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# Blending & Shortlisting Indicators from Existing Sustainability Rating Systems in Indian Context

**Sanket Bele, Nivedita G. Gogate**

***Abstract***: ***The meaning of sustainability in today's world varies from place to place, region to region and person to person. In such a scenario the absolute or standard parameters used by various sustainability rating systems cannot stand accurate in a geographically, climatically and socially diverse nation like India. In such cases some buildings which have considerably low impact on the environment are unable to get green rating certification due to the rigidity in existing rating systems. Also occupants in different regions have contrasting perceptions about the relative importance of various sustainability indicators. The opinion of local people with idea about sustainability can be the key in defining affective sustainability practices as and local people have the minutest knowledge about their surroundings and their needs. This article attempts to identify, blend and shortlist optimum sustainability indicators in Indian context by studying the existing popular rating systems (LEED, GRIHA and IGBC). It also aims towards ranking the relative importance of the 7 major domains of sustainability indicators with help of qualitative research methodology.***

***Keywords***: ***Sustainability, Sustainability Indicators, LEED, GRIHA, Rating System.***

## I. INTRODUCTION

Sustainability can be defined as the ability and practice of using resources wisely so that they sustain and stay available for the needs of future generations. Sustainability has three different aspects in which the concept can get a complete definition,

Environmental Sustainability: The ability to keep a check on various environment related constraints such as pollution, non-renewable resource consumption as well as maintaining the rate of harvesting renewable resource.

Economic Sustainability: The ability to use financial resources responsibly to ensure considerable economic growth without harming social or cultural aspects of the population. Also ensuring the prevention of future generations from possible financial crunch.

Social Sustainability: It refers to the practices undertaken to ensure the wellbeing of the members associated with an organization directly or indirectly also to maintain health and safety of present as well as future generations.

A more complete & robust definition of sustainability is thus environmental, economic, and social sustainability, which forms the three pillars of sustainability.

Sustainability practices in construction & infrastructure sectors are popular globally nowadays due to meteoric growth in these sectors. Various tools such as benchmarks, indices and rating scales are being widely used to measure the sustainability in construction & infrastructure sectors. These rating systems have differentiated domains and sub domains which are called as sustainability indicators which determine the extent to which a particular project is sustainable. But, some standards and parameters in these rating systems do not stand accurate in a climatically, topographically and socially diverse country like India.

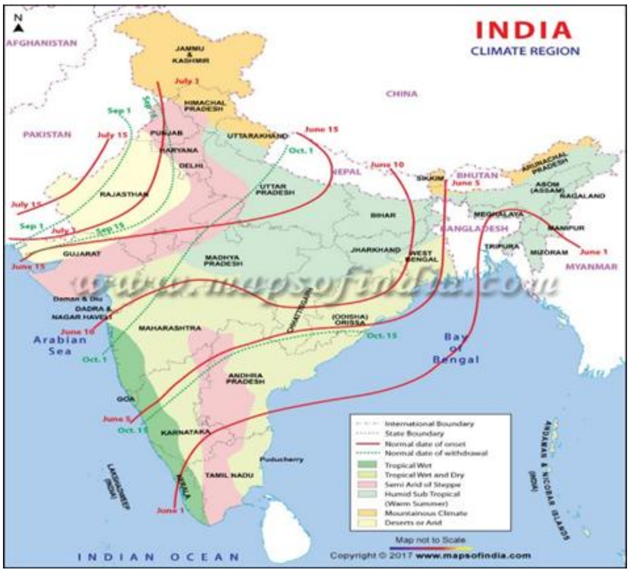


**Figure 1. Climatic Regions (Physical)**

India is a large tropical country that has Tropical Wet (Humid), Tropical Dry, Sub-tropical Humid Climate and Mountain Climate. India experiences 4 different seasons throughout the country that are winter, summer, rainy and autumn. The reason for these varied climates are:

- Latitude – Tropic of Cancer passing through the country.
- Altitude – Varying altitude of 18000 feet in the north to 90 in the south.
- Monsoon Winds – Blowing from Central Asia.

