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GREEN LIBRARIES FOR SUSTAINABLE DEVELOPMENT: NATIONAL AND INTERNATIONAL PERSPECTIVES

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Abstract

This paper gives an overview of green libraries, their definition, application, universal standards, key projects and challenges. The paper highlights why sustainable practices should be used to reduce the environmental effects and maximize the indoor environmental quality. It also puts into the limelight key green library projects in India and globally. Nevertheless, it recognizes the challenges associated with implementation such as financial limitation, resistance to change and regulatory challenges.

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1.0 INTRODUCTION

One of the objectives of the United Nations Sustainable Development Goals is on environmental sustainability. The idea of so-called green libraries has become relevant in the library and information science domain recently due to the emergence of standardized structures in construction industries (Kurbanoglu and Boustany, 2014). The rapid expansion of the green movement is evident in the fact that India's green footprint has now reached 15 billion square feet as of 2025, supported by more than 18,310 IGBC registered projects nationwide. With the emerging concerns related to the environmental sustainability in society, libraries have started playing an active role in the definition of green practices and awareness creation. New World Encyclopedia defines the term Green Library (GL), or Sustainable Library, as, "a library constructed with environmental issues in consideration. According to the LEED performance system of the US Green Building Council, a green library building may be defined as one that has been constructed by taking into consideration the design aspects such as sustainable site selection and development, water conservation, energy conservation, local resource, material conservation, waste reduction, indoors air, and design innovation. By the standards that are set by the Indian Green Building Council (IGBS) and the U.S. Green Building Council (USGBC), green library is a library that is intended to ensure that the negative effects on the natural environment are reduced as much as possible and the quality of the interior environment is maximized through all possible means and measures. The concept of green libraries does not only look at ensuring that library buildings are energy-efficient. It includes a broad strategy aimed at the introduction of sustainable practices in all library activities, services, programs, and community extension activities (Fedorowicz-Kruszewska 2020; Dogan 2023). Essentially, it further prompts libraries to seek methods of mitigating their environmental effects by using wiser resources and technology application. It is not merely a decrease in consumption, but an outspoken enlightenment of the users on how to treat the environment by exhibitions, activities, educational programs, and carefully selected collections about sustainability (Razali and Ismail, 2021). Some libraries have developed collaborations with the local environmental bodies, government and businesses that are environmentally friendly. Such partnerships help libraries to add value and support community-wide initiatives like recycling efforts, clean-up initiatives, and advocacy campaigns (Jones and Wong 2016). The green library movement is intended to make libraries agents of change using sustainable best practices. Libraries can encourage personal patrons and communities at large to become better environmental stewards by setting a good example of their own operations and providing learning opportunities and discussion (Aulisio, 2013). There are numerous national efforts and policies which are being implemented in India in order to promote the use of environmentally friendly approaches in libraries and other industries. The Make in India campaign organized by Government of India and with the assistance of Department of Science and Technology strives to develop sustainable economy through the introduction of green manufacturing initiatives and improvement of infrastructure. Moreover, there are the attempts to address the problem of climate change, including National Action Plan on Climate Change, with emphasis on the missions, including green India, to increase energy efficiency and promote sustainability. Libraries being part of the learning system are also encouraged to adopt environmentally-friendly behaviors in order to minimize their negative environmental imprints. This is in line with the suggested Green Movement of Libraries in India. It aims at helping to make India greener and more environmental friendly. The libraries are encouraged to reduce their adverse effect on the environment by careful choice of site, use of natural resources, conservation and proper waste management which are in tandem with the green building movement. According to the recent surveys that are done on big Indian libraries in cities like Kolkata, Mumbai, Delhi, and Chennai, there are efforts, including incorporation of natural source of light, implementation of lighting systems that are more energy efficient like LED bulbs, and hygienic facilities that encourage green consciousness and sustainability. The New Education Policy 2020 has also highlighted the importance of libraries in the education systems by promoting their key roles in investigating materials research activities as well as skill acquisition opportunities. All these are collective efforts geared towards promoting environmentally friendly activities and inculcating a sense of environmentally friendly practices among library infrastructures in India. Summing up, one can state that Green/Sustainable Library is the object of the time and is made to cause a minimal adverse effect on the environment and bring the highest possible quality of the indoor environment. This would be done by careful selection of the site, using natural and biodegradable materials, energy conservation, proper waste disposal, and resource conservation. Sustainable design features found in these libraries include sustainable site selection, water saving, energy saving, local resources utilization, reduction of wastage, as well as indoor environmental quality. It is the goal to promote ecology and make sure that the economic activities and cultural practices will not cause damage to the environment in the long term. The aim of the research is to discuss the green library movement, with particular reference to libraries, the way they can be expected to uphold the principles of ecological balance.

