International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395-0056
Volume: 09 Issue: 06 | Jun 2022 www.irjet.net p-ISSN: 2395-0072

Green Ratings of Residential Buildings: Survey, Analysis and Suggestions

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Abstract – *Usage of natural things deriving from human activities is increasing day by day acting against the standard of the environment and sustainable use of natural resources. Human interference has caused an adverse effect on the environment. Construction activity has caused a serious impact on the environment. To reduce these problems people are moving to eco-friendly practices. Today, there is a large level of demand for sustainable buildings. With the increase in demand for green buildings, the demand for Green Building Rating System (GBRS) is also increasing. Hence, it is considered an attempt to check the status of green building growth in India. This paper includes the Objective, Methodology, and Study process adopted for criteria of the Green Building Rating System (GBRS) to improve the performance of residential buildings in the Sangli and Kolhapur region, suggestions, and the expected conclusion. The analysis of residential buildings is done as per the criteria of the SVAGRIHA rating system. After that suitable suggestions are given to residential buildings and a cost comparison of green buildings and residential buildings is done. This research helps the builders to consider the criteria of the Green Building Rating System (GBRS) for residential buildings during the planning phase of the project. This will lead to the development of a sustainable world.*

***Key Words*: Sustainable buildings, SVAGRIHA rating system, Analysis, Suggestions, Cost comparison**

1. INTRODUCTION :

Due to increased population and rapid urbanization, there is a huge demand for commercial and residential buildings. Traditional methods of construction and materials are harmful to our society and environment because they emit greenhouse gases (GHGs), and dust, and consume more water and energy. Natural resources like forests, ground cover, energy, and water are reducing to give way to buildings. Many occupant functions and building processes create a huge amount of waste. Therefore, buildings are major pollutants that affect urban air quality and contribute to climate change. To resolve these issues, it is necessary to go for sustainable construction or green building. A Green building utilizes less energy, and less water creates less waste and gives more advantageous spaces to tenants as compared to a regular building.

The Green Building focuses mainly on two objectives:

•To reduce building's negative impact on the environment and human health, by site selection, better design, construction, operation & maintenance.

•To increase the efficiency of buildings by using energy, materials, and water.

As the demand for green buildings is increasing, the demand for Green Building Rating Systems and assessment tools is also increasing. For evaluating the environmental performance of buildings all over their life cycle, a Green Building Rating System is a rating tool. This rating tool helps to reduce the negative impact on the environment by promoting quality green buildings. It consists of a set of criteria that includes different parameters related to design, construction, and operation of green building performances, benchmarks, and largely quantifiable goals which are mentioned in each criterion. Each criterion has pre-assigned sets and points. If the project fulfills the rating criteria, then it is awarded by points and the final rating of a project is decided by adding points from start to end. For fair calculation of project rating systems call for an independent third party and different processes are put in place.

Some of the successful international Green Building Rating System programs which are used in India are:-

- **GRIHA-** Green Rating For Integrated Habitat Assessment
- **LEED-** Leadership in Energy and Environmental Design.
- **IGBC-**Indian Green Building Council

To reduce the effect of human activities on our planet and improve the living standards of all, one solution is to go for sustainable buildings in the country. The solutions that we make now will shape our opportunities in the future and those of future generations. Thus, it is considered an attempt to check the status of green building growth in India. Further, it will help in creating awareness in the builders and the general public and motivate them to use this concept. This will lead to the progress of a green world.

The project aims to study and analyze the current status of the application of Green Building concepts in the Sangli and Kolhapur region. Also, to give suggestive measures to improve the performance of residential buildings and to create awareness amongst the builders and general public about the standards of application of Green Building Rating Systems in Sangli and Kolhapur region.

2. OBJECTIVES OF THE STUDY:

- To study the present status and make a literature review of the application of Green Building concepts in the Sangli and Kolhapur region.
- Collection of required data according to the various criteria of the selected Green Building Rating System for residential buildings located in the Sangli and Kolhapur region.
- To perform analysis of ongoing and recently completed residential buildings as per selected Green Building Rating System criteria.
- To suggest suitable Green Building techniques to the residential buildings that have been analyzed, to improve the performance of residential buildings.
- To compare the cost of the residential building before and after the application of selected Green Building Rating System criteria.

3. METHODOLOGY:

The following methodology was adopted for analysis of residential buildings and suggestions for improvement of performance for residential buildings in Sangli and Kolhapur region, as shown in Chart No. 1.

