Original Article
ISSN (Online): 2350-0530
ISSN (Print): 2394-3629

International Journal of Research - GRANTHAALAYAH
June 2023 11(6), 66–82

THE CHALLENGES AND OPPORTUNITIES IN ADAPTATION OF GREEN BUILDING RATING SYSTEM IN NEPAL

Ar. Itiza Sharma [1], Dr. Sushil Bahadur Bajracharya [2], Er. Aashika Pokharel [3]

[1] Senior Architect/ Managing Director, Architecture Department, Nepal Engineering College, Kathmandu, Nepal
[2] Assistant Dean, Institute of Engineering, Pulchowk Campus, Hariharbhawan, Lalitpur, India
[3] Department of Road/ Senior Divisional Engineer, Kathmandu, Nepal

Received 14 May 2023
Accepted 15 June 2023
Published 30 June 2023

Corresponding Author

Itiza Sharma, itizasharma@gmail.com

DOI
10.29121/granthaalayah.v11.i6.2023.5210

Funding: This research received no specific grant from any funding agency in the public, commercial, or not-for-profit sectors.

ABSTRACT

Nepal especially Kathmandu Valley is highly rich in huge number of residences and users from all over the country which is major source of increasing Greenhouse Gas emission and CO2 footprints. Haphazardly mushrooming concrete jungle without proper planning, environmental consciousness and future vision is the big, alarming sign of degradation of its beauty and environment. Nepal is leading towards "grey rather than green". Electricity consumption growing rate of approximately 10% per year and the total energy consumption at a rate of 2.4% per year is in increasing order. At present context, the depletion of energy resources and the risk of climate change is demanding for a sustainable development path based on renewable energies and energy efficiency. Therefore, incorporating green features in buildings can substantially save energy, water consumption, and reduce GHG emissions. Green Building Rating System provides framework for healthy, efficient, carbon and cost saving green buildings. It helps the building industry to move toward sustainable development and enhances performance, durability, aesthetic, and sustainability of built environment. In many developed and developing countries, there is a minimum mandatory rule for rating system. Rating of building helps user to know and aware about how much his/ her houses consume energy and reduce; not only energy consumption but also reduces the energy expenses. The knowledge about energy efficiency, green building, green features, design parameters and Green Building Rating System is very low among the general public and most of the technical persons and is the reason why still Green Building Rating System is still not implemented in Nepal. There is a very low demand of Green Building Rating system in Nepal due to the lack of awareness both social and cultural. Lack of education, lack of proper and mandatory green building related guidelines and lack of skilled manpower and technology are the major challenges. Group of renowned Architects and experts of Nepal were involved and tried their best with green building projects to register under LEED certification but was failure to get the certificate. Additionally, draft of ERA guidelines (preliminary) prepared by the group of pioneer Architects of Nepal was the initiation towards establishment of own building rating system in Nepal. Green Building Rating System will be the solution for energy optimization and will mark a turning point for the green design and green movement in building industry in Nepal.

Keywords: Footprints, Green Building, Rating System, Green, Climate Change, Sustainable, Efficiency

1. INTRODUCTION

Nepal facing budget gap Mishra & Aithal (2021), Mishra & Aithal (2021) can adopt green environment policy to manage it as frequently suggested that green environmental perspective can help to avoid unnatural maintenance expenses

Mishra & Aithal (2022). "A green building is one which uses less water, optimizes energy efficiency, conserves natural resources, generates less waste and provides healthier spaces for occupants, as compared to a conventional building." Green buildings refer to a structure and using process that is environmentally responsible and resource efficient throughout the building lifecycle, from sitting to design, construction, operation, maintenance, renovation, and demolition holding various environmental effects Mishra and Rai (2017). Green building, in the true sense of concern for environmental impact, is an increasingly important aspect to new construction and renovation. Effects range in scale from local, such as displacement of ecological habitats, to global, such as greenhouse gas emission ultimately leading to global warming and climate change. Similarly, operation period will have pollutants emission both directly and indirectly. Green building practices and technologies seek to address these foreseeable adverse environmental effects. The increasing demand of housing and insufficient supply of the same raises the questions and strong demand for searching new ways to fulfil it Mishra et al. (2020), Mishra & Shah (2018) , Mishra (2019)

The U.S. Green Building Council (USGBC) state that the Leadership in Energy and Environmental Design (LEED) LEED "encourages and accelerates global adoption of sustainable green building and development practices through the creation and implementation. LEED certification process is globally recognized as a symbol of sustainability achievement. Development of the program marks a turning point for the design and construction industries. Over 91 countries have LEED projects. "LEED" green building rating programs, represent a critical development within the green movement as it encourages designers and builders to reevaluate current construction practices and focus sustainability of building. "LEED" certified buildings save at least 50% of the energy used by a comparable non- certified building. Different green building rating systems have been developed around the world following LEED categories at first with gradual modification according to requirement and naming it differently.