2.0 THE CURRENT STUDY IS AN ATTEMPT TO FIND OUT THE ANSWER OF THE FOLLOWING QUESTIONS

1. How are green library standards being implemented globally and in India?
2. What unique design components exist for green libraries?
3. What challenges do Libraries face in adopting green practices?
4. How library professionals contribute to environmental education and awareness among its stakeholders?

3.0 WHY GREEN LIBRARIES?

The concept of green libraries has been discussed in the literature over the last two decades. This was required for the following key reasons.

3.1 Environmental Impact Reduction

Green libraries have the main objective of reducing the environmental impact. They ought to adopt a combination of measures that will reduce their environmental impact. This will involve the use of energy efficient lighting systems,

heating, ventilation and air conditioning (HVAC) and energy star rated appliances in the entire facility. Green libraries must also invest in renewable sources of energy like solar energy to supplement or completely satisfy their energy needs using clean sources. Water conservation, in other words low flow fixtures, rain water collection and recycling of water contribute to the drastic reduction of water usage. Additionally, the green libraries must take collective actions to foster recycling programs and minimize waste production via activities, e.g. paperless operations, single-use plastic eradication, and strong recycling channels of different materials. All these environmentally friendly practices allow the green libraries to substantially reduce their consumption of natural resources, and at the same time mitigate greenhouse gases.

3.2 Promoting Sustainability

Green libraries are constructions devoted to the ecological safety. They create materials and designs that are environmentally friendly, purchase environmentally friendly products and hold campaigns to sensitize people about the environment. These libraries as models of sustainability, promote environmental friendliness among people in their day-to-day lives. They have an effect outside the library and the culture of environmental awareness they have created is beneficial to the community.

3.3 Protecting Collections

Due to climatic change, library collections are threatened by -Increased temperatures and humidity. -Extreme weather conditions increasing in frequency. -Increasing pests Sustainability-oriented libraries employ strategies to protect their collections against such dangers (Anwar and Tang, 2022).

- Refurbishing temperature and humidity controls.
- Application of environmentally friendly building materials.
- Development of emergency and hazard plans.

3.4 Fitting In With Professional Values

Sustainability is an essential value of librarianship adopted in libraries all over the world, including India. Green libraries also have an essential role to play in ensuring that librarians adhere to this principle (Şeşen and Kuzucuoğlu 2024).

Improving library practices that minimize its negative impact on the environment.

- Promoting environmental concern and responsibility.
- Ensuring the timeliness and suitability of libraries to community. Requirements

In conclusion, green libraries play the critical role of reducing environmental footprint of library operation, securing collections, promoting sustainability, and following principles of library profession.