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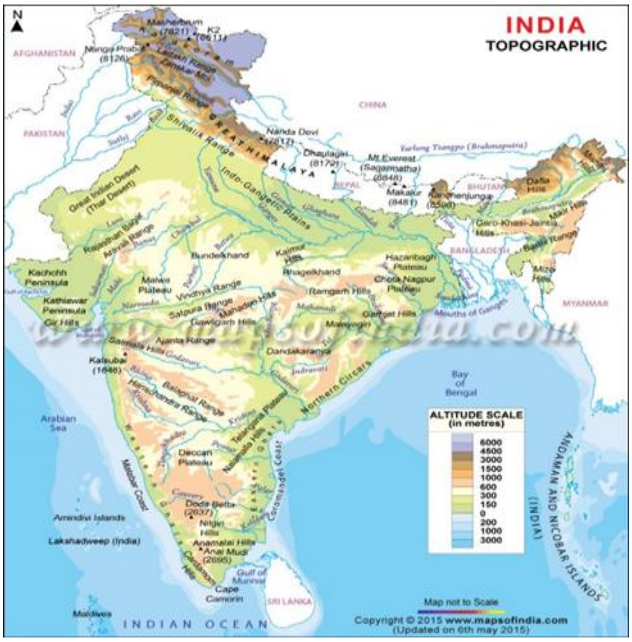


**Figure 2. Climatic Regions (Zonal)**

A lot of research studies has been performed on comparative study of different sustainability rating systems but very few attempts were made to find the best suited rating system for Indian context. Also the available rating systems have various sub rating systems and a large number of indicators which makes the assessment time consuming and tedious. This study aims towards studying the existing rating systems, shortlisting various indicators and blending them to form a set of lesser and more representative sustainability indicators.

### A. *Objectives of the study*

- To study different climatic and topographical conditions of India.
- To study the existing sustainability rating systems popularly practiced in India.
- To shortlist and blend representative sustainability indicators from the studied systems.
- To rank the major shortlisted domains according to their relative importance

## II. LITERATURE REVIEW

M. Abhishek Rana et al [2016] found that there are several buildings which possess a minimum impact on the environment, yet fail to get certified under the various criteria set by the green building rating tool. Hence they saw a need for modified Green Building Rating tool for the state of Gujarat. The authors studied the widely used sustainability rating systems practiced in India which are LEED, GRIHA and SBtool. Various sustainability indicators were extracted and combined from these rating system to form a set of new improved indicators. Shiva Ji et al [2017] in their research studied and compared the two leading Sustainability Assessment rating systems in India namely GRIHA and LEED. The comparative study shows that GRIHA still laid more emphasis on the environmental and economic pillar and less emphasis on the social pillar t whereas LEED has good emphasis across all the three pillars. H. AL WAER and M. SIBLEY [2005] in their research analysed different ways of measuring sustainability in architectural projects. This paper attempted to define the key indicators for sustainability assessment, and compares three separate methods for the sustainability assessment tools which are as follows: the Green Building Challenge assessment; BREEAM; and Sustainable Architecture Matrix. Literature review suggests that the existing rating systems cannot fully cover the sustainability aspects of building from a variety of geographical regions. Many researchers have tried to shortlist appropriate indicators and revise sustainability rating systems in their respective region.

## III. METHODOLOGY

The methodology used in this research is as follows:

1. Studying the Indian climatic and topographic conditions.
2. Identification of existing and most popularly practiced Sustainability Rating systems in India.
3. Studying each of the sustainability rating system thoroughly.
4. Reviewing literature on various studies related to sustainability rating systems in India.
5. Listing out all the indicators in broad areas according to their Relevance to Indian Conditions, Intensity of importance and Recurrence in studied rating systems.
6. Blending and shortlisting representative broad domains and sub domains of sustainability indicators.
7. Preparation of a generic questionnaire using choice architecture technique.
8. Recording the responses of the surveyed audience for ranking the broad domains of indicators.
9. Representing the responded data regarding the relative importance of the sustainability indicators.

