Building Council (IGBC) manages a unique version of the LEED grading system called Leadership in Energy Efficient Design (LEED) India. The registration of new commercial building projects for green certification has expanded dramatically with the introduction of the LEED India Green Building Rating System for New Construction and Core & Shell. The rating method used by LEED India is based on performance. Rather of defining particular technology and materials, LEED India establishes performance criteria and encourages project teams to employ resources in the most efficient way possible to meet them [16].

3.2.2 LEED India Rating System

The LEED INDIA grading system provides a framework for assessing and recording the success of all sorts of buildings at all stages of their lives. Many buildings in India have been certified as LEED Green Buildings. IT parks, offices, banks, airports, conference centres, educational institutions, hotels, and housing estates are the most essential structures for registering LEED ratings. LEEDINDIA for New Construction and Major Renovations is a high-performance commercial building rating system [16].

3.2.3 What is the mechanism behind this grading system?

All LEED systems are based on credits earned for meeting certain requirements in the seven areas listed below:

A Location that has long-term

- Water conservation
- Materials and Resources • Energy and Atmosphere
- Design innovation • Indoor environmental quality (bonus points)

- Priority for the Region (Bonus Points)

3.3 GRIHA (Green Building Rating and Information Association)

3.3.1 Context

Given India's climatic circumstances, particularly the majority of non-air-conditioned structures. GRIHA's national rating system is applicable for all types of buildings in all climate zones across the country [15].

TERI (The Energy Resources Institute) designed and developed this system, which was then transformed to GRIHA as a nationwide rating system after incorporating different adjustments offered by a group of architects and specialists. It considers the National Building Standards Act of 2005; the Energy Saving Building Standards Act of 2007, issued by BEE, as well as other IS codes, municipal ordinances, and other local standards and legislation.

3.3.2 Advantages

On a larger scale, this system benefits the environment by lowering greenhouse gas emissions, as well as the activities and processes that contribute to them. It enriches the entire community.)

Improving emissions, energy security, and natural resource conservation. The following are some of the advantages of green design for building owners, users, and society at large:

- Lower your energy bill without losing comfort
- Reduce air and water pollution (with immediate health advantages)
- Reduce natural area degradation, biodiversity, soil loss due to erosion, and so on.
- Lowering water usage
- Limiting trash creation through recycling and reuse
- Lowering pollution

- Increasing user productivity
- Boosting image and marketability

Conclusion:

There is little doubt that the United States, as a developed country, has been in the forefront of embracing and implementing green construction principles across the world. As a result of LEED-impact, USA's the Indian Green Building Council was established in India. Overlaps were found in the criteria used for grading systems in these nations' green building movements, based on a chronological examination. An effective national green building council has also helped raise public knowledge of green building practices and ensure that green building standards are strictly adhered to across the board. To show how sustainable development will work in the future, green buildings have become a symbol of the 21st century. These buildings balance long-term economic and environmental health with social well-being. An integrated approach to design can be used to minimise the negative effects of construction on the environment and its people, so that ecologically efficient structures can be built. Developing an Indian system of green building certification for homes in warm and humid climates will necessitate starting an investigation into the effectiveness of rating systems implementation. Assessment methods for green buildings can only be developed in accordance with the local context if sustainable constructions are being made, which results in a greater grasp of the idea.

Bibliography

- Bhagirath Behera, R. V. (2011). Analysing the Impact of Anthropogenic Factors on the Environment in India. Environment and Natural Resources Research .
- blog.propertynice.com. (n.d.). Retrieved from blog.propertynice.com: blog.propertynice.com
- ccsmeerut.academia.edu. (n.d.). Retrieved from ccsmeerut.academia.edu: ccsmeerut.academia.edu
- [drfixitinstitute](http://drfixitinstitute.com). (n.d.). Retrieved from [drfixitinstitute](http://drfixitinstitute.com): www.drfixitinstitute.com
- greenbuilding-ap@envis.nic.in. (n.d.). Retrieved from greenbuilding-ap@envis.nic.in: [http://apenvis.nic.in/All%20PDF%20Files/Newsletters/Paryavaranam%203\(2\)%202009.pdf](http://apenvis.nic.in/All%20PDF%20Files/Newsletters/Paryavaranam%203(2)%202009.pdf)
- [greenbuilding-environment-ecology](http://greenbuilding-environment-ecology.com). (n.d.). Retrieved from <http://environment-ecology.com/environment-and-architecture/80-green-building.html>: <http://environment-ecology.com/environment-and-architecture/80-green-building.html>

- greenbuildingsindia. (n.d.). Retrieved from wordpress.com: greenbuildingsindia.wordpress.com
- Hikmat H. Ali, S. F. (2009). Developing a green building assessment tool for developing countries – Case of Jordan. *Building and Environment* , pp. 1053-1064.
- <http://environment-ecology.com/environment-and-architecture/80-green-building.html>. (n.d.). Retrieved from <http://environment-ecology.com/environment-and-architecture/80-green-building.html>
- Illankoon, I. M. (n.d.).
- Illankoon, I. M. (2017). Key credit criteria among international green building rating tools. *Journal of Cleaner Production*. Key credit criteria among international green building rating tools. *Journal of Cleaner Production* , 164. 10.1016/j.jclepro.2017.06.206.
- Laxman Jadhav, S. L. (2019, december). Comparative Study of LEED, BREEAM and GRIHA Rating System. Retrieved from INTERNATIONAL JOURNAL OF ENGINEERING RESEARCH & TECHNOLOGY (IJERT) volume 08,issue 12: <https://www.ijert.org/comparative-study-of-lead-breeam-and-griha-rating-system>
- Mohammed Ali Berawi, P. M. (2019). takeholders' perspectives on green building rating: A case study in Indonesia. *Heliyon* , e01328.
- technicaljournalonline.com. (n.d.). Retrieved from technicaljournalonline.com: technicaljournalonline.com
- www.cedbik.org. (2017). Retrieved from cedbik: www.cedbik.org
- www.meghraj.com. (n.d.). Retrieved from www.meghraj.com: www.meghraj.com
- www.scribd.com. (n.d.). Retrieved from scribd: www.scribd.com