International Journal of Engineering Research & Technology (IJERT)
ISSN: 2278-0181
Vol. 6 Issue 07, July - 2017

To Develop Green Building Assestment Tool for Existing Building Located in Kolhapur Region

Kashmira K. Malwade [1]
[1] P. G. Student (Construction & Management),
Dept, Of Civil Engineering, TKIET,
Warnanagar.

B. V. Birajdar [2]
Head of Civil Engineering,
Dept., TKIET,
Warnangar

***Abstract* - The purpose of this research is to contribute to a better understanding of the concept of green building assessment tool and its role for achieving sustainable development through developing an effective green building rating system for non- residential in terms of the dimensions through which sustainable development tools are being produced according to the local context . Developing such system is becoming necessary in the Developing World because of the considerable environmental, social and economical problems. India as one of these countries is in need for this system, Therefore, this research studied international green building assessment tools such as such as LEED, BREEAM, and Indian assessment tool IGBC, As all above tools could not be applied totally to any regions because of many reasons .**
In western maharashtra region considering Kolhapur region as a local context a brief study has been carried out & an attempt is made to develop new green building assessment tool which considers all local perspectives.

Keywords- Green Building, BREEAM-In use,LEEDv4,IGBC.

I INTRODUCTION

An international or even national green building tool covering all region in the world is 'relatively complex' due to the unique characteristics of each place. Studies revealed that an assessment method which could be applicable in one place may not be applied in other. The importance given to the issues (energy, water, etc) associated with a tool design is different across regions. Consequently, if a tool specific to a country is used in another, the assessment results will not reflect the realistic performanc of a building.A number of environmental factors could prevent the direct use of currently available tools in another country.Some of the factors are as follows :- Climate context,Geographical features,Resources Consumption,Government policy and regulation,Understanding of the importance of historical building,Understanding of the cultural values and public awareness .From the above list, it appears that all these factors vary between regions. Thus, understanding of the concept of sustainability is changed in relation with these environmental factors. Even in one country designing a tool could be challenge where climate and topography change from one place to another.

II. LITERATURE REVIEW :

[7]A work done by Bahacan Aktas and Beliz Ozorhon (2015) were LEED Certified Buildings (existing Buildings) in Turkey. It investigate framework of greening process of existing Building such as (enablers, benefits, impacts, barriers, resources, drivers). Research has found that if the existing building went through a major renovation or retrofit before the certification process then greening becomes less expensive and less complicated to the clients. This research paper found that. 1) Strict environmental policies of the clients have been the major reason to convert existing buildings into green buildings. 2) LEED consultancy has been the major component of the investments. 3) Unavailability of LEED-approved materials and difficulties in documentation have been the major barriers. 4) Commitment of the owners, top management support and collaborative work among project parties have been the most important enablers 5) Varied savings were achieved in water, electricity & gas consumption. 6) The corporate image of the organizations was improved and critical lessons were learned.The major contribution given by this research paper in that the use of national certification system may be a solution to overcome the problems that are related to unfamiliarity with international standard and language.

[8] work done by Hikmat H. Ali, Saba F Al Nsairat (2008) studied international green building assessment tools such as LEED, CASBEE, BREEAM GBtool and others to develop an effective green building rating system for residential units in Jordon. The major contribution of this research is done in categories indicators and parameters of assessment tool. AHP method (analytical Hierarchy Process) is used as weighing method. This research found that although, there are similarities on the category level between developed and developing countries there are differences in the weighting of each category. This research suggest a number of recommendation to develop green building assessment tool in general

1) First, developing such assessment framework should be based on scientific research and technical knowledge.
2) The assessment framework should suit the local context of the country.
3) Countries can learn from each other's work and ideas and they should use the work of experts as inputs to their discussion.