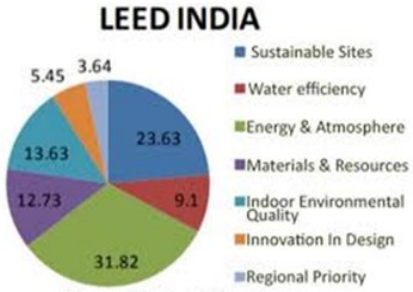

Fig. 1. LEED v4 Points category

LEED Scoring Criteria

LEED	*Sustainable Sites (26 pts) *Water Efficiency (10 pts) *Energy and Atmosphere (35 pts) *Materials and Resources (14 pts) *Innovation and Design Process (15 pts) *Regional Priority (4 pts)	*Certified: 40-49 points *Silver: 50-59 points *Gold: 60-69 points *Platinum: 70-110 points

CASBEE®
Comprehensive Assessment System for Built Environment Efficiency

WORLD GREEN BUILDING COUNCIL

Green building design is a growing field within architectural design. It has emerged in the construction industry as the practice of designing, constructing, and operating facilities in such a manner that their environmental impact, which has become a great concern of construction professionals, can be minimized. "The construction material in use today should be sustainable and "Green solutions has to be developed to meet the emerging needs. As buildings are one of the major

contributors to greenhouse gas emissions, there is a need to promote green building concept by both the private sector and the government in Nepal. With the increasing energy demand, consumption and release, the traditional practices of construction process and management are found unable to control unprecedented challenges including the carbon emission issue. It is found that passive design building is highly green but do not cover requirements in case of multistoried green buildings.

Figure 1

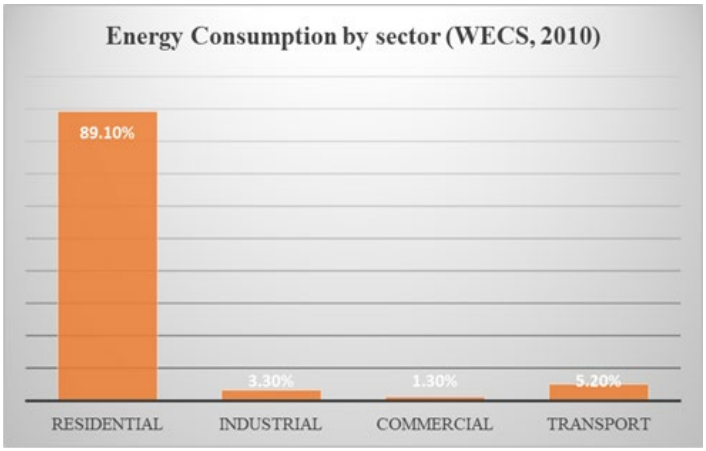

Figure 1 Energy Consumption by Sector (WECS, 2010)

Green building rating system is very essential key to move the construction industry toward sustainability but adoption of it of other developed country in different context cannot cover all the issues of sustainability of Kathmandu Valley and Nepal. LEED give maximum priority to its energy and atmosphere category and emphasis on using mechanical system but in Nepal's context, more emphasis should be given to the production of renewable energy, water management, waste management, quality of local materials and integrated process for better validity of work culture.

Figure 2

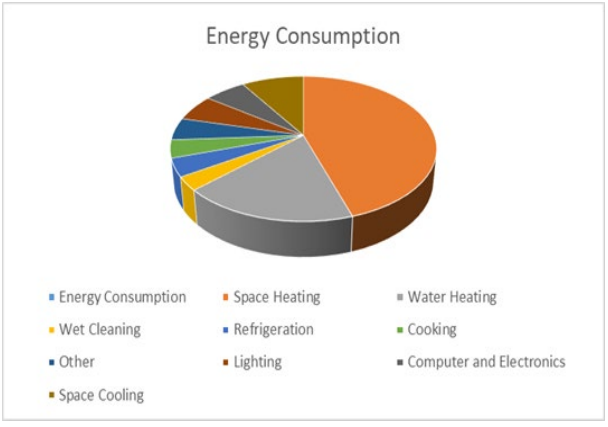

Figure 2 Residential Primary Energy Consumption, 2010 Buildings Energy Data Book

Numerous practices and efforts have been evolved previously in building industry in Nepal for the development of green buildings over the last two decades. Architect Bibhuti Man Singh, Architect Sushil Bajracharya with their involvement in Green Home Project was a very effective approach towards green movement. In

spite of these efforts, building practices do not seem to have undergone any tremendous, marked changes. The reasons for and/or against participation in green building rating programs on behalf of businesses involved in construction speak volumes as to where the industry is headed. Rating/Labeling systems of building is gaining popularity in present due to ease in measure of energy efficiency and emission worldwide. Other Architect Ujjwal Man Singh, LEED AP Sujata Tuladhar, Architect Sona Prajapati were highly involved in green projects. Similarly in 2015 thesis research was also done by Architect Saurabha Shakya of IOE on Sustainable Building Rating System (SBR) for Nepal- With a case in Kathmandu Valley.