4.0 IFLA CHECKLIST FOR GREEN LIBRARIES

The meaning of green library has been illuminated by various authors in varied manners. International Federation of Library Associations and Institutions (IFLA) invested much effort in this concept to create a checklist (Hauke, P., Latimer, K., and Werner, K.L., 2013) (Asim, 2022). They have also come up with a 12-point IFLA checklist on green libraries that includes planning, development and library services. The world of libraries is perusing into the world of sustainability by integrating different environmentally friendly activities into the very fabric of planning and building of the project through to maintenance and operation of the library. Their priorities were harmonizing with environmental goals, they measured the cost of life cycles and environmental consequences, they used green construction certificates like LEED and BREEAM, they chose ecologically friendly materials, they maximized natural lighting and ventilation, they used renewable energy source, they encouraged energy and water efficiency, they offered sustainable services to users, they embraced green technology, they managed their waste materials and by-products, they used certified suppliers, they impacted positively on business partners and employees and visitors, and they raised environmental awareness among employees and visitors. The concept of sustainability is incorporated into a brand image and marketing strategies of a library. With a comprehensive checklist, including such areas as the choice of locations, architecture, interior design, climate control methods, as well as environmentally responsible administrative practices; libraries can demonstrate themselves as the leaders in environmental protection, as well as add to the user experience and realize long-term cost-efficiency.

5.0 STANDARDS TO ASSESS GREEN LIBRARIES

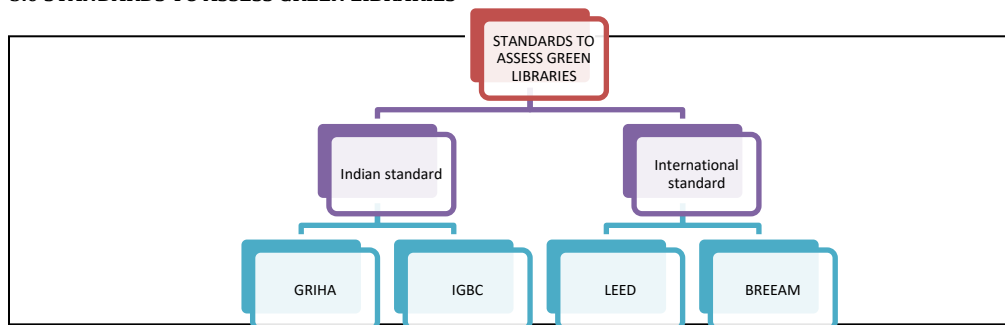


Fig 1: Standards to assess Green Libraries

6.0 INTERNATIONAL STANDARDS TO ASSESS GREEN LIBRARIES

International standards include the Building Research Establishment Environmental Assessment Methodology (BREEAM) and Leadership in Energy and Environmental Design (LEED) certification systems.

6.1 Leed (Leadership In Energy And Environmental Design)

LEED is observed as a performance standard, a building owner or planner can select how to attain benchmark figures without following predetermined guidelines. Projects can earn LEED points to meet green building standards using a point-based system. The six credit categories for new building development include sustainable sites, water efficiency, energy and atmosphere, materials and resources, indoor environmental quality, and creative design (Thomas 2017); (Bangar 2018); (Ingole and Kumari 2021). India consistently ranks 3rd globally in LEED certifications, trailing only China and Canada, which shows the nation's commitment to the UN Sustainable Development Goals (USGBC, 2024).

6.2 Breeam (Building Research Establishment Environmental Assessment Methodology)

The BREEAM is the leading and most widely used environmental assessment method for buildings. It sets the standard for best practices in sustainable design and enables the measurement of a building's environmental performance. Environment-friendly features include the use of low-carbon technologies for heating and cooling, low-energy lighting, and water conservation systems. Eden Prairie Library, Eden Prairie- First in US to create natural gas fuel cell to create power and heat on-site. It is composed of recycled materials, low-VOC materials, and efficient lighting arrangements.

7.0 INDIAN STANDARDS TO ASSESS GREEN LIBRARIES IN INDIA

The Indian government has modified GRIHA to become a National Rating System. The Indian Green Building Council (IGBC) was founded in 2001 to promote the grading of green buildings throughout the country.