[9]another work done by Peng Wu1 and Sui Pheng Low2 (2010) focused in assessing the three green building rating systems, on one major difference, which is project management to identify the role of project management is achieving the green agenda or sustainable construction. The three rating systems are LEED 2.2, BCA Green mark 3.0 and green globes. It was found that green globes allocates most of the credits in the project management section. This research

International Journal of Engineering Research & Technology (IJERT)
ISSN: 2278-0181
Vol. 6 Issue 07, July - 2017

reveals the importance of project management, in terms of both the practice and process. The project management process is highlighted in the green globes by allocating 62.7% to progress meeting, coordination, benchmarking, commissioning, and documentation although LEED 2.2 and BCA green mark 3.0 allocates 20-30% of the project management points to process, most of points are allocated to commissioning and certification activities and no points are allocated to planning and coordination which may lead to problems in rating and will finder LEED 2.2 and BCA green mark 3.0 from reaching their full potential.

[10] work done by Vyas Gayatri Sachin (2012) studied the different rating system in developing and developed countries such as BREEAM, LEED, DGNB, Green Star, GRIHA and GBAS. It made comparision between the rating systems. This research found out that in context of developing countries, economy is more important so, it is necessary to consider which is not taken in GRIHA, GBAS & LEED. Project management is important to achieve economy. In the BREEAM, Green Star, Green Globe and GRIHA, project management aspect is considered. This Paper found out that in India, topography and climate changes from north to south & from east to west. For such varied conditions, a rating system should also consider topographical and climatic factor.

III WHY BREEAM IS NOT INCLUDED IN THE COMPARISON

BREEAM has the highest number of credits over the other existing schemes. However, the number of key environmental aspect covered are so similar that the advantage of having a higher number of criteria may be negligible. BREEAM has nine categories such as management, transport, waste and pollution which are integrated in other rating system._A noteworthy difference is that "acoustics" are considered in BREEAM which is not considered in other systems. Unique to BREEAM, is its management criteria. Buildings should be operated well & maintained over time and thus should be a key area of performance compared to BREEAM, the emphasis on management criteria is weaker. In certification process – BREEAM requires a licensed auditor to go on site and verify the assessment of the criteria before issuing the certification. The difficulty in access of information to the general public makes BREEAM more cumbersome and complex to follow.

BREEAM- In use is divided into three parts.

In Part - I is the assessment for the asset performance, which only takes the features and functional operations of the building.

In Part - II is about "building Management".

It provides comprehensive view of building management whereas only few management polices are cover in other tools.

In Part - III "Occupier Management".

Thus, BREEAM in use is more complicated and time consuming rating tool. There is a need of flexible rating tool to carry out assessment.

IV ANALYSIS OF BUILDING USING LEEDV4 AND IGBC RATING SYSTEM

IGBC- Indian Green Building Council. The rating system used for these thesis is IGBC Green Existing Building O & M. Rating system pilot version Abridged Reference Guide April 2013.

LEED- Leadership in energy & environment design. The rating system used for thesis is LEED v4 for building operations and maintenance.

IGBC is divided into five main parts

site and facility management → 18 credit points

Water efficiency → 26 credit points

Energy efficiency →30 credit points

Health and comfort → 14 credit points

Innovation Category → 12 credit points

Out of 100 credit points.

Energy efficiency has been given highest credit points.

Leed v4 is divided into eight main parts

location and transportation – 15 credit points

sustainable sites – 10 credit points

water efficiency – 12

Material and resources – 8 credit points

Indoor environment quality – 17 credit points

Innovation – 6 credit points

Regional priority – 4 credit points

The water efficiency criteria has been given more credit points in IGBC rating system with respect to LEED v4.

Energy efficiency has near about same credit points in both the rating system.

There is criteria in LEED v4 of regional priority. Which has 4 credit. These points are extra bonus points. So which is not so important in any rating system.

Innovation category is same in both the rating systems.

In LEED v4 there is extra criteria of material and resources which has point of solid management. But in case of commercial non residential building there is no use of such criteria or there is no such amount of solid waste formed. Both these rating system has only considered environmental issues, but economic and social issues are also important.

So, the new rating system shall have social and economic issues with environmental issues. For this new rating system information about Air, Noise and water of Kolhapur city has been obtained from MPCB and CPCB. The new rating system will also consider the local conditions of Kolhapur city.

