Proceedings of International Conference on Sustainable Development (ICSD 2019)
In Association with Novateur Publications IJIERT-ISSN No: 2394-3696
ISBN. No. 978-93-87901-05-6
February, 14th and 15th, 2019

ICSD/16

STUDY OF THE CONCEPT OF GREEN BUILDINGS, PRACTICES FROM THE PAST AND ITS APPLICABILITY TODAY

Pradnya Patki
[1]Sinhgad College of Architecture, Pune, India
pradnyanesarikar.scoa@sinhgad.edu

Anjali Rasane
Sinhgad College of Architecture, Pune, India

Sudhir Deshpande
Brick College of Architecture, Pune, India

Abstract

The paper aims at understanding green building and its interpretation over the years. The objectives are to study green building, to find similarities and differences between different terminologies. The methods used are to summarize understanding from literature review and case examples; to study the similarities between old cultural practices related to climate and new concepts; to understand way of living in the past, needs and today's fast pace changing lifestyle.

Keywords: Climate, Green, interpretation, lifestyle, practices.

1. Introduction

In today's world, there is a trend of putting old things in a new shoe. Currently in architecture and civil industry, experts and philosophers are talking about green architecture very frequently. Remaining close to nature is an old concept. It is also traditionally bound in various countries with their respective lifestyles.

Today's Architecture faces a dilemma; adopting a modern lifestyle, urbanization and absorbing westernized concepts or appreciating traditional values and leading a more sustainable and green or zero waste lifestyle. With the global warming looming as a constant threat we need to achieve a golden mean between the two.

Building industry plays a vital role in the economics of a nation, but on the other hand has a significant impact on the environment. Due to its large scale, building industry, is a major user of energy, materials, resources such as water and a great polluter too. Thus a few people thinking differently than the ongoing trend set an example for many to follow.

The aim of paper is to understand the meaning of concepts that are close to green building and its interpretation over the years. The objectives are to study the definition of green through literature review; to find similarities and differences between different terminologies close to green–do they lead to the same thing and how.

2. Literature review

For the past few years, the word 'Green' is increasingly in the limelight in the building industry. Many organizations have defined 'Green buildings' as sustainable, climate responsive, vernacular, net zero, smart, renewable, low embodied energy, low carbon, etc. The concepts that are expressed already exist in the Indian lifestyle for several centuries. The Intergovernmental Panel on Climate Change (IPCC) has identified Building sector as one of the largest energy consuming and carbon emitting sector, thus having the larger opportunity or potential to tap the energy conservation and reduce on the carbon emission leading to substantial economic benefits (IPCC, 2007).

2.1 Existing mechanisms or tools functioning presently in India

There are measurement tools such as rating certifications which define the greenness of a building. The present rating systems in India are National building Code (NBC), GRIHA, Indian green building Council (IGBC), Energy Conservation Building Code (ECBC/BEE). These rating systems definitely provide a guideline to achieve the greenness goal, but certain aspects of lifestyle inclusion, innovation are considered in a very superficial manner. The teachings which are already with us from traditions are being reframed in different words (in a packaged/ glamorized way) today. But we must admit that this reframing has provided us with measurable parameters.

2.2 What Makes a Building Green? / Different facets of Green

Table 1. Definitions and objectives of different terminologies that speak about greenness of a building

