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EVOLUTION OF GREEN BUILDING CONCEPT IN INDIA

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ABSTRACT

In ancient times, people used natural resources like tree and caves as shelter. Our ancient builders tried to harmonize the five elements of nature (i.e., wind, water, fire, earth and space) in building construction to take maximum advantage of nature. They called this science as Vastushastra. At present, the modern builders try to implement the science of vastushastra along with modern technologies to prevent the nature from any harm due to humanly practices. This concept is known as Green Building Concept. There are certain criteria for a green building. These criteria are set by the rating systems. There are three major green building certifications in India, namely: IGBC (Indian Green Building Council), GRIHA (Green Rating for Integrated Habitat Assessment) and BEE (Bureau of Energy Efficiency). Sustainability criteria of buildings depends on these rating systems. More the rating, more is the building sustainable.

Keywords: Green Building, Evolution Of Green Building, Rating Systems.

I. INTRODUCTION

The evolution of housing began with the use of nature and natural resources such as trees and caves to provide protection from the harsh effects of natural elements such as the sun, rain, and wind. In India, the Confederation of Indian Industry (CII) adopted the Green Building Movement in 2001. They established the Indian Green Building Council (IGBC), a non-profit organization dedicated to promoting the green building concept in India. In comparison to a conventional construction, a green building consumes less water, optimizes energy efficiency, conserves natural resources, generates less trash, and provides healthier places for occupants. It's also known as a high-performance or sustainable construction. Typically, its performance is determined by a set of sustainability criteria that are then combined to determine the design effect. Sustainable sites, water efficiency, energy and atmosphere, material and resources, and indoor environmental quality are all part of these criteria.

II. BENEFITS OF GREEN BUILDING

Green building construction is advantageous in social, economical and environmental aspects. The following are some of these benefits:

- Conservation of scarce national resources.
- Reduced energy consumption without sacrificing levels of comfort.
- According to National Building Code (NBC), green buildings save material to about 25- 40% compared to conventional buildings.
- Reduction in air and water pollution (with direct health benefits).
- Limited waste generation due to recycling and reuse.
- Increase in user productivity.
- Enhanced image and marketability.
- Improving and safeguarding the residents' health and well-being.
- Heighten aesthetic qualities.
- Optimize life-cycle economic performance.

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III. BARRIERS IN GREEN BUILDING CONSTRUCTION

While green building approaches are becoming more popular in India, there are certain obstacles and roadblocks to overcome. They are as follows:

- Even today, a large section of Indian users is unaware of green buildings.
- Developers already go through a tedious process of multiple approvals and are apprehensive of the additional burden of green compliances in the list of approvals, which can potentially cause more delays.
- Architects, engineers, contractors, and labourers in India lack the necessary skills and knowledge to develop green structures.
- The initial cost for green building construction definitely involves a higher cost than the conventional ones.

IV. ANCIENT BUILDING CONSTRUCTION TECHNIQUES

Traditional construction materials and techniques have been the subject of extensive research and are still being studied, but their purposes, particularly in contemporary development, are frequently disputed. Some techniques are discussed below:

- **Mud Construction**

Mud construction system is less energy-efficient and more effective under different climatic conditions. Earth is one of man's oldest building materials, and it was employed in some manner by most early civilizations. It was easily accessible, affordable, and durable, and it only required basic technology.

- **Construction using lime mortar**

When impure limestone is used in the furnace, the creation of hydraulic limestone, which comes into contact with water, is accelerated. This type of lime should be kept as a dry powder. A pozzolanic substance, such as calcium clay or brick dust, can also be used in the mortar mix. By reacting with water, a pozzolanic chemical will cause the motor to set up quickly. It can be difficult to use Portland cement mortars to repair old buildings that were originally built using lime mortar. Because lime mortar is softer than cement mortar, it allows the brickwork to adapt to changing ground or other dynamic conditions more easily. When there are two mortars on the same wall, this variation might cause the brickwork to crack.

- **Mud and clay**

Building styles vary depending on the amount of each material employed. The quality of the soil used is usually the deciding factor. Low-clay soil is frequently connected with grass construction, and large-scale clay is usually associated with the Cobb / Adobe style. Other essentials include varying amounts of sand, gravel, and straw, as well as grass. The thermal mass of the earth, particularly clay, is excellent for maintaining temperature stability. Earth-built homes are naturally cool in the summer heat and warm in cold weather. Clay, like stone, holds heat or cold and releases it over time. Because the temperature of soil walls changes slowly, intentionally raising or lowering the temperature will require more resources than a wood-fired home, but the heating/cooling will last longer.