7.1 Green Rating For Integrated Habitat Assessment (Griha)

It has been adapted by the Government of India as the National Rating System. Considering the Indian agro-climatic conditions and, in particular, the preponderance of non-AC buildings, GRIHA was developed as a rating system that is suitable for all types of buildings in different climatic zones of the country (Thomas, 2017).

7.2 Indian Green Building Council (Igbc)

It was established in the year 2001 to promote and rate green buildings in India. While the green building movement in India was in its initial stages a decade ago, it has since become a movement. As of 2025, the Indian Green Building Council (IGBC) reports over 18,310 registered projects with a combined green footprint of 15 billion square feet (IGBC, 2025). This massive growth reflects India's position as a global leader in sustainable construction.

8.0 MAJOR GREEN LIBRARY INITIATIVES WORLDWIDE

8.1 Brighton's Jubilee Library Uk (2005)

Brighton's jubilee library UK is the winner of multiple building awards, including the BREEAM excellent rating. Solar and wind energy are used to heat and cool buildings naturally, except at extreme temperatures. Air is taken in from the outside, circulates through the building through spaces in the walls and under the heat-absorbing floor, and is pushed out through roof vents. Rainwater was harvested from the roof, collected in the tank, and used in the toilets. Internal lighting automatically adjusts to the conditions of light requirements. The library emits half the carbon dioxide emitted by buildings of comparable size (Vasanthi, 2019).

8.2 Fayetteville Public Library, Minneapolis (2004)

Fayetteville Public Library, Minneapolis(2004) has earned many certificates. It has green roofing and reduced air temperature by 20 °C, saving Rs. 2, 40,000/- per annum energy cost. Roof water is harvested for landscaping, and irrigation further reduces energy costs by 75%. Natural light is used in public areas (Vasanthi, 2019).

8.3 National Library, Singapore (2005)

This is known as the greenest building on the planet. It uses light shelves, allowing light to be filtered into a library. Sensors dim or brighten light for maximum comfort (Vasanthi, 2019).

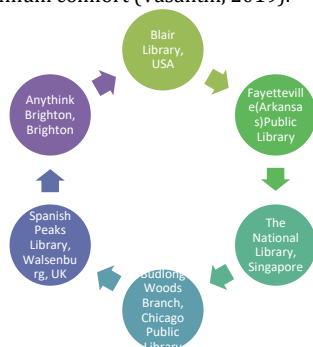


Fig 2: Major Global Green Library Initiatives

9.0 GREEN LIBRARY INITIATIVES IN INDIA

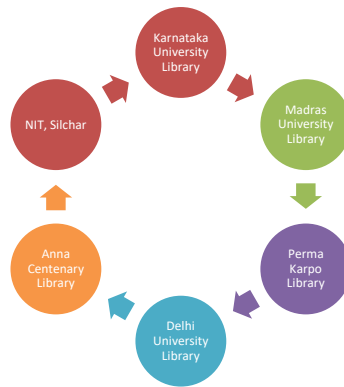
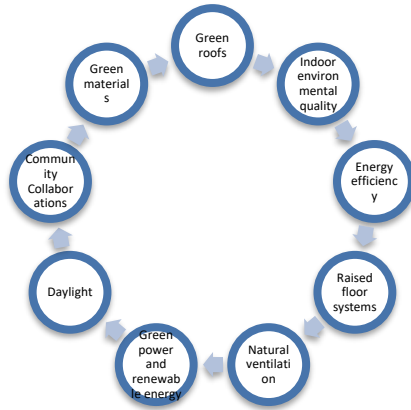