S. no	Definition	Objective
1	**Green /sustainable/ high performance building-** Green building is the practice of creating structures and using processes that are environmentally responsible and resource-efficient throughout a building's life-cycle from siting to design, construction, operation, maintenance, renovation and deconstruction. **(**https://archive.epa.gov/greenbuilding/web/html/about.html) Green Buildings are defined as structures that ensure efficient use of natural resources like building materials, water, energy and other resources with minimal generation of non-degradable waste. (www.greencleanguide.com, Shailesh, August 22, 2012) **Bioclimatic design-** Response to nature with climate as basic parameter of design and comfort as a critical issue.	• To protect occupant health • Provides healthier spaces using resources in an efficient manner • Reduce impact on environment • Optimizes energy efficiency • Conserves natural resources • Generates less waste
2	**Climate responsive or passive design-** Passive design is design in which the form, fabric and systems of a building are arranged and integrated to maximize the benefits of ambient sources and sinks of energy for heating, lighting and cooling in order to reduce the consumption of conventional fuels and the emission of greenhouse gases. (Cardiff University, Environmental Design of Buildings, Introduction to Passive Design, 2007) Passive design is design that takes advantage of natural energy flows to maintain a building's thermal comfort, and reduces the need for mechanical heating or cooling.	• To best take advantage of the local climate • To collect, store, and distribute solar energy or reject heat
3	**Sustainability-** It can be defined as the continued ability of society, an ecosystem or any such interactive system to function without exhausting key resources and without adversely affecting the environment. "It is the development that meets the need of the present without compromising the ability of future generations to meet their own needs" (Bruntland commission-1987) "Green or sustainable building is the practice of creating healthier and more resource-efficient models of construction, renovation, operation, maintenance, and demolition." (EPA)	• To treat all waste products into nutrients • To replace man's dominance over nature with a better relationship with harmony • To generate no toxic waste • To use safe, healthful materials
4	**Vernacular/Native/traditional architecture-** Vernacular construction tends to meet the most pressing basic needs of a culture and a region in manners that are tied closely to climate and other local conditions. Vernacular buildings are built by ordinary people who possess principles, or patterns, that have traditionally been handed over from generation to generation. (Steve Mouzon)	• Takes into account the climate of the region and social and economic conditions of the people • To consider in technology, locally available materials, environmental adaptations
5	**Zero waste building -** Zero Waste is a goal that is ethical, economical, efficient and visionary, to guide people in changing their lifestyles and practices to emulate sustainable natural cycles, where all discarded materials are designed to become resources for others to use. **(**Zero Waste International Alliance ZWIA) Zero Waste means designing and managing products and processes to systematically avoid and eliminate the volume and toxicity of waste and materials, conserve and recover all resources, and not burn or bury them.	• The goal is for no trash to be sent to landfills or incinerators • To emphasize waste prevention • Discarded materials are resources for others to use. • To use materials that can be recycled
6	**Low-carbon buildings (LCB) -** A LCB is a building which emits significantly less GHG than regular buildings. **(**Jain A, Cooling India**,** Jul 15, 2017)	• Engineered with GHG reduction in mind. • Maximize recovery of materials for reuse
7	**Smart /intelligent Building-** Smart buildings deliver useful building services that make occupants productive (e.g. Illumination, thermal comfort, air quality, physical security, sanitation, and many more) at the lowest cost and environmental impact over the building lifecycle. (www.institutebe.com, 6th May 2015)	• To create Productive spaces • Comfortable spaces • Low environmental impact

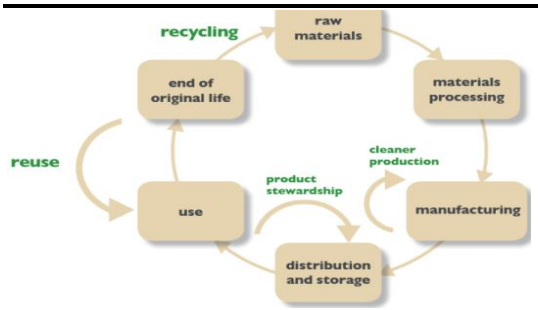

Fig. 1. Zero waste philosophy

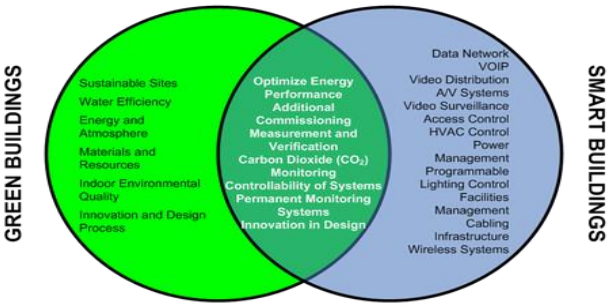

Fig. 2. Commonality of Smart Buildings and Green Buildings

3. Method

The study is aimed to take an overview of all above mentioned definitions, concepts and try to find a common link between them. An attempt is made to relate our habits and lifestyles to the futuristic built environment that we need. The scope of the study is limited to Indian case examples where conscious owners have taken steps towards moving towards green rather than studying designed residences by architects or by green building consultants. Selection of the residence will be on the basis of different areas depicting varied cultural background and geographical location in India. Each individual residence has its own particular peculiarities that need to be documented. Parameters to study case examples are to study Lifestyle and Building design (materials, planning, services).

4. Analysis of case studies

4. 1 Case study 1-Kachra Mane, the house of scrap (trash house), Bangalore

Owner: GV Dasarathi, **Architect:** Vijay and Dimple, architects from Maya Praxis, Vismaya Interiors. Completed in 7 months

Fig. 3. House exterior

Lifestyle- second hand appliances are used like fridge, microwave, stove, etc. All products were bought at approximately 15% of what a new one would cost. The owner is an environmentalist and uses a cycle to commute.

Building design- Simplicity is the essence of the house. The house is constructed on an existing building, keeping the structure intact and altering interiors with wooden plank flooring, bamboo corrugated roof, timber windows. Instead of regular 1 inch plaster, ¼ inch plaster is used. Dasarathi has quoted in an interview that "Windows are for letting the weather in and walls are for keeping them out." So there is more window to wall ratio than conventional residences to allow more light and ventilation.