- **Bamboo**

Bamboo is a traditional building material that has been employed in a wide range of countries and structures. Bamboo was employed in humid and hot climates such as the tropics because of its structural capabilities and adaptability. It was used in the construction of temporary structures, huts, mud houses, roofs, scaffolding, flooring, partitions, etc. Bamboo was chosen as a construction material in such locations because it is a locally available, fast-growing resource that is also inexpensive, lightweight, allows for natural ventilation, is flexible, and has excellent construction capabilities. Some types of bamboo houses are:

1. **Assam type houses**

In Assam's vernacular architecture style, materials like as wood, bamboo, reed mesh, and plaster are arranged in a wooden framework to produce single-story structures with no common walls with neighboring buildings.

2. **Zawlbuk house**

Traditional buildings in the north-eastern region are built on a variety of topography, including plains, mountains, and flood-prone locations. Bamboo serves as the principal load-distribution element in these

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constructions. On the sloping land, they make their dwellings out of wood and bamboo. The walls of the house are prepared by mud, bamboo, and cow-dung as materials for construction, the partitions are made of bamboo screens the flooring and roofing are also done from bamboo.

3. Tulou

Stone, bamboo, wood, and beam were used to make 2 m thick walls without windows in the circular or square-shaped dwellings with a courtyard in the center. These walls provided good earthquake resistance, good ventilation, and enough light. Despite building by local materials with the simple technique, Tulou is as strong as a fortress and can protect people from the outside dangers.

V. ARCHITECTURAL TECHNIQUES IN ANCIENT INDIA

Indian architecture was an excellent example of using natural elements to make shelter. People in hot, humid India used to live without air conditioners, which polluted the environment with harmful chlorofluorocarbons.

Here are five methods that were once employed in Indian architecture:

- **Jharokas**

The Hawa Mahal in Jaipur is so named because it features 953 jharokhas, or windows, that allow for air flow and so keep temperatures down. In a hot and humid country like India, making small perforations in the building is a clever approach to naturally cool it.

- **Roshandan**

Roshandan was a key feature of many houses in the northern part of India, which both ventilated air and let light in. They are frequently found at the top of windows or on the upper end of the ceiling wall. Their location was important because they let hot air close to the ceiling escape while maintaining cooler air inside and below. Roshandans were shuttered and utilised as skylights in the winter.

- **Jaali**

Jaali are small openings in a wall that exclude direct sunlight while allowing air to circulate freely. It also allows light to pass through without causing glare, therefore the intensity of light is unaltered.

- **Baori**

A stepwell is a type of vernacular architecture that was popular in mediaeval India. A pool of water excavated into the ground or encircled by walls that keeps the air cool by evaporating water in a shady, contained region.

- **High ceilings**

The idea behind high ceilings is that hot air rises and leaves through vents, resulting in an automatic cooling effect.

VI. MODERN GREEN BUILDING CONSTRUCTION TECHNIQUES

As the world evolved there took place many changes in the techniques of construction of buildings. These techniques may cause some hazards to the environment. So, to prevent the construction techniques from causing any hazard to the environment, there has emerged a new concept of Green Building. In this method, the buildings are constructed in an eco-friendly manner keeping in mind the safety of nature. We will now be studying further about the system of this technique.

MATERIALS USED

Eco-friendly building materials are those that do not harm the environment during their manufacture, usage, or disposal, and may be easily recycled. Here are some green building/ eco-friendly materials:

- **Earthen material**

At the present time, mud is being reassessed as a viable green building material. Fibrous materials like straw and grass can be added to earth to improve its strength and durability. Earthen materials, on the other hand, work well in arid regions.

- **Slate**

Slate is a natural metamorphic rock. Because of its outstanding characteristics, it has been utilised for thousands of years. It is water resistant, fire resistant and durable. Slate comes in a wide range of colours, patterns, and textures.

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- **Bamboo**

Bamboo is an excellent green building material. It has double the strength of concrete. Bamboo is a plant that you can see growing. Bamboo is a green building material that may be used for both roofs and walls. Green bamboo constructions that are strong and flexible have been known to resist hurricanes and earthquakes.

- **SIPs**

SIP stands for Structurally Insulated Panels. A rigid core layer is sandwiched between two layers of structural board in a SIP. Metal, plywood, or cement might be used for the structural board. SIPs not only save energy, but they also take less energy to make.

- **Rice husk ash concrete**

Rice husk ash concrete is gaining popularity as a sustainable alternative to cement. The rice paddy industries release rice husk as a by-product. Rice husk by itself is not biodegradable but when burned under the right conditions it produces rice husk ash. Rice husk is not biodegradable on its own, however it forms rice husk ash when burned under the appropriate conditions. Rice husk is extremely reactive, with a chemical structure that is similar to that of many organic fibres. Thus, it is used as supplementary binder with mortar and cement.