Flow Chart:

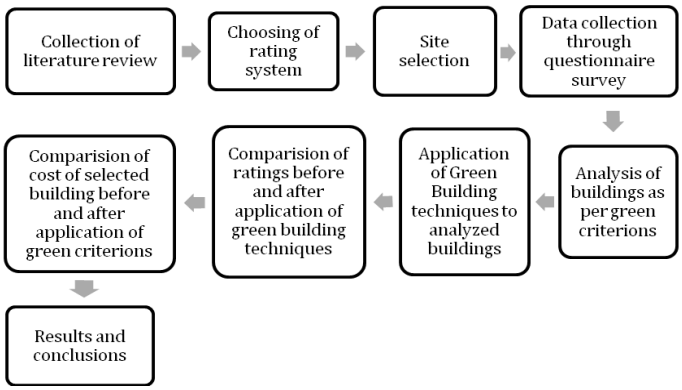

Chart-1: Projects Work Methodology Plan

3.1. Study of Literature Review:

Dr. Dina Ahmed Elmeligy (May 2014) described comparative review to understand the differences in using different types of evaluation systems, particularly in categories of each one, and performance of their impact as applied to sustainability—both from the viewpoint of General information, Applicability, Certification levels, Usability, Categories and present a case study as well as a Sample of On-line Evaluation. By this comparison, it can be concluded that it is necessary to select the suitable rating system according to its categories which are generally considered the most significant measure in building sustainability assessment, likewise to ensure the sustainable design environmental performance goals are being met when desired ratings are achieved. Nangare Priyanka Pandharinath, Pound Gaurav Chandrakant (2015) described that the comparison of green building with conventional building concerning the economy is studied. It also includes the study of existing green buildings, by surveying concerning energy saving, operating cost, saving in electricity water, etc.

Rakesh Awasthi (2016) has explained that there are different rating systems available in India, the process of awarding the green building system & finally finds out which is the most critical part of the green building certification process. He gives the idea to understand the rating system & critical parts of the certifications process so that we can have a detailed understanding of the selection process. Shaik Rehana Begum, B. Harish Naik (2017) described how to understand and find solutions to the significant impact of real estate activity in India on the environment and resources. They investigate the cost efficiency of green buildings through a cost-benefit analysis and a study on the payback period of the extra investment in developing green buildings. Starting with the benefits that may be obtained during the design and construction phase, the discussion then shifts to the asset value and returns received by investors and developers. This is followed by the operational benefits such as cost savings, workplace health, and productivity, and finally the issue of risk mitigation, which plays a role in every stage of a building's economic life.

3.2. Choosing of rating system:

There are different rating systems, but for residential buildings, SVAGRIHA rating system has been selected. SVAGRIHA is a green building rating system that is being developed for small stand-alone buildings like residences, commercial offices, dispensaries, schools, etc. and it is applicable for buildings with a cumulative built-up area of 2500 sq.m. or less.

3.3. Site Selection :

15 different residential building sites having a built-up area of about 2500 sq.m. or less in the Sangli and Kolhapur region were selected.

3.4. Analysis of Data And Rating Sheet:

Analysis of selected residential sites is done as per the SVAGRIHA rating system which has 14 criteria. These criteria are divided into 5 broad sub-groups-namely: architecture & energy, water & waste, materials, landscape, and lifestyle. It will be compulsory to attempt specific points under each sub-group. The total points the project can achieve are 50 And the rating of the project will be done on a 1-5 star rating scale.

Analysis of site No.1 is done per SVAGRIHA rating system criteria, shown below in Table No.1.In this table as per the SVAGRIHA rating system, 14 no. of criteria are given. The total points allotted for this criterion are 52 out of which points gained by Site No.1 are 22. So as per the SVAGRIHA star rating shown in table no.2, none of the stars were achieved by site no.1. Analysis of all 15 sites is done as per this criterion which is shown in table no.3. So from this analysis of all 15 sites, it is clear that there is a lack of knowledge of green ratings in the Sangli and Kolhapur regions.

Criterion Number	Criterion Name	Points Allotted	Points Gained
1	Paved surface on site and native vegetation	6	6
2	Passive & Active architectural design and systems	4	3
3	Good fenestration design & daylight penetration	6	3
4	Efficient artificial lighting system	2	2
5	Thermal efficiency of building envelope	2	2
6	Use of energy efficient appliances	3	2
7	Use of renewable energy on site	4	0
8	Reduction in building and landscape water demand	5	0
9	Rainwater harvesting	4	0
10	Generate resource from waste	2	0
11	Reduce embodied energy of building	4	2
12	Use of low-energy materials in interiors	4	1
13	Adoption of green Lifestyle	4	1
14	Innovation	2	0
TOTAL		52	22