2. LIMITATIONS

- Using the term of construction works, it only concern with buildings.
- The research was focused inside Kathmandu Valley Only.
- Case study was done based on the green projects that followed LEED credits.
- The LEED analysis was focused on Building Design and Construction for
- Commercial and residential building, apartments.
- The recommendations are based on the case study, Qualitative Analysis (Interviews).

3. OBJECTIVE

The overall objective of this research was to analyze the challenges and opportunities in adaptation of green building rating system in Building industry in Nepal. The specific objectives of this research were:

- To analyze the challenges in adaptation of green building rating system in Building industry in Nepal.
- To identify the opportunities in adaptation of green building rating system in Building industry in Nepal.

4. METHODOLOGY

Research Methodology provides the systematic process of describing research questions, research objectives, methods of data collection, data analysis, and defining results and discussions. The research was based on the quantitative as well as qualitative approach for the entire research. For this, quantitative survey was done with 35 respondents and qualitative with 20 professionals, clients, consultants, contractor, and LEED professionals regarding green building projects. The study population for the research was based on the selected number of completed green building projects.

The sample number selection varied in different projects that are taken on the basis of features and its expertise involvement in the relative project. The study population consisted of the client, consultant, and contractor; corporate heads involved in the green projects. Primary data were the basis of this research. For the collection of primary data, field observation, questionnaire survey and key informant interviews (KII) were done. Field observation was done by visiting four numbers of rated building and two numbers of non-rated building for this research. For questionnaire survey, set of separate questions was designed for the client, consultant and contractor representatives worked in the green building projects

regarding construction of green building and its environmental impact, the challenges, opportunities, and applicability of green building rating system in Kathmandu Valley. Similarly, for KII set of open-ended questions were prepared focusing on key informant. All total twenty-two number of professionals were selected for KII. Thus, primary information regarding green building construction and its environmental impact, the challenges, barriers, opportunities, and applicability of green building rating system in opportunities, ley were collected.

Figure 3

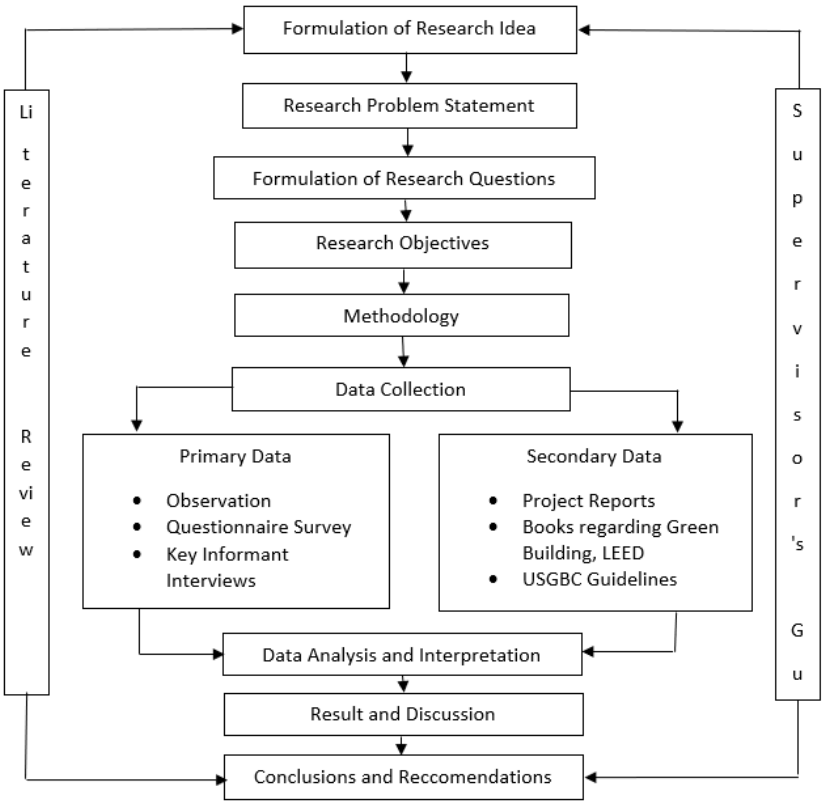

Figure 3 Methodological Framework of Research

Secondary data were gathered from national and international articles, published journals, reports, previous thesis and dissertation, conference papers, websites, published documents, literature, government acts and regulations, technical support documents, documents from websites and other related documents. Nepal Green Building Guidelines and other reference guide of LEED were referred for knowledge gain. The whole population from all six projects i.e., 35 respondents were considered as the sample size for this study. The sample number selection varied in different projects that are taken on the basis of features and its expertise involvement in the relative project.