- Climatic conditions.
- Geographical conditions.
- Potential for renewable energy gain.
- Appreciation of historic value.
- Population growth.
- Public awareness

The new KM existing building rating system consist of three main parts.

Environment

- Water
- Energy
- Indoor environmental quality
- Waste
- Material and components.

Social

- Occupant comfort
- Access to facilities.
- Education, Health & Society

International Journal of Engineering Research & Technology (IJERT)
ISSN: 2278-0181
Vol. 6 Issue 07, July - 2017

Economic

- Innovation Category
- Cost of operation, maintenance & Repair
- Management and maintenance.

V. CLIMATIC CONDITION OF KOLHAPUR REGION

- *Geographical characteristic.*

Kolhapur is an inland city located in South West Maharashtra, 228 km South of Pune, 615 km North West of Bengaluru and 530 km west Hyderabad. Kolhapur has an elevation of 569 meters (1867ft). It lies in the Sahayadri mountains in the Western Ghats.

- *Climatic Conditions :*

Kolhapur's climate is a blend of coastal and inland elements common to Maharashtra. The temperature has a relatively narrow range between 10^0c to 35^0c
summer in Kolhapur is comparatively cooler, but much more humid. Than neighboring inland cities. Maximum temperature rarely exceeds 38^0c.
The city receives abundant rainfall from June to September due to its proximity of Western Ghats. The heavy rains often lead to severe flooding during these months. Temperatures are low in the rainy season and range between 19^0c to 30^0c. Kolhapur experiences winter from November to February. The winter temperatures are warmer than other cities in Maharashtra such as Pune and Nashik.
Humidity is low in this season making the weather much more pleasant.

- *Hydrology :*

The Panchaganga River originates in the Western Ghats. It has five tributaries which supply the city and surrounds.The Bhogavati, Tulsi, Kumbhi, Kasari and the Dhamani rivers. The Panchaganga is polluted with untreated domestic sewerage, industrial effluents, biomedical sewerage , crematorium ash, religious offerings.The BOD level of panchaganga river have been increased as per MPCB report.
Kolhapur has a number of lakes important of them are Rankala and Kalamba.

- *Governance :*

Kolhapur is governed by the Kolhapur Municipal Corporation (KMC). The city is divided into five wards named with the letters A to E. The corporation provides services such as sewerage treatment and free cremation for residents and has made a number of improvements, for e.g. Kolhapur Road Project, the anti-encroachment drive to stop unwanted building activity encroaching on the city's open space and the Suvarna Jayanti Nagarothan Project for improvement of roads and storm water management.

- *Population Growth :*

As per the reports of Census India, population of Kolhapur in 2011 is 549236 of which male and female are 280366 and 268870 respectively.

- *Transport :*

The Chhatrapati Shahu Maharaj Terminus links Kolhapur via rail to India's Major cities with express services to Pune, Mumbai, Bangalore & New Delhi. Kolhapur is located on National Highway 4 and NH 204. The city has three state transport bus stands. Central Bus Stand (CBS), Rankala Bus Stand, Sambhaji Nagar Bus Stand . KMT provides local bus services in city
Central government granted 78 buses for KMT. The CBS of Kolhapur is the busiest bus stand in Western Maharashtra.

- *Pollution Problem*

According to MPCB, the level of noise pollution have been increased above the limit in both day time and night time calculation in residential, commercial & silent zones.
According to Air Ambient quality monitored at Kolhapur,at three locations the amount of (SPM) have been exceeded above standards.the amount of (RSPM) value have been also increasing above average.

VI NIRMAN RATING SYSTEM

For Existing Non-Residential Building

A.Formation of Categories (Sub Criteria, are color coded)