Table No.1: Rating Sheet for Site No.1

Points achieved	SVAGRIHA Rating
25-29	⋆
30-34	⋆⋆
35-39	⋆⋆⋆
40-44	⋆⋆⋆⋆
45-50	⋆⋆⋆⋆⋆

Table No.2: SVAGRIHA star rating for Site No.1

4. RESULT :

Analysis of all 15 sites is done as per criterion of SVAGRIHA rating system which is shown in table no.3. So from this analysis of all 15 sites it is clear that there is lack of knowledge of green ratings in Sangli and Kolhapur region. So it is required to create awareness amongst general public and builders related to green ratings of residential buildings. So some suggestions according to this criterion are given to all 15 sites. Site no.1 suggestions are shown in table no.5.Due to this suggestions points gained by site no.1 are increased. So all this 15 sites are got SVAGRIHA star rating; after giving these suggestions to site as shown in table no.4

Criterion	Site No 1	Site No 2	Site No 3	Site No 4	Site No 5	Site No 6	Site No 7	Site No 8	Site No 9	Site No 10	Site No 11	Site No 12	Site No 13	Site No 14	Site No 15
1	6	2	4	3	3	3	4	0	0	0	3	0	0	0	2
2	3	4	3	2	3	3	1	1	0	1	2	2	0	0	0
3	3	4	4	4	4	3	3	4	4	4	3	5	4	4	5
4	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
5	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
6	2	0	0	0	2	2	0	0	0	0	0	0	0	0	0
7	0	1	0	1	1	0	0	1	1	1	0	0	0	1	0
8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
10	0	0	0	1	0	0	0	0	0	1	0	0	0	0	0
11	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
12	1	1	1	1	1	1	1	1	1	1	1	0	1	1	1
13	1	1	1	2	0	0	1	1	2	2	2	2	2	2	2
14	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	22	19	19	20	20	18	16	14	14	16	17	15	13	14	16

Table No.3 : Comparing Rating Sheet for all sites

Site No.	SVAGRIHA Star rating (before giving suggestions)	SVAGRIHA Star rating (after giving suggestions)
1	-	★★★★
2	-	★★★★
3	-	★★★★
4	-	★★★★
5	-	★★★★
6	-	★★★
7	-	★★★★
8	-	★★★★
9	-	★★★
10	-	★★★
11	-	★★★
12	-	★★★
13	-	★★★
14	-	★★★
15	-	★★★

Table No.4 : SVAGRIHA Star rating

Cr. No.	Max pts	Gained pts.	Suggestions	Pts. can be gained	Final pts.	Min. pts.	Final pts.
1	6	6	No suggestion	0	6	3	6
2	4	3	Terrace gardens/ green roofs should be provided	1	4	11	17
3	6	3	No suggestion	0	3		
4	2	2	Use of T5 Tube lights will reduce more power consumption	0	2		
5	2	2	No suggestion	0	2		
6	3	2	Install all 5 Star rated appliances Ex. Fans, Television, Refrigerator.	1	3		
7	4	0	Provide 1 kW solar panel	2	3		
			Provide 100 LPD solar water heater.	1			
8	5	0	Install low flow water fixtures which will reduce water consumption by 50%	3	5	6	10
			Use of shrubs and native trees	2			
9	4	0	Provide roof top rainwater harvesting	3	4		
			Provide rain water harvesting for recharging aquifer with filtration system.	1			
10	2	0	Dig pits for composting organic household waste generated.	1	1		
11	4	2	No suggestion	0	2	4	6
12	4	1	Use low energy materials for interiors.	2	4		
			Use low energy flooring materials	1			
13	4	1	Create awareness among other people	1	2	1	2
14	2	0	No innovation	0	0		
Total	52	22		19	41	25	41

Table No.5 Suggestions for improvement in ratings and points in Site No.1

5. CONCLUSIONS :

1) After analyzing all the buildings which are selected for the survey, it has been found that no residential building is getting a star from the SVAGRIHA rating system, while there is a scope for improvement in all the buildings. This is because people are not much aware of green building and their positive effect on everything. It has been found that people are not ready for extra initial investment other than building the structure. Spreading the word about green buildings is very much an important and necessary task to make aware.

2) All the buildings studied are residential buildings (bungalows) having an area of less than 2500 sq.m. For such buildings to achieve a minimum star rating by SVAGRIHA i.e. to achieve a 1-star rating, suggestions are provided for improvement in residential buildings.

3) It is unable to achieve a 5-star rating by providing suggestions for existing residential buildings once the infrastructure is ready and cannot be changed. Still, it is possible to get a 2-4 star rating.

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