Table 1

Table 1 List of Respondents from the Client, Consultant and Contractor

S. No.	Project' Name	Client Representative	Consultant Representative	Contractor Representative	Total
1	Crystal Palace Tahachal, Kathmandu	1	2	1	4

2	Central Park Apartment Bishalnagar, Kathmandu	2	2	1	5
3	Hama Iron and Steel Building-Kamladi, Kathmandu	2	3	3	8
4	Siddhi Poly Path Lab-Dillibazar, Kathmandu	2	3	3	8
5	Mato Ghar-Budhanilkantha, Kathmandu	2	2	2	6
6	Pyramid House-Thaiba, Lalitpur	1	2	1	4
	Total	10	14	11	35

Data analysis was done based on the data collected from the questionnaire was analyzed using the Microsoft Excel application and for ranking the factors overall using the Simple weightage method. Before analysis began, several preliminary processes were adapted: editing data, addressing blank responses, categorizing data, producing data files, and doing few relative calculations. These procedures were designed to assure data consistency and allow for meaningful interpretation of results.

Figure 4

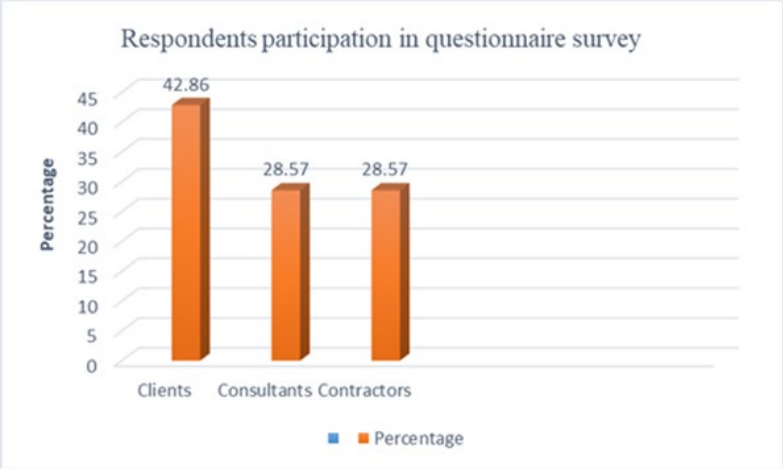

Figure 4 Respondents Participation in Questionnaire Survey

Validity measures the degree of agreement of the results or conclusions withdrawn from the research questionnaire with the real world. High validity is the absence of systematic errors in the measuring instrument. The result of the previous research was also in agreement with the result drawn from the questionnaire survey in this thesis. The questionnaire was prepared with the help of LEED professional, Architects, Engineers involved in green building projects. And finally guided and approved by the supervisor. The questionnaire set was prepared and used for this research was tested for Reliability Test. The questionnaire set consisted of 69 items in questionnaire. To measure internal consistency of the questionnaire, it was subjected to Cronbach's alpha test by importing excel sheet in SPSS and the obtained Cronbach's Alpha Value was 0.963 which shows the excellent range of result.

Table 2

Table 2 Cronbach's Alpha Level of Reliability	
Cronbach's Alpha Value	**Internal Consistency**
$\alpha \geq 0.9$	Excellent
$0.9 > \alpha \geq 0.8$	Good
$0.8 > \alpha \geq 0.7$	Acceptable
$0.7 > \alpha \geq 0.6$	Questionable
$0.6 > \alpha \geq 0.5$	Poor
$0.5 > \alpha$	Unacceptable

Source Bujang, et al., 2018

5. CASE STUDIES

Kathmandu Valley was selected as study area for this research. For the selection of the projects inside Kathmandu and Lalitpur district, 4 numbers of green building projects applied for LEED certification as rated and 2 numbers of buildings with application of green technology only but not applied for LEED certification as non-rated buildings were taken as study projects. As there are limited projects on count with green technology application and applied for LEED certification, the study was conducted in different apartments and corporate buildings with LEED credits.

Table 3

Table 3 List of Projects Registered for LEED Certification

S. No.	Building	Location	Building Type	Owner/ Investor	GBRS	Built-up Area	Registered Date
1	Central Park Apartment	Bishalnagar, Kathmandu	Apartment	Clean Developers Pvt. Ltd.	LEED CS 2.0	73,286 Sq.ft.	23/06/2009
2	Butwal Power Company	Buddhanaga, Kathmandu	Corporate	Butwal Power Company Ltd.	LEED NC 2009	56,760 Sq.ft.	16/06/2010
3	Crystal Palace	Tahachal, Kathmandu	Apartment	Technical Interface	LEED NC 2010	325,392 Sq.ft.	18/06/2010
4	Hama Iron and Steel Building	Kamaladi, Kathmandu	Corporate	Hama Iron and Steel	LEED NC 2009	68,942 Sq.ft.	23/08/2010
5	Siddhi Poly Path Lab	Dillibazar, Kathmandu	Healthcare	Siddhi Poly Clinic	LEED NC 2009	10,196 Sq.ft.	05/09/2010
6	Corporate Office of Sipradi	Thapathali, Kathmandu	Corporate	Sipradi Trading Pvt. Ltd.	LEED NC 2009	36,196 Sq.ft.	23/02/2013
7	Annex Block, Kathmandu Mall	Sundhara, Kathmandu	Religious Worship	Happy Science International	LEED NC 2009	5940 Sq.ft.	19/05/2013
8	Buddha Lifestyle Scheme	Baluwatar, Kathmandu	Corporate	Buddha lifestyle Pvt. Ltd.	LEED NC 2012	13,364 Sq.ft.	02/06/2013
9	Buddha Lifestyle Scheme	Baluwatar, Kathmandu	Corporate	Buddha lifestyle Pvt. Ltd.	LEED NC 2009	33,304 Sq.ft.	16/05/2014
10	Marriot Hotel, Thamel	Thamel, Kathmandu	Hotel	Everest Hospitality and Hotel Pvt. Ltd.	LEED NC 2009	265,103 Sq.ft.	16/12/2015
11	Soaltee Westened Premiere	Main Chowk, Nepalgunj	Hotel	Soaltee Sibkrim Hotels and Resort	LEED NC 2009	84,034 Sq.ft.	21/10/2016