Fig 3: Major Green Library Initiatives in India

Tamil Nadu Government has opened the Anna Centenary Library (2010) which is a state library. It is situated in the neighbourhood Kotturpuram in Chennai. The building was planned to have enough natural light in its reading area. Service spaces located on both sides of the western end were to block the sun-radiation. The atrium is seven stories and enables the daylight to be abundant. The library building was the first in Asia to receive LEED NC Gold rating, which was granted by the IGBC. The project is awarded 43 LEED points that, to date, is the best of any Government building in Tamil Nadu (Vasanthi, 2019). The Madras University Library has a number of green initiatives that are conducted on campus. Large windows, open space, sunshades, wide corridor to enter natural air, and hardwood furniture have been introduced to the library building to make it environment friendly (Vasanthi, 2019). Karnataka University Library began a Green Library Project. The concept is to provide a natural and friendly environment of study. This system involves integration of all the comforts of a modern, though traditional design. The reason behind the erection of benches under the trees is so that the students get to sit under the trees and read the books they have borrowed in the university library rather than on bookshelves, seats, or tables. In seeing this trend, the Green Library was constructed in the core of the campus to enable the students to access all the reading materials they require to study. The facilities such as sitting area, availability of drinking water, Wi-Fi, and other simple facilities (Vasanthi, 2019). The ideal example of how science, clever design, and local know-how can converge to make a place where people can gather and make a structure that is not only beautiful but also sustainable is the Perma Karpo Library (2010), designed by Arup in a small town in Ladakh, in the Indian Himalayas. Some of the technology and design solutions that were used on the job site include a mud roof, timber panelling, wool insulation, ventilated Trombe Walls as well as solar panels on the roof. To ensure the knowledge is retained, the materials are located locally, and the design solutions and experience are elaborated with the help of the individuals at hand. National Institute of technology silchar library was established in 1977. The library contains all knowledge materials in the various disciplines like management, science and technology, humanities and social sciences and other areas of interest. Recently NIT Silchar has used 44 crore to construct a state of the art and cutting edge, warm, and flexible library system (Vasanthi, 2019). Delhi University Library is a historic building that has numerous green characteristics, which are currently preserved by the current manager of the library as well. The characteristics are a significant height of the building, the presence of vast open spaces, thick walls, and windows, which run the entire length of the eastern wall (Vasanthi, 2019).

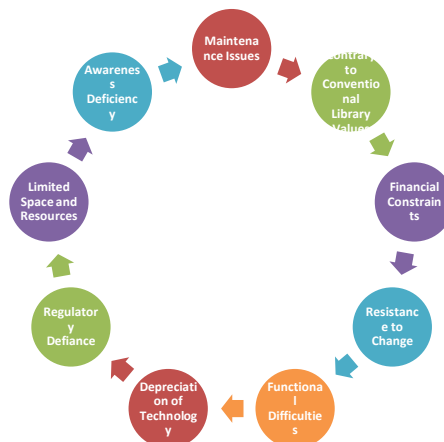
9.1 Green Design Components

Green design components play a crucial role in creating sustainable library spaces. As identified by Brown (2003), these components encompass a wide range of features that can be incorporated into library design and operations. Key elements include site selection and landscaping, which focus on minimizing environmental impact and enhancing natural surroundings. Water conservation is prioritized through efficient fixtures and rainwater harvesting systems. Energy efficiency is achieved through the use of renewable energy sources, high-performance HVAC systems, and energy-efficient lighting. The choice of building materials emphasizes sustainability, favoring recycled, locally sourced, and low-emission options. Indoor environmental quality is enhanced through improved ventilation, use of natural light, and careful selection of furnishings and finishes. Waste reduction strategies are implemented throughout the library's lifecycle, from construction to daily operations. These green design components not only reduce the library's ecological footprint but also create healthier, more comfortable spaces for users and staff, while often resulting in long-term cost savings. By integrating these elements, libraries can serve as models of sustainability for their communities. The following green library design components can be used in libraries.