Recycling- The owner has found new meaning and purpose of various trash items, the philosophy behind his house is based on the 4Rs - "Reuse, Reduce, Recycle and Rethink". Materials that he has reused and recycled are glass for windows, wooden staircase, kitchen cupboards, cane chair, book shelves from discarded Pinewood packing cases. So the house was built at half of the cost than what a conventional house would cost. The owner believes that "This is the 'new' way or rather the 'old old' way of looking at things instead of the 'old new' way where everything is being built from scratch using new material which causes extreme stress on the environment," (Dasarathi G, 2013).

Services- All bathroom fittings (Jaquar) and kitchen sinks are from demolished buildings. The owner is involved in sustainable transport and garbage segregation not only limited to his own house but also motivates his locality. Rainwater harvesting and Grey water recycling is adopted.


Fig. 4. Reused sanitary fittings **Fig. 5.** Rain water sump

Fig. 6. Reused wood furniture

Fig. 7. Large reused windows

4.2 Case study 2-Gaud Desh, Kolhapur 1725 sq. ft. Total area

Owner and designer: Mr. Rahul Deshpande

Lifestyle- Traditional methods such as mud fridge, mud flooring to keep the interiors cool are used. The Owner is an eco spiritualist and environmentalist.

Building design- "Simplicity is Prosperity", says Mr. Rahul Deshpande. The house is designed to act in tune with Mother Nature. Using mud allowed Mr. Deshpande to save substantially on cement and steel and avoid painting totally. The house is built with the local material such as mud used for flooring. Such roof tiles make spaces for various birds to build their nest.

Recycling- All the wooden elements in the house are from the wood obtained from demolished buildings. The house was built at almost 50% cost of a RCC house. All the waste generated is recycled. Thus the house is a true example of reduce, reuse and recycle.

Services- Rainwater is harvested and stored during the rainy season. All kitchen waste is recycled to produce biogas which provides cooking gas up to 3 hrs daily and also manure for the garden.

Fig. 7. Exterior view

Fig. 8. Interior view

Fig. 9. Mud Fridge

Fig. 10. Roof lights

4.3 Case study 3- Homebelaku, Bangalore

Owner: Karunaprasad Kanavi, Completed in March 2006

Lifestyle-Lifestyle in 'Homebelaku' is very close to nature. As the name suggests, maximum day lighting is used in the structure. It creates a pleasant ambience by providing natural diffused light.

Building design-Total built up area of a structure is around 2700 sq. ft. The structure is designed in a way that the relation of a building with nature could be achieved. The structure has a blend

of steel and use of of traditional material like compressed mud blocks, etc. The structure is built using compressed stabilized mud blocks on rammed stabilized earth foundation. Stabilized earth plaster for walls exposed to rain and sun and stabilized earth mortar. Locally available stone has been used for the foundations and a few walls to accentuate for architectural purposes. Roofing channels, precast sills, *Hourdi* block (Hollow blocks) are used in the structure to reduce solid concrete and acts as a heat insulator- the heat transferred into the indoors is reduced by 4^0 C with this kind of roofing system.

Recycling- Existing site was lower than the road level before construction. Therefore the wastage from site itself and the surrounding site is used to fill the site. Plastic in the surrounding was used. In roofing also In-situ jack arch panel roofing elements are used to reduce on steel and cement consumption. All materials sourced within 25-30 kms from Bangalore helped in reducing transportation cost and pollution.

Services- Rainwater harvesting is done to utilize the rainwater for gardening and utility purposes. Solar Lights are used which gets functioned during power shutdown. The user has adopted solar water heater (No electric geysers and UPS). Structure welcomes day lighting throughout the day by provision of skylights. For night time Only CFL bulbs are fitted to minimize electrical consumption. *Sadarahalli* stone and slab used for bathroom flooring and compound wall Kadapa slabs used as shelves instead of wood. No bore well water is used. Rainwater is used for all purposes, including drinking after filtering. (6000-8000 litres of fresh rain water collected from 25 minutes of heavy shower) Soap water from washing machine is used to flush commode and to wash car.