Case study of four numbers of green rated building and two numbers of non – rated building of Kathmandu and Lalitpur district were done. Its comparison helped to know the present green building scenarios inside Kathmandu Valley. For the rated building, Crystal City at Tahachal, Hama Iron and Steel building at Kamaladi, Siddhi Poly Path Lab at Dillibazar and Central Park Apartment, Bishalnagar were selected. But due to numerous reasons including high cost, time to time design change and building use requirements from client, lack of confident Heating, ventilation, and air conditioning (HVAC) team these buildings were unable to get LEED certificate.

Figure 5

Figure 5 (a) Crystal City Apartment, Tahachal **Source** crystalcitytahachal.com.np

(b) Siddhi Poly Path Lab, Charkhal **Source** Siddhilab.com.np

Figure 6

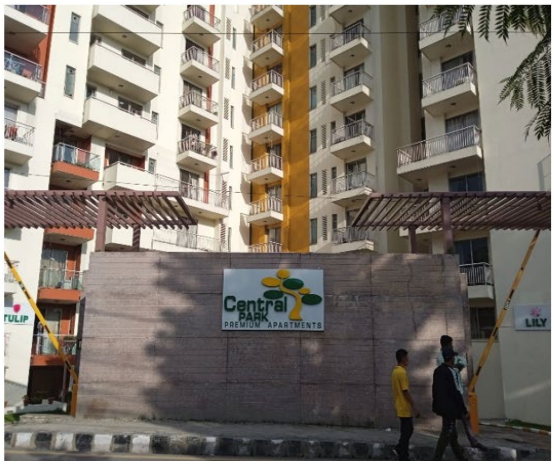

Figure 6 (a) Central Park Apartment External View **Source** centralparkapartment.com.np

(b) Hama Iron and Steel Building, Kamaladi **Source** Siddhilab.com.np

5.1. GREEN BUILDING FEATURES

In case studies it was found to get the LEED rated certificate for a building, different green building features had been used to make it sustainable like:

- Photovoltaic System
- Insulated Walls and openings

- VRV HVAC System
- Winter Heat Recovery and Circulation
- Energy Efficient Lighting Techniques
- Thermal Displacement Ventilation
- Eco- Friendly Refrigerant
- Green Roof
- Maximum use of glass for Daylighting
- Building Integrated Energy Management System

As the environmental impacts of buildings has become more apparent these days, the planners in the country have started discussing the concept of green homes to create healthier and more resource- efficient building construction. Especially Architecture firm has really taken initiation toward green building construction and trying to verify green buildings designed by them to motivate the construction industries toward sustainable development. There is no specific rules and regulations to follow for design and construction of such kind of building in Nepal and also there is still no any green building rating system of Nepal till date that measures the features of such buildings. As a result, the consultant who are really concerned about the environment and who really wants to work toward green projects in Nepal are forced to implement Green Building Rating System of other countries.

Figure 7

Figure 7 **(a)** Matoghar Exterior View **(b)** Pyramid House
Source Prabal Thapa Architects **Source** Innovative Createers Pvt. Ltd.

6. OBSERVATION, STUDY AND ANALYSIS

6.1. QUESTIONNAIRE SURVEY RESPONSE

6.1.1. FAMILIARITY WITH GREEN BUILDING RATING SYSTEM

Figure 4 shows, all the expertise is aware and familiar with green building rating system as the selected respondents for questionnaire are already involved in the green projects. After questionnaire survey, it was found 57.14% of the professionals are familiar with LEED rating system, 17.14% LEED and GRIHA, 14.28% LEED, GRIHA and BREEAM, 8.58% LEED, GRIHA, BREEAM and CASBEE and 2.86% LEED and LBC. From the analysis, it shows LEED is very popular and comes first among all the green building rating systems.