A	Site Management
1.	Waste collection and disposal
2.	Eco-friendly landscaping practices
3.	Site planning and management
4.	Reduction in Urban Head island (roof)
5.	Reduction in Urban Head island (Non-roof)
6.	U factor and solar Heat-gain co-efficient (Thermal efficiency)
7.	Provisions of car parking, cyclistic facilities Public transport
8.	Outdoor light Pollution Reduction
B	Water Management
1.	Rain water management
2.	Water efficient fixtures
3.	Recharge of ground water
4.	Waste water treatment
5.	Waste water reuse
6.	Water metering & leak detection
C	Energy Management
1.	Eco-friendly Refrigerants & Halons
2.	Exterior lighting Control, Exit sign
3.	Power factor correction (checking)
4.	Transformer safety and losses
5.	Internal lighting control, (A.C. central)
6.	Renewable Energy use (Net solar Energy)
7.	Cool roof technology
8.	Check metering and monitoring
D	Indoor Environmental Quality
1.	Use of low-voc paints & Compounds in building interior
2.	Tobacco smoke control
3.	Thermal comfort, indoor temp. (air ventilation)
4.	Integrated Pest Management
5.	Outdoor and indoor noise level
6.	Carbon dioxide monitoring & control
7.	Green cleaning products and materials
8.	Acoustics Conditions (Auditorium)
F	Waste Management Control
1.	Plastic waste management
2.	E-waste management
3.	Solid waste management
F	Society and Culture
1.	Historical value/Aesthetic quality
2.	Occupants Satisfaction /well being
3.	Awareness using examples & education Economy
4.	Emergency plan
G	Economy
1.	Life cycle costing
2.	Operating and maintenance cost
H	Special Category
1.	Increase in environmental awareness
2.	Design for Universal Accessibility
3.	Organic farming
4.	Special programs conduct- Blood donation camp/eye donation awareness among people
I	Management
1.	Building user education
2.	Operation and maintenance manuals

International Journal of Engineering Research & Technology (IJERT)
ISSN: 2278-0181
Vol. 6 Issue 07, July - 2017

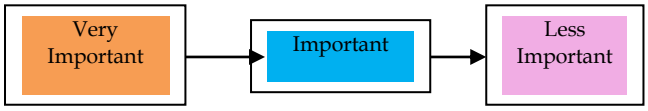
B. *Organizing in Groups of Importance-Weighting*

The criteria weighting method is taken from the master thesis " Sustainability evaluation of green building certification system".

Having collected criteria and sub criteria, the question arises how to utilize them for the purpose of the thesis. However, since not every criterion can be seen as equally important, nevertheless, some criteria have a greater influence than others. Therefore, all criteria will be organized in the following group of importance. "Very important", "Important" and " Less important".

The procedure of assigning the criteria in the respective group of importance is based on a table set up by the organization "Sustainability Performance Assessment" and "Bench marking of Buildings" (2010)

The following colour-coded tables indicates the main criteria group for the purpose of identifying the main criteria group, the following strip gives an overview of the colours that are combined with the corresponding main criteria Group.



Group of Importance	Criteria Group
Very Important	• Site planning and management • Reduction in Urban Heat Island (Roof) • Reduction in Urban Heat Island (Non Roof) • U-factor and Solar Heat gain Co-efficient • Water efficient fixtures • Waste water treatment • Waste water reuse • Water metering & leak detection • Eco-friendly refrigerant and Halons • Power factor checking • Internal lighting control • Renewable energy use • Use of low voc paints & Compound • Carbon dioxide monitoring & Control • Plastic Waste management • E-waste management • Life cycle cost • Increase in environmental awareness • Operation and Maintenance cost
Group of Importance	Criteria Group
Important	• Waste Collection & disposal • Provision of car parking, cyclist facility Public transport • Rain water Management • Transformer safety and losses • Check metering and monitoring • Tobacco smoke control • Thermal, comfort, indoor temp • Outdoor & indoor noise level • Acoustics conditions • Solid waste management • Historical value/Aesthetic quality • Occupant satisfaction/ well being • Design for universal Accessibility • Operation and Maintenance Manual
Group of Importance	Criteria Group
Less	• Awareness using examples & education • Emergency plan
Important	• Organic forming • Special programs • Building user education • Eco-friendly landscaping Practices • Cool roof technology • Outdoor light pollution reduction • Recharge of ground water • Green cleaning products and materials • Integrated pest management • Exterior lighting control.

The next paragraphs explains the different steps that lead to the point allocation of the very important, Important and Less important criteria. It contains the procedure of determining the weight for each group of important.