Choice architecture (Tripp Shealy and Leidy Klotz 2015) was used while framing the questionnaire to ensure and encourage a decent rate of response. It is a technique to design questions in such a manner which would make it simpler for the respondents to anticipate the questions and respond actively, thus ensuring quality data inputs for a research study.

## IV. DATA COLLECTION & ANALYSIS

I. After a detailed study of existing sustainability rating systems and discussion with stakeholders, the indicators were shortlisted in following broad areas:

- Site Selection and Planning
- Water Efficiency
- Energy Efficiency
- Material and Resource
- Indoor Environmental Quality
- Social Sustainability
- Others

**Table 1. Combined and shortlisted indicators**

| Sr. no. | Description of the Indicators | Rating System | Justification |
|---|---|---|---|
| **1.** | **Site Selection and Planning** | **LEED, GRIHA and IGBC** | |
| 1.1 | Erosion and Sedimentation Control | LEED | Mandatory |
| 1.2 | Site Selection | LEED, GRIHA & IGBC | Recurrence |
| 1.3 | Development density and Community connectivity | LEED | Suitable for Indian conditions. |
| 1.4 | Alternative transportation | LEED | Critical parameter |
| 1.5 | Site development | LEED | Critical parameter |
| 1.6 | Storm water design | LEED | Critical parameter |
| 1.7 | Local Building Regulations | IGBC | Mandatory |
| 1.8 | Soil Erosion Control | IGBC | Mandatory |
| 1.9 | Proximity to Public Transport | IGBC | Suitable for Indian conditions |
| 1.10 | Low-emitting Vehicles | IGBC | Suitable for Indian conditions |
| 1.11 | Natural Topography or Vegetation | IGBC | Suitable for Indian conditions |
| 1.12 | Preservation or Transplantation of Trees | IGBC, GRIHA | Suitable for Indian conditions |
| 1.13 | Heat Island Reduction, Non-roof | IGBC, LEED | Suitable for Indian conditions |
| 1.14 | Heat Island Reduction, Roof | IGBC, LEED | Suitable for Indian conditions |
| 1.15 | Basic Facilities for Construction Workforce (Sanitation & Safety) | IGBC, GRIHA | Mandatory - Workforce welfare |
| 1.16 | Green Building Guidelines | IGBC | Critical parameter- Design |
| 1.17 | Reduce Air Pollution During Construction | GRIHA | Mandatory |
| **2.** | **Water Efficiency** | **LEED, GRIHA and IGBC** | |
| 2.1 | Efficient water use during construction | GRIHA, LEED | Recurrence |
| 2.2 | Rainwater Harvesting, Roof & Non-roof | IGBC | Mandatory |
| 2.3 | Water Efficient Plumbing Fixtures | IGBC | Mandatory |
| | | | |
| 2.4 | Management of Irrigation Systems | IGBC | Suitable for Indian conditions |
| 2.5 | Wastewater Treatment and Reuse | IGBC, GRIHA | Recurrence |
| 2.6 | Water Metering | IGBC | Suitable for Indian conditions |
| 2.7 | Water Efficient Landscaping | LEED, IGBC | Recurrence |
| 2.8 | Water efficiency in A/C systems | LEED | Moderate parameter |
| 2.9 | Innovative wastewater technologies | LEED | Suitable for Indian conditions |
| **3.** | **Energy Efficiency** | **LEED, GRIHA and IGBC** | |
| 3.1 | Minimum Energy Efficiency | IGBC, LEED | Mandatory |
| 3.2 | Commissioning Plan for Building Equipment & Systems | IGBC, LEED | Mandatory |
| 3.3 | Eco-friendly Refrigerants | IGBC | Suitable for Indian conditions |
| 3.4 | Enhanced Energy Efficiency | IGBC | Recurrence |
| 3.5 | On-site Renewable Energy | IGBC | Suitable for Indian conditions |
| 3.6 | Off-site Renewable Energy | IGBC | Suitable for Indian conditions |
| 3.7 | Energy Metering and Management | IGBC | Suitable for Indian conditions |
| 3.8 | CFC reduction in HVAC & R equipment | LEED, GRIHA | Mandatory |
| 3.9 | Optimized Energy Performance | LEED, GRIHA | Recurrence |
| 3.10 | Renewable Energy Utilization | LEED, GRIHA | Recurrence |
| 3.11 | Optimized Building Design to Reduce Conventional Energy Demand | GRIHA | Mandatory |
| 3.12 | Use low-energy material in interiors | GRIHA | Suitable for Indian conditions |
| 3.13 | Enhance outdoor lighting system efficiency | GRIHA | Suitable for Indian conditions |
| 3.14 | Energy Audit & Validation | GRIHA | Mandatory |
| 3.15 | Operations & Maintenance Program for M & E Equipment | GRIHA | Mandatory |
| **4.** | **Material and Resource** | **LEED, GRIHA and IGBC** | |
| 4.1 | Segregation of Waste, Post-occupancy | IGBC, GRIHA | Mandatory |
| 4.2 | Sustainable Building Materials | IGBC, LEED & GRIHA | Suitable for Indian conditions |
| 4.3 | Organic Waste Management, Post-occupancy | IGBC, GRIHA | Suitable for Indian conditions |
| 4.4 | Handling of Waste Materials, During Construction | IGBC, LEED | Suitable for Indian conditions |
| 4.5 | Use of Certified Green Building Materials, Products & Equipment | IGBC | Critical parameter |
| 4.6 | Storage & collection of recyclables | LEED | Mandatory |
| 4.7 | Resource Reuse | LEED, GRIHA | Recurrence |
| 4.8 | Local / Regional Materials | LEED | Suitable for Indian conditions |
| **5.** | **Indoor Environmental Quality** | **LEED, GRIHA and IGBC** | |
| 5.1 | Minimum Fresh Air Ventilation | IGBC | Mandatory |
| 5.2 | Environmental Tobacco Smoke (ETS) Control | IGBC, LEED & GRIHA | Mandatory |
| 5.3 | $CO_2$ Monitoring | IGBC | Critical parameter |
| 5.4 | Daylighting & Views | IGBC, LEED | Recurrence |
| 5.5 | Minimize Indoor and Outdoor Pollutants | IGBC, LEED | Recurrence |
| 5.6 | Low-emitting Materials | IGBC, LEED | Recurrence |
| 5.7 | Occupant Well-being Facilities | IGBC | Critical parameter |