Source: Sharma & Deb, 2024
Fig 4: Green Library Design Components

10.0 DIFFICULTIES IN IMPLEMENTATION OF GREEN LIBRARIES



Source: Das & Thakur, 2024

1. **Financial restrictions:** The implementation of green technologies into practice or the transformation of the old buildings into more sustainable ones can cost a significant sum of money. It normally limits the library administration ability to invest in environment friendly infrastructure.
2. **Resistance to Change:** Employees and members of the society often turn aggressive towards any change in the physical processes of the traditional libraries. Resistance may be caused by lack of awareness regarding green practices or even concerns regarding issues during adoption.
3. **Lack of Awareness:** The libraries face a problem of creating awareness to the community and employees on the benefits of sustainable practices.
4. **Space and Resources Limitations:** The libraries might lack the capacity to completely utilize the green technologies, especially those which are in older buildings. Re-fitting an existing structure can be both costly and lengthy in terms of time.
5. **Regulatory Defiance:** Libraries might experience difficulties in interpreting various environmental certifications and regulations and complying with them. More documentation, examination or compliance procedures might be required in order to meet some of the green standards.
6. **Depreciation of Technology:** Sometimes, it is hard to maintain the pace with the ever-changing condition of green technologies. Use of sustainable solutions could be compromised by the fear of investing in technologies that could end up being obsolete.
7. **Functional Difficulties:** It may lack the ability to sustain the necessary level of service quality throughout the process of transition and adaptation to the new operational changes and make them more sustainable.
8. **Maintenance Problems:** A great number of green technologies might require constant, professional

11.0 ROLE OF LIBRARY PROFESSIONALS IN PROMOTING SUSTAINABILITY

The professionals in the field of Library and Information Sciences are early adopters of the change and are providing the mankind with the basic cognition based on the conciseness and simplicity of the concepts. They are integrating the change into the working of the libraries as per the demands of the world and this demonstrates a commitment to sustainability within the sector (Fedorowicz-Kruszewska, 2020). They are already significant in modifying the green library models in order to promote sustainability. Their roles as the catalyst of change are the following

1. **Designing Eco-Friendly Spaces:** Library professionals work with designers and architects in designing environmentally friendly spaces in libraries. They are characterized by the following:
 - a. Natural Lighting: The use of sunlight will minimize energy use.
 - b. Energy-Saving Systems: LED lighting installation, high-performance HVAC, and intelligent controls.
 - c. Green Roofs and Walls: The inclusion of living plants into insulations and decorations.
 - d. Recycled Materials: Furniture, flooring, and fixtures, use is made of sustainable materials.
2. **Encouraging Environmental Literacy.**
 - a. The library professionals hold sustainability seminars, workshops, and activities. They host professionals and talk about such themes as the zero waste, biodiversity and the circular economy.
 - b. School library professionals are striving to ensure the inclusion of storytelling sessions to children who tend to be nature-oriented, wild life and conservation-oriented which makes the young minds open to the greener environment.
3. **Leading by Example**
 - a. The library professionals are demonstrating environmental friendliness. They engage in recycling, energy saving, and conscientious consumption.
 - b. The dedication motivates the clientele and fellow employees.
4. **Community Engagement**
 - a. Green libraries are community engagement locations.
 - b. The library professionals are working together with the local schools, colleges, non-governmental organizations, and the environmental organizations to create awareness.
5. **Measuring and Reporting Impact:** Library professionals can be significant in measuring the environmental impact of library operation.
 - a. Monitoring energy consumption, waste minimization and other sustainability indicators.
 - b. Writing reports of the sustainability activities of the library.
 - c. Taking informed decision based on data regarding the future sustainability efforts.
 - d.

12. CONCLUSIONS

To sum up, green/sustainable libraries seek to reduce the environmental impact and at the same time optimize interior quality by means of designing, choice of materials and conservation of resources. The IFLA checklist and internationally known systems such as LEED and BREEAM have helped in guiding the green library development. There are also Indian standards such as GRIHA and IGBC. The world is witnessing some of the best green libraries in India and globally with different responses to sustainability. Although it has advantages, the difficulties associated with implementation include financial limitations, opposition to change, lack of knowledge, space, regulatory, technological depreciation, functional and maintenance problems.

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