Figure 8

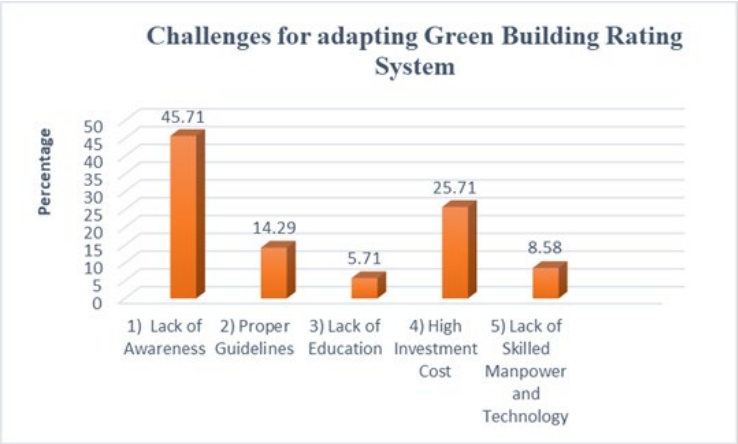

Figure 8 Familiarity with Green Building Rating System

6.1.2. CHALLENGES FOR ADAPTING GREEN BUILDING RATING SYSTEM

Figure 7 shows the result of analysis of the challenges for adapting Green Building Rating System. Analysis of data was done and result shows the highest value for lack of awareness with 45.71%, secondly 25.71% for project high investment cost, 14.29% for proper guidelines, 8.58% for lack of skilled manpower and technology, and least value of 5.71% for lack of education.

Figure 9

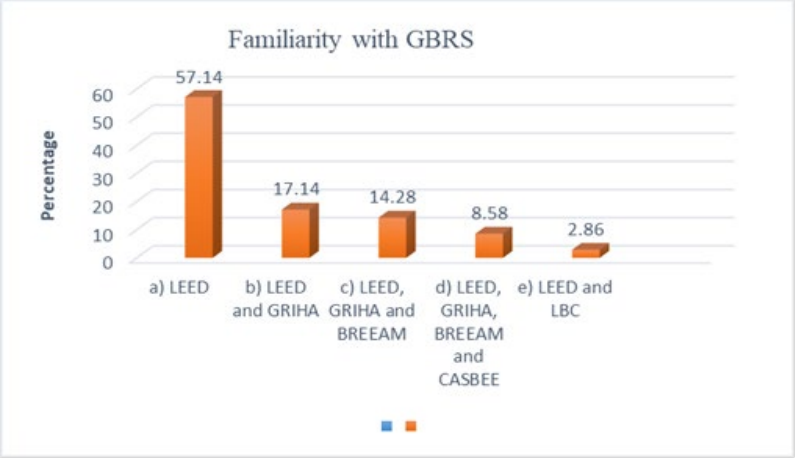

Figure 9 Familiarity with Green Building Rating System

6.1.3. OPPORTUNITIES FOR GREEN BUILDING RATING SYSTEM

Figure 7 shows the result of opportunities of adapting GBRS. From the result it was found 45.71% majority for Ecological. Secondly, 34.28% for economical and 14.28% for social and cultural and 5.73% for advancement in professionalism. In context of Nepal, traditional Nepalese vernacular architecture is passive design techniques-based architecture which is already green. The main concept of

establishment of GBRS was to save the environment by coming up with environment friendly smart design with that directly supports ecology.

Figure 10

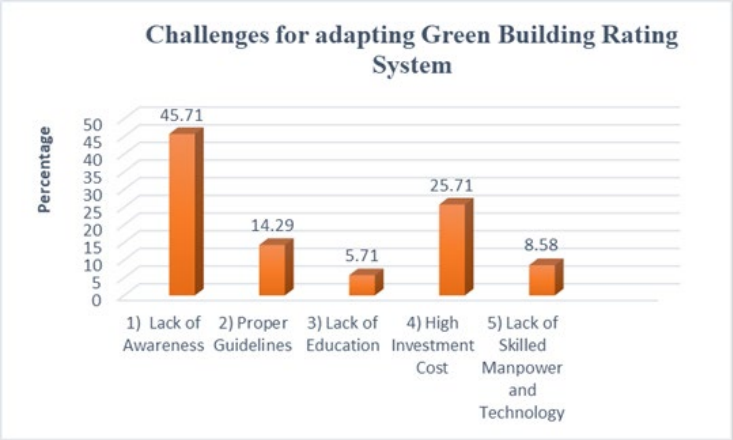

Figure 10 Opportunities of Green Building Rating System

6.2. KII RESPONSES

For this research, KII was done with 22 number of professionals including Architects, Civil Engineer, Environmentalist, Climate Change Expert, Contractor, Corporate Heads. During KII, very effective and helpful data were collected. Most of the respondents had similar point of view regarding establishment of Green Building Rating System in Nepal. Few effective selected discussions from KII are mentioned below:

6.2.1. DISCUSSIONS FOR THE CHALLENGES IN ADAPTATION OF GREEN BUILDING RATING SYSTEM IN BUILDING INDUSTRY IN KATHMANDU VALLEY

1) **Discussion 1:** Lack of LEED license holder professionals known as LEED AP is major reason for the zero development in context of green buildings. As previous failure examples for registration are mostly due to lack of green projects experience. Also scarcity of other skilled technical persons with fine experience in green technology and projects may be the reason that green projects are lacking behind in Nepal.so, we should implement it through building code and bylaws similar to other recommendations made earlier Mishra (2019).
2) **Discussion 2:** Topography of Kathmandu is vulnerable with steep slopes and irregular infrastructures as well. Government agencies, stakeholders should focus on plot sizes which is main barrier as well to cover Green Building Rating System criteria. Before implementation of GBRS, green norms and guidelines should be developed and strictly apply in building designs.
3) **Discussion 3:** Awareness Programmes are mendatory. No any awareness programme are there relating environment and Green Building Rating System. Strategies should be made for general public in Nepal because the GBRS is known to very few and limited among few technical persons in case of Nepal.

4) **Discussion 4:** Variation in status and the living standard of people is the main for the demand of Green Building Rating System. Everyone could not afford. Obviously, the project cost initially goes high then general building which may not be affordable for everyone with low income.
5) **Discussion 5:** Awareness and Education is major thing for the establishment of GBRS in Nepal. Interested clients, Investors and designers are there but lack of our own GBRS we are unable to rate the building as a green and there are confusions rate up to what extent. So, lack of measuring guidelines.
6) **Discussion 6:** Government agencies, stakeholders should focus and make display of prototype of green buildings with its estimation so that it can be easier for the visitors and public to compare with general buildings and clearly visualize the differences.
7) **Discussion 7:** Before applicability of final version of GBRS for Nepal, RND regarding GBRS should be established at least for 4 to 5 years until we get the fine outlines of GBRS to establish.

6.2.2. DISCUSSIONS FOR THE OPPORTUNITIES OF GREEN BUILDING RATING SYSTEM IN BUILDING INDUSTRY IN KATHMANDU VALLEY

8) **Discussion 8:** Nepal should have its own contextual GBRS, selecting few credits and prerequisites criteria from "LEED" to cover green guidelines. GBRS in Nepal can be implemented and it will be very effective for green movement in future.
9) **Discussion 9:** GBRS for Nepal especially for Kathmandu Valley will be very effective regarding environmental issues. Kathmandu valley is contributing towards climate change and proving its contribution for global warming worldwide though the percentage is few but its in increasing order.
10) **Discussion 10:** LEED certificate for a building is like stars rating to hotels. For Nepal, at first starting should be done from capital as it covers booming construction and huge population to motivate. Incentives from municipalities should be provided to users and tax credit availability should be made for the user who made their building green to encourage them and motivate others.
11) **Discussion 11:** GBRS will be very effective for upcoming future environment friendly green buildings, Net Carbon building designs for the designers. Mostly the designers at first should follow the environmental guidelines which is lacking behind in a general design of building.
12) **Discussion 12:** Implementation of Green Building Rating System in Nepal should be done according to climate and topography of three regions, as availability of local materials construction technologies and landscape vary in these three regions. Different locally available materials can be introduce.
13) **Discussion 13:** As GBRS focuses on reduction of GHG and CO_2 footprints, therefore for the increment in environmentally sound buildings GBRS is highly applicable and mostly in demand in between designers, experts, and planners.
14) **Discussion 14:** Green Building Rating System in Kathmandu is highly applicable and will be effective as GBRS focuses on waste management, grey water treatment, wastewater reuse, reuse of materials under different

criterias which is the panic problem of today's context inside Kathmandu Valley.

7. SUMMARY OF FINDINGS

From the study, it is found that almost all of the consultant in Nepal are using LEED for their building because there is no any building rating system of Nepal implemented till date and LEED is the only green building rating system tool which claims for its universal application as of Kumar et al. (2012).

Lack of awareness is found as major challenge for any green building project to implement. Lack of awareness results lack of demand. Therefore, till date GBRS is not in implemented in Nepal because there are very few demands for it. Those who are familiar with GBRS and interested in doing green projects are able to get the client who wants to invest extra high cost on their green building projects, but lack of technical persons and manpower is the major challenge to work on green projects. Lack of proper and mandatory guidelines for green buildings from government agencies, stakeholders is another big challenge for establishment of GBRS which is directly connected to the lack of skilled LEED AP, visionary planners, and technical persons. It needs to be focused as it is one indicator for sustainable development as well Mishra and Pokharel (2023), Parkin et al. (2003).

Ecology based design for Nepal is the main opportunity by the implementation of Green Building Rating System. Including different categories focusing on the use of available natural energy and resources, local materials, low transportation, re-use of materials, waste and water management, grey water reuse GBRS will promote for ecological design in Nepal. In long run it saves economy with reduction in electricity and energy consumption cost though the initial cost may high be due to the design, research, costly technology, and material used Santori (2007), Shahi (2013), Shakya (2015), Utama and Gheewala (2009).