| | | | |
|---|---|---|---|
| 5.8 | Acceptable Indoor and Outdoor Noise Levels | GRIHA | Suitable for Indian conditions |
| 5.9 | Minimum IAQ Performance | LEED | Mandatory |
| 5.10 | Construction IAQ Management Plan | LEED | Suitable for Indian conditions |
| 5.11 | Thermal Control | LEED | Suitable for Indian conditions |
| **6.** | **Social sustainability** | | |
| 6.1 | Focus on End Users' Well Being | Self-Suggested | |
| 6.2 | Focus on Occupant Living Conditions | Self-Suggested | |
| **7.** | **OTHERS** | | |
| 7.1 | Innovation in Design | LEED, GRIHA and IGBC | Innovative and Critical |
| 7.2 | Study and promotion of ancient sustainable practices | Self-Suggested | Many ancient structures are designed sustainably. |
| 7.3 | Classification of India into Climatic Zones | Self-Suggested | Diverse climatic conditions |
| 7.4 | Classification of India into Topographic Zones | Self-Suggested | Diverse topographic conditions |
| 7.5 | Compulsion of Recycled Water for Flushing Purpose | Self-Suggested | Considering rising water scarcity in India. |

II. A Generic questionnaire was created using choice architecture. The data was collected from a set of professionals from Construction as well as other fields. The questions were kept general focusing on the understanding of the sustainability related practices of the respondents.