Step-1

The first step contains the combination of currently used scoring approaches of two selected certification system in order to establish the point allocation system for the weighting process.

The two certification system requires a minimum scored number of points for each certification level.

e.g. LEEDV4 calls for 50 points "Silver certification while IGBC requires 60 points LEED requires 80 points for highest certification level. These values are coloured in Table below.

IGBC - Certification level	Points	Percentage
Certified	50 – 59	50% - 59%
Silver	60 – 69	60% – 69%
Gold	70 – 79	70% – 79%
Platinum	80-100	80%- 100%
LEEDv4- Certification level		
Certified	40 – 49	40% – 49%
Silver	50 – 59	50% – 59%
Gold	60 – 79	60% – 79%
Platinum	80+ points	80%

Combination of using Scoring Approaches for establishing point allocation system.

Step-2

In this study, the percentage for the highest possible Certification level is determined by calculating the mean of the two different values that are colored blue

(90% + 90%) /2 = 90% at-least for very good rating level

The same procedure is applied for an average certification level. The mean of pink colored values.

(60% + 60%) /2 = 60% at least for good rating level

with these threshold percentage, the study has to assign the weights for each group of importance. Obviously, the very important criteria groups receives the highest share of points, in this Case 60% The difference between the calculated 90% and 60% is assigned to important criteria group. The remaining 15%(In order to have 100%) are allocated to the less important criteria group.

Therefore, the following applies.

Weight for very important criteria 60%
Weight for important criteria 30%
Weight for less important criteria 10%

Step-3

International Journal of Engineering Research & Technology (IJERT)
ISSN: 2278-0181
Vol. 6 Issue 07, July - 2017

The last step describes the point allocation for the different criteria in each criteria group. At first, the percentages are translated into points, each percentage constitute one point. These points (60 points, 30 points, 10 points) are allocated to the different criteria groups. There are 18 very important criteria groups from table, 15 important criteria groups from table and 12 less important criteria groups from table. As a result, the following point allocation occurs.

- 19 very important criteria group 60 points -3.15 points for each group
- 14 Important criteria group 30 points – 2.14 points for each group
- 12 less important criteria group 10 points- 0.9. points for each group

However, since the very important criteria group contains for the majority of all criteria, each of its criteria would be allocated fewer points than for important and less important criteria.

Therefore, the ratio of numbers of criteria between each criteria group has to be considered and translated into the point allocation procedure. The ratio between the number of very important, important, and less important criteria is approximately (189:64:9) (21: 7.13 : 1) Multiplying these values with the number of its respective groups result in the ratio 399:99:12, which present a more meaningful relationship between the three criteria groups. As the sum yield is almost 510 points, each number is divided by 5.1 to have a total score of 100 points.

For simplicity, the number for very important criteria was rounded down and important criteria has also rounded down and less important criteria have been rounded up. It means that 78 points are assigned for very important criteria, 19 points to important criteria, and 3 points to less important criteria.

X n group / 5.1

Round down/up

Very important	189 21	399	78.23	78
Important	64 7.13	99	19.41	19.50
Less Important	9 1	12	2.35	2.5

Calculation steps for establishing the Point Allocation System.

Finally, due to the fact that the entire 100 points can be evenly distributed. The study determines the following point

- Very Important criterion : 4.10 point
- Important criterion : 1.40 points
- Less Important criterion : 0.20 points

C. *Innovation criteria & professional credit points*

To encourage innovation in performance of existing buildings and to reduce environmental impacts innovation criteria has been included in the new rating system. As it is one of the important criteria in rating system so five credit points are given to this criteria

Innovation criteria are introduced to achieve significant , measurable environmental performance not addressed in the new rating system.

To involve green building accredited professional in the project (IGBC AP, LEED AP, OR GRIHA professional) so as to facilitate design and implementation of environment friendly measures. It helps project in professional and right manner. So at least one principal participant of the project team must be accredited professional and for that five credit points are awarded

D. *Validity of Nirman Rating system for Existing non-residential building*

- Nirman rating system for existing non-residential building is valid for a period of three year from the date of issue of the certification (2017)
  - Minimum 50% of each criteria of credit points must be satisfied to get certified for Nirman rating system.