Building Bye- Laws of Nepal will get modified more in precise way including different categories. Building rating system will enhance the value of the property. Green Buildings will get recognition, also the building owners get incentives from government if facility of provided by the government. The value of building also increases after they get certified, it will be value for the customer who are going to buy as well as for the seller as the building selling price, therefore housing sector will develop increasing the value of property logically.

8. CONCLUSION AND RECOMMENDATION

8.1. CONCLUSION

From the case studies, analysis, qualitative and quantitative data's, the identified challenges, and opportunities in adaptation of Green Building Rating System and its implementation in Nepal are found as follows:

- **Cost of Implementation:** From the analysis, it came that Cost of Implementation is the main barrier of its adaption. Investor and consultant still think that add –on value is too high for the scale of the project and investor are still not assures regarding the payback values of the investment.
- **Availability of Technologies and Green Materials:** Availability of technologies and green materials is another main barrier of its implementation. Since the market of green building is still new in Nepal, experts and consultant find it very difficult to find the required technologies and green material. Indian material such as paint, coatings, adhesive, water

efficient fixtures are already available in Nepali market, so this trend will change slowly toward better sustainability in future.

- **Not Relevance to Nepal Context:** Third main barrier is, still many stakeholders of construction industries think that some points of LEED are not relevant to Nepal's Context. They think that LEED or any other green building rating system are made for the country's context where they are developed. They cannot be relevant to the different countries with different cultural values, climate, and context. They put a strong suggestion that, either LEED should be modified in Nepal's context like India did in LEED-India or we must develop our own BRS which match our context, culture, and climate.
- **Lack of Awareness:** Fourth main barrier is lack of Awareness and Knowledge regarding Green building rating system and the advantages it could bring to the project through implementation among Investor, government agencies, consultant, project manager and other discipline of construction towards sustainable development. Investor should be made aware by consultant regarding its benefit in energy, water, indoor air quality and financial benefits in operation and maintenance, the add-on value of the project with its green features in future market. They should be motivated by government agencies through incentives and taxes, and insurance, etc.
- **No Bylaws and Standards:** There is still no bylaws and standard regarding green building or sustainable building in Nepal. Most of the Municipals had initiated their concern toward environment though incorporating small basis items in Design drawing, such as plantation of minimum 2 trees in small residential buildings, use of septic tank and now STP. Provision of open space by minimizing building footprints. Maximum of these points remains only in drawing, during construction clients modified these changes only concerning about monetary their values. And the worst part is there is no system of monitoring of the implementation.

8.2. RECOMMENDATION

8.2.1. KNOWLEDGE AND AWARENESS

From the study it has become clear that, architect consultants are well aware about the green construction, and they are urging about the immediate action for the awareness, Both Cultural and Social Awareness. Awareness is required for every sector of the construction field, mainly to the key players of this industry – Client (Owner), Architects/ Consultants, Contractors, Manufacturers.

Recommendation

- **Academically:** In academic context, architecture courses already cover passive design architecture, building services, etc. But the courses are based on very traditional technology. Exposure to the much-achieved technology and improvised courses still lacks in our academic. Green Construction should be included in the courses which will match the current advance practice in the developed world. So that the future professionals becomes aware of this initiation toward environmental sustainability.
- **Professionally:** Building practitioners, especially in construction, need to be informed and educated about green building practices. Training and workshops should be available to all practitioners and all employees. Green building initiatives cannot succeed if all employees involved in green

building do not have same understanding. Promoting the green building benefits to owners, investors are an important step to start upgrading the construction market. They should be educated about the initial high expenses of green systems, and the long-term financial benefits that are gained.

- **Government Level:** Government should promote the green buildings through awareness training, upgrading local mandatory codes and enforcing green practices at least in public buildings.

8.2.2. TEAMWORK CULTURE

From the research it is clearly seen that there should be contribution from each and every team member for the successful green project. However, in Nepal the teamwork culture is missing, as most of the projects are executed through the traditional design approach, in which each team member work separately and integration between consultants and contractors doesn't exist.

Recommendation

- Main issue here in Nepal is absence of communication and coordination among project teams: Client, Architect and Designers, Civil Engineers, MEP, HVAC, Contractor due to which project suffers a lot. This gap should be covered by assigning a dedicated team or person to be responsible for communication and coordination.
- As we work on very outdated technology in compare to other countries, since there is still no culture for proper documentation and because of lack of proper documentation tools and relevant software's there is always a chance of losing and omitting valuable data, information. It's a high time to use coordination and documentation tools and software.
- Still, we have a culture for not caring for the project scheduling and project deadlines, our projects are always time overrun, cost overrun and there is always a confusion and miscommunication among the team members.

CONFLICT OF INTERESTS

None.

ACKNOWLEDGMENTS

None.

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