- **Sheep's wool**

Sheep's wool is entirely natural and environmentally friendly materials that can be regrown quickly. Wool is most commonly associated with warm blankets and sweaters. However, its threads create millions of tiny air pockets that trap air, making it an excellent house insulator.

- **Cork**

Cork is made of oak tree, which is one of the highly renewable and eco-friendly resources. Cork ceiling panels, acoustic walls, and flooring are all examples of another wonderful green buoyant material. Cork is a tough substance that can withstand water and other liquids (hence the wine). Its structure allows it to absorb vibrations.

- **Straw bales**

Straw bales also have high insulating properties. Like wool, straw bales are usually placed in walls, attics and ceilings to keep the temperature stable. Straw may be gathered and replanted with low environmental impact because it is a renewable resource.

VII. TECHNOLOGIES USED IN GREEN BUILDINGS

With a central focus on the efficient use of energy and resources, water preservation, improved occupational health, and reducing pollution and waste, the goal is to ensure that building and construction methods are cost-effective, durable, and reduce overall effects on the environment and human health. Now, let's take a look at some sustainable construction technologies used in a green construction.

- **Solar power**

Solar energy is becoming more widely used as a sustainable construction method. In green construction, it can be utilized in two ways, one pertains active solar energy and another is passive solar power. Active solar power makes use of solar systems that capture the sun's light and convert it to heat and electricity. It reduces the need for electricity or gas. Passive solar power, on the other hand, makes use of the sun's rays to warm homes by carefully placing windows and using heat-absorbing materials.

- **Green insulation**

Because it reduces the need for high-end finishes made of non-renewable materials, green insulation has shown to be a sustainable construction solution. It also provides a solution by utilizing old and used materials such as denim and newspaper.

- **Cool roofs**

Cool roofs are one of the green design methods that aims to reflect heat and sunlight away from the building. The cool roof design incorporates reflecting paints and unique tiles that absorb less heat and reflect the majority of solar energy, lowering summer temperatures by up to 50 degrees Celsius.

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VIII. GREEN BUILDING CERTIFICATIONS IN INDIA

There are three major green building certifications in India. They are as follows:

- **INDIAN GREEN BUILDING COUNCIL (IGBC)**

Indian Green Building Council (IGBC) has developed green building rating programmes to cover commercial, residential, factory building, etc. Rating programmes would help projects to address all aspects related to environment and is an effective tool measure the performance of the building/project. Green projects rated by IGBC fall under one of the following levels: Certified; Silver; Gold; Platinum.

- **GREEN RATING for INTEGRATED HABITAT ASSESSMENT (GRIHA)**

GRIHA stands for Green Rating for Integrated Habitat Assessment. GRIHA is India's National Rating System for Green building. By comparing a building's resource consumption, waste generation, and overall ecological/environmental effect to specified nationally approved limits/benchmarks, GRIHA seeks to reduce a building's resource consumption, waste generation, and overall ecological/environmental impact.

- **BUREAU OF ENERGY EFFICIENCY (BEE)**

The Bureau of Energy Efficiency is an agency of the Government of India, under the Ministry of Power created in March 2002 under the nation's 2001 Energy Conservation Act. The goal of the Bureau of Energy Efficiency is to "institutionalize" energy saving services, enable delivery methods across the country, and lead energy efficiency efforts across all sectors. The major goal would be to minimize the economy's energy intensity.

IX. SCOPE OF GREEN BUILDINGS

With the dawn of the green construction era, architects and builders have begun to include green ideas into their designs, such as energy saving, water harvesting, and waste management. They promote the use of environmentally friendly building materials such as fly-ash and silica fume cement and blocks, steel and tiles, recycled aluminium, bamboo-based goods, and green roofing materials, among others. There are many alternatives for building green homes in terms of technology as well. Energy can be extracted from the environment, stored, and used as needed in this manner. India's energy and water needs may be met through a combination of new green concepts and cutting-edge technology.

X. CONCLUSION

With India's rapid urbanization, globalization, and booming economy, the country is seeing a surge in building development across a wide range of city activities and socioeconomic levels, driving up demand for building materials including glass, cement, metals, and ceramics. Uncurbed consumption of these high embodied energy materials is a reason for environmental degradation. Green buildings provide a great and promising answer in today's times, where energy crisis is a huge issue. These are designed to use minimum energy. The In India, the IGBC has adopted the LEED rating method for assessing green building performance. Green architecture is a gift to society since it allows for lower energy and water use while yet increasing productivity for occupants, as well as their health, safety, and well-being. Green buildings are necessary in today's world because environmental balance is critical for human existence and progress. The only road to a sustainable future is to develop green buildings.

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