The threshold criteria for certification levels are as under :

Certification level	Points	Recognition
Certified	50-59	♦
First level	60-69	♦♦
Second Level	70-79	♦♦♦
Third Level	80-110	♦♦♦♦

REFERENCE

[1] Ali M. Memari, F.ASCE1; Patrick H. Huelman2; Lisa D. Iulo3; Joseph Laquatra4; Carlos Martin5; Andrew McCoy6; Isabelina Nahmens7; and Tom Williamson, F.ASCE8.(2014) "Residential Building Construction: State-of-the-Art Review"*Journal of Architectural Engineering @ASCE* 2014 (20) pp 1-38.

[2] Ali, H & AL NSAIRAT , S F 2009, Developing a green building assessment tool for developing countries, case of Jordan.

[3] Bahacan Aktas1 and Beliz Ozorhon2(2015) "Green Building Certification Process of Existing Buildings in Developing Countries: Cases from Turkey" *Journal of management engineering* @ ASCE 2015 pp 1-9.

[4] Bo Xia1; Jian Zuo2; Martin Skitmore3; Stephen Pullen4; and Qing Chen5 (2013)"Green Star Points Obtained by Australian Building Projects"*Journal of Architectural Engineering* @ASCE 2013/4 ,pp 302-308.

[5] BREEAM –IN USE International –Technical manual SD 221-1-0:2015 version O-Version Date:March 2015.

[6] GRIHA Guide version 2015.

[7] Guidelines for Environmentally sound management of E- waste.

[8] GIBBERD , J Assessing sustainable building in developing counties "Sustainable building assessment tool (SBAT)

[9] Hikmat H. Ali, Saba F Al Nsairat (2008) "Developing of green building assessment tool for developing countries – case of Jordan*"Building and Environment 44 (2008).pp* 1053-1064.

[10] IGBC Green Existing Buildings Operations & Maintenance Rating System Pilot Version Abridged Reference Guide April 2013.

[11] K.G,A,S Waidyasekara and M.L De Silva (2013) " Comparative Study of Green Building Rating Systems : In Terms of Water Efficiency and Conservation"

[12] LEED V4 for Building Operation & Maintenance existing Buildings.

[13] Mohmed Solla, Lokman Hakim Ismail & Ridvan Yunus (2015)" Evaluation of Non- Residential green building in Malaysia." *International Conference data mining, civil and mechanical Engineering (ICDMCM 2015)* Bali, Indonesia.pp 65-69.

[14] Maharashtra Pollution control board (www.mpcb.gov.in) .

[15] MERC (Net metering for roof- top solar photo voltaic systems) regulations , 2015.

[16] Nurul Sakina Mokhtar Aziz 1,Elizabeth Fassman,A.M.ASCE 2,Suzanne Wilkinson 3,and Adi Irfan che Ani (2013) "Management Practice to Achieve Energy efficiency performance:
Green vercus conventional office Buildings in Malaysia"*Journal of legal affairs & dispute resolution in Engineering & Construction* @ASCE 2013.5:pp 205-214.

International Journal of Engineering Research & Technology (IJERT)
ISSN: 2278-0181
Vol. 6 Issue 07, July - 2017

[17] Peng Wu1 and Sui Pheng Low2 (2010) "Project Management and Green Buildings: Lessons from the Rating Systems"*Journal of professional issues in Engineering education* @ASCE,136 pp 64-70.
[18] Peter E. D. Love1; Michael Niedzweicki2; Peter A. Bullen3; and David J. Edwards4 (2012) "Achieving the Green Building Council of Australia's World Leadership Rating in an office Building in Perth"*Journal of Construction Engineering management* @ ASCE 2012 (138) :pp 652-660.
[19] Plastic Waste Management 2016 , (www.cpcb.gov.in) .
[20] Report on Ambient noise monitoring on metropolitian cities in Maharashtra 2014. (www.mpcb.gov.in) .
[21] Vyas Gayatri Sachin (2012)" Comparative Study of Rating systems for green building in developing and developed countries".