Fig. 11. In-situ Jack arch roofing panels

Fig. 12. *Hourdi* blocks as heat insulator

Fig. 13. Day lighting - Skylights

Fig. 14. Double height courtyards – Natural Light and Ventilation

Fig. 15. Provision of Rain Water Harvesting Filter

4.4 Case study 4- Good Villa, Bangalore

Owner: Mrs. Kanimozhi and Mr. Deenadayalan designed by Sathya Consultants in 2012

Building design- Bangalore city is a congested place, but in this structure in spite of having adjacent structures day lighting is achieved effectively. The private spaces, the bedrooms and the baths, are woven around a large open space that defines the living, dining and family spaces. The ground plus first storied structure is punctured by light in two major nodes that bathes the interior in natural light. (INSIGHT, 2014) A small garden area is designed at ground floor. Living is connected to the garden area by sliding folding door to have an inside garden effect on a habitable space. The offsets in the plan allow the interiors to open into private gardens. Even in enclosed bedrooms, the diagonal placement of tall windows provides maximum light and ventilation throughout the daytime.

Recycling- Chapadi Stone and Hollow Clay Blocks are used for external masonry walls. Filler slabs are used for roofing. All materials act as a heat insulator in summer season. The use of natural elements in design and construction the structure conserves energy and becomes self sustainable at a greater extent.

Services- Solar energy oriented fixtures are fitted to conserve and utilize maximum solar energy throughout the year except rainy months. *Jali* fenestration in the facade brings cooling effect on structure. (INSIGHT, 2014)

Fig. 16. Front View

Fig. 17. Green spaces in the landscape

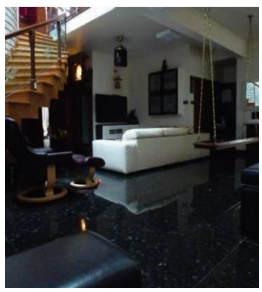

Fig. 18. Internal Ambience with day lighting

5. Summary

The common findings from the case studies are-
Reuse of materials, use of on-site resources as raw materials, detailing of fenestrations and skylights to allow natural light and ventilation techniques, use of alternative construction techniques, use of low maintenance finishes, maximizing use of rainwater harvesting, using waste as a resource. The case studies display a mix of all the concepts mentioned in the literature review in varied proportions. The core intent of all is common to utilize resources and save energy by efficient design and material use. Along with a conscious, environment friendly building design inclusion of our ancestral value systems is the need of the day.

5.1 Recommendation

Building plan and orientation- as per taking advantage of the winds and cutting down heat in the building
Materials and Technology- adaptive and experimental approach using zero waste/ low energy embodied or local materials
Daylight and Ventilation- skylight, atriums and properly designed windows (corner windows, strip windows)
Alternative resources- solar, biogas, rain water harvesting, vermin-composting
Landscape- green spaces, trees, intermediate spaces

6. Conclusion

With the advancement of globalization and technology, there is less response to climate, while designing buildings. If we compare our country with the other Asian countries like Bhutan, China, Japan and Nepal the traditional wisdom is not carried forward in the urban centres. India is so rich with practices and lifestyles that should be marketed as a brand. Right from the culinary art to the fashion, present architecture also needs to be considered. Going back to the traditional architecture will give us solutions to cater to energy crisis today and in the coming future. There is a lot of scope of reviving age old principles of climatic controls that can be applied in today's world. The five principles of reduce; reuse, recycle, reproduce, and use renewable sources of energy if followed in a strict fashion, the environment around us would be a better place to live in.

Acknowledgement

The authors acknowledge Sinhgad College of Architecture, Pune.

References

[1] http://www.thealternative.in/lifestyle/bangaloresgreenest-homes-kachra-mane/Lavanya Keshavamurthy Jun 27, 2013
[2] http://www.thealternative.in/lifestyle/water-ranger-simple-ways-to-save-water-and-reduce-electricity/

[3] Green Building http://www.calrecycle.ca.gov/GreenBuilding/Greg Dick: Gregory.Dick@calrecycle.ca.gov (916) 341-6489 Last updated: September 5, 2014.

[4] https://archive.epa.gov/greenbuilding/web/html/about.html Last updated on 2/20/2016.

[5] Indian Insight, 2014, *Vernacular roots for a contemporary living*, Sathya Consultants.

[6] Hombelaku, 2013, Slideshare Presentation

[7] //www.thebetterindia.com/86424/eco-friendly-homes-sustainability-bengaluru/

[8] https://en.wikipedia.org/wiki/Green_building_in_India this page was last edited on 10 April 2018, at 14:24.

[9] http://greencleanguide.com/three-primary-rating-systems-for-green-buildings-in-india/

[10] By Shailesh On August 22, 2012 In Featured, Green Buildings Tagged BEE, Green Rating, Green structure, GRIHA, IGBC, LEED 10 Comments.

[11] https://en.wikipedia.org/wiki/Zero_waste.

[12] http://www.uncrd.or.jp/content/documents/25816-3R_City-Report_Ahmedabad_ref.doc3-Zero-Waste-Road-Map.pdf Road map for Zero waste Ahmadabad A visionary document to guide Ahmadabad towards becoming A 'resource efficient and zero waste city' by 20.