One mandatory question in the questionnaire was ranking the shortlisted indicators in accordance to relative importance according to the preference of the respondents. The indicators were asked to be ranked from 1 to 7, where 1 being most important to 7 being the least important. The responses are as follows:

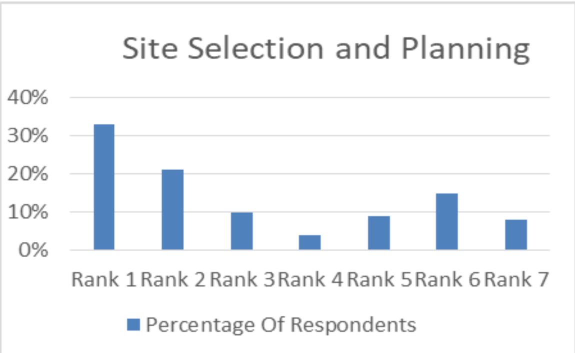


Figure 3. Responses for Site Selection and planning

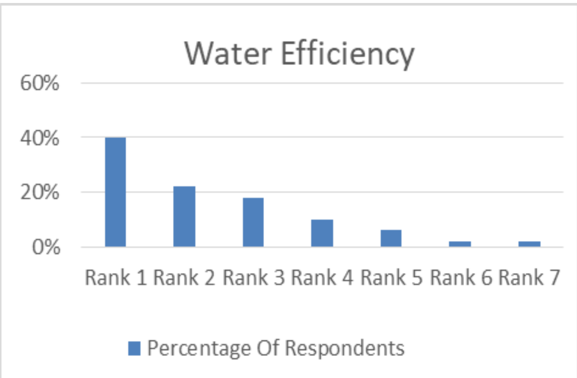


Figure 4. Responses for Water Efficiency.

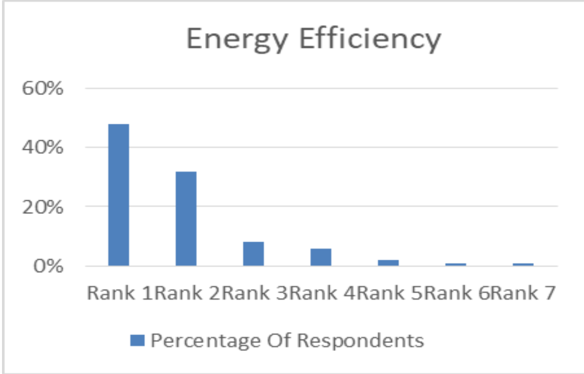


Figure 5. Responses for Energy Efficiency.

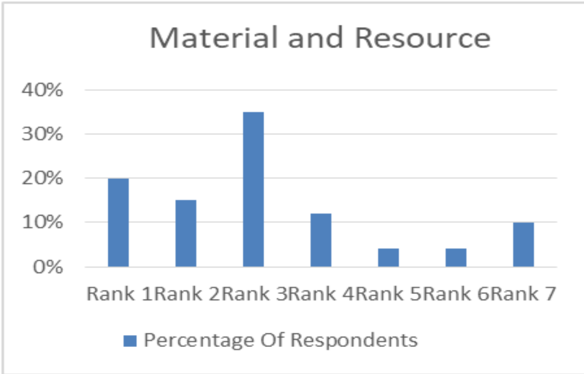


Figure 6. Responses for Material and Resource

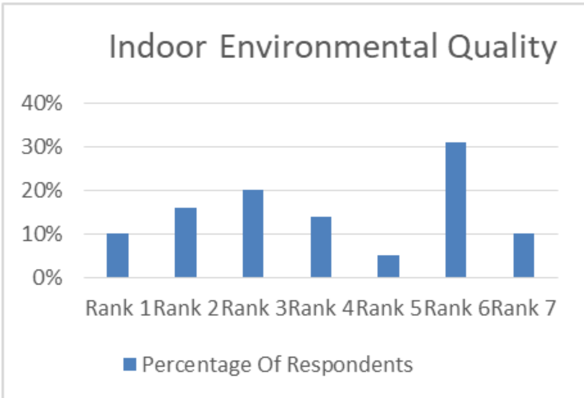


Figure 7. Responses for Indoor Environmental Quality

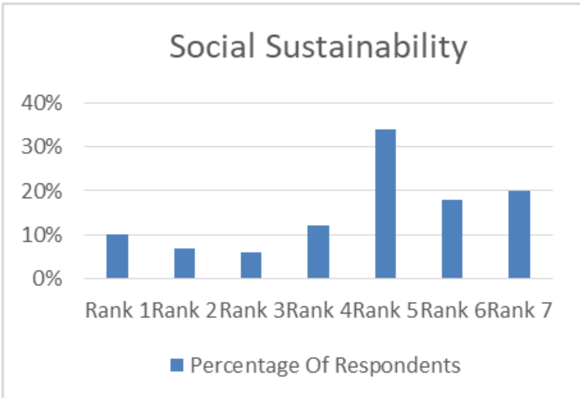


Figure 8. Responses for Social Sustainability

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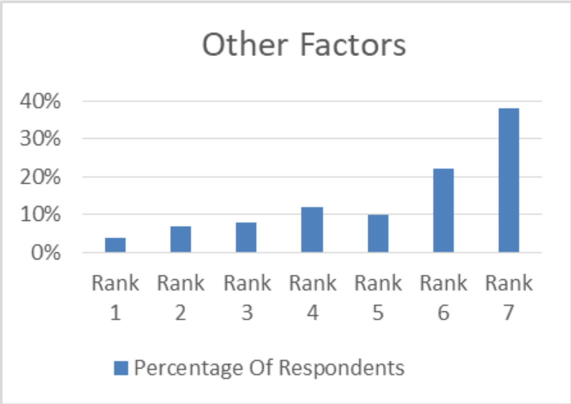


Figure 9. Responses for Other Factors

## V. RESULTS AND DISCUSSIONS

1. The detailed study of 3 most popularly practiced sustainability rating systems in India (LEED, GRIHA and IGBC) resulted in shortlisting of 7 broad domains and 61 sub domains of sustainability.
2. The analysis of the collected data concludes that the Energy Efficiency is most important sustainability domain according to the surveyed audience, following a descending order of importance by Water Efficiency, Site Selection and Planning, Material and Resource ,Social Sustainability, Indoor Environmental Quality and Other Factors being of the least importance among the shortlisted sustainability indicators. Also it was concluded that different people have varied perspective regarding the shortlisted domains and indicators of sustainability
3. The results of relative importance of the 7 shortlisted broad domain according to the surveyed audience are shown in the table below:

Table 2. Ranks of the 7 indicators according to their relative importance

| Rank | Name of the Domain | Relative Importance |
|---|---|---|
| 1 | Energy Efficiency | Most Important |
| 2 | Water Efficiency | |
| 3 | Site Selection and Planning | |
| 4 | Material and Resource | |
| 5 | Social Sustainability | |
| 6 | Indoor Environmental Quality | |
| 7 | Other Factors | Least Important |

## VI. CONCLUSION

As studied earlier, the meaning of sustainability in today's world varies from place to place, region to region and person to person. From this research it was concluded that people have varied perceptions about different domains of sustainability. Also, it was concluded that there is a need of a sustainability rating system which would be more simplified, robust and having sustainability parameters suiting to Indian context.

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