IJCRT.ORG ISSN : 2320-2882

INTERNATIONAL JOURNAL OF CREATIVE RESEARCH THOUGHTS (IJCRT)

An International Open Access, Peer-reviewed, Refereed Journal

Green Building Concepts, Principles And Elements: A Review Of National And International Library Science Theses

[1]Ayushi Soni, [2]Dr.Ritu Singh

[1]Research Scholar, [2]Associate Professor and Head of the Department

[1]Dr. S.R. Ranganathan Institute of Library and Information Science,

[1] Bundelkhand Univeresity, Jhansi, India

Abstract*:* Increased interest in environmental degradation and the condition of climate have introduced a new issue that people are now focusing on sustainability in other fields such as libraries. The green building ideas focus on the environmentally aware and resource saving practices applied during the life cycle of a building. Social and educational institutions such as libraries are important in implementing and encouraging sustainable infrastructure and service. This paper has a descriptive and analytical review of the concepts, principles and elements of green building as expressed in the theses presented by Library and Information Science (LIS) across the globe nationally. The paper will analyze the fundamental elements of the green building including sustainable site selection, water conservation, energy efficiency, waste management and indoor environmental quality based on their main use in library buildings. The paper based on the analysis of the selected Indian and international LIS thesis determines the research trends, methodological approaches, and gaps in the literature. The results indicate that although the green and sustainable libraries are getting more and more familiarized with the idea, it is not practiced extensively and on a framework basis. The paper mentions that empirical research and policy based models are required to help toward making traditional libraries sustainable and green.

Index Terms - Green Building, Sustainable Libraries, the Green Library Concepts, Library Science Theses, Sustainability.

1. INTRODUCTION

The rate of environmental challenges is on the rise and this has necessitated sustainability as a priority agenda in the world through climate change, resource depletion and ecological imbalance. Here, the green buildings should be engineered to reduce adverse environment conditions and improve on human health and well-being. The International Federation of Library Associations and Institutions (IFLA) defines a green or sustainable library on the theme of environmental sustainability, economic sustainability, and social sustainability. Libraries, as a form of knowledge and community center are well placed to be at the forefront of development of sustainability initiatives by green infrastructure and services which are environmentally friendly.

Green architecture deals with efficient utilization of energy, water, materials, and land as well as minimization of carbon emissions and operation expenses. LEED, BREEAM, GRIHA, and IGBC certification systems are standardized frameworks of measuring building (or library) sustainability. Green building research has been researched on extensively across the architectural as well as the engineering fields; however, its systematic investigation in the scope of Library and Information Science is rather scarce. In particular, LIS theses level research provides useful information on the way sustainability concepts are perceived and realized in libraries. In this gap, this research provides a review on both national and international LIS theses on the concepts and practices of green buildings in libraries.

IFLA also defines a green or sustainable library as one that puts emphasis on environmental, economic and social sustainability. A green or a sustainable can be of any size though they must have clear agenda to follow and guideline like:

- Green buildings and equipment.
- Green office principles
- Sustainable economy
- Sustainable library services.
- Social sustainability
- Environmental management
- Devotion to overall environmental objectives and initiatives.

2. OBJECTIVES

The main aim of the given work is to review and generalize the conceptualization and incorporation of green building concepts, principles, and elements in Library and Information Science (LIS) research, especially in the national and international thesis work. In order to meet this primary objective, the study aims at the following objectives:

- To identify and describe the meaning of the green building concepts to the context of sustainable development and library infrastructure.
- To establish major principles and components of green and sustainable buildings as they are applied to environmental, economic as well as social sustainability.
- To examine how green and sustainable construction models are being covered in LIS research works contained in the national and international repositories.
- To determine the research gaps in the current literature, and thesis-level scholarship in the topic of green/sustainable library infrastructure and associated sustainability practices.
- To formulate some future research topics that will be used in the establishment of a conceptual comprehension of sustainability and translation in library design and operations.
- These are the goals that will guarantee a systematic, thorough way of determining the value of LIS research towards sustainable building practices and environmental accountability in libraries.

3. CONCEPTUAL BACKGROUND

In order to base the study on the theory and practice that are valuable to it, it is valuable to elucidate important concepts that can frame the concepts of sustainability of libraries and green buildings.

(a) Green Building and Sustainable Development.

Green building is a kind of building that is designed, built, operated, and maintained in a manner that minimizes the negative effects on the environment, saves energy and water, wastes less, and offers healthy environment to the occupants (Rostami, 2025). Green building is not just a performance that is energy based but covers resource performance, indoor environment quality and lowering carbon foot print on a life cycle basis of the building.

This insight is consistent with the wider definition of sustainable development the United Nations Brundtland Report suggests sustainable development as the ability to address the needs of the current generation without endangering the functioning of future generations to fulfill their needs (as cited in IFLA, 2022). Green building practices, therefore, are a subordinate to sustainable development planning used in the built environment.

(b) Green Libraries as the Implementation of Green Building Principles.

The International Federation of Library Associations and Institutions (IFLA) defines a green and sustainable library as the reason behind the implementation of areas of sustainability of the environment, economy and social practices within the infrastructure, operations and services provided by the library. Green library is a proactive structure in minimizing its carbon footprints, adapting energy efficient design schemes, adopting eco-friendly business operation, and contributing to environmental educational research and awareness amongst its customers (IFLA, 2022). Some of the key aspects that the IFLA definition establishes revolve around green buildings and equipment, green office principles, sustainable economy, and sustainable library services (IFLA, 2022).

Green buildings and equipment are oriented towards reducing the emission and carbon footprint by designing the buildings, building materials, indoors environmental quality, and planning of the sites. Green office principles are the common practices in operations which encourages environmental friendly conduct by the personnel and stakeholders. Sustainable economic factors are focused on limited consumption, material preservation, and closed economic systems. Sustainable library services involve the provision of environmental access to the user, providing sustainability education, and efficient services delivery on par with larger environmental objectives (IFLA, 2022).

These theoretical spheres are used to demonstrate how sustainability is not only building-centered when it comes to the physical scheming; it also can be applied to the practice of the organization and the community engagement and therefore green libraries can be considered a model of sustainable practice in the knowledge-based institutions.

(c) Interrelationship of Concepts

The concept of environmental responsibility as the intersection of green building principles and the concept of sustainable library services is that environmental responsibility needs to be part of the planning of institutions, and physical facilities, as well as service delivery. Libraries can act as sustainability examples not only in minimizing their ecological footprint but also in providing information on environmental topics and in teaching users how to be more environmentally friendly (Jain et al., 2025; Ritu, 2024). The hypothesis rationale on which this research will be based therefore grounds the concept of green building in the broader context of sustainable development and shows the way green buildings can be used in library infrastructure and operations.

4. GREEN/SUSTAINABLE BUILDING

One of the ways to diminish negative influence on environment, as well as on human mental health, is green architecture or green building design (Roy, 2008). Design or green or sustainable buildings or eco-friendly building is developed in a way ensuring emphasis is placed on efficient use of location, building material and design to augment sustainability. The process is supposed to conserve

water, use less energy, recycle, minimize carbon release and decrease further maintenance expense (Tasci, 2015). We spend such large part of our life in offices, schools and home and only now the possibilities to improve them become the subject of attention. High-tech structures are bound to be made with characteristics of energy efficiency, and minimization of wastes, and more water saving structures, healthy interiors, and enhanced air quality. Through these green designs, the society can have increased quality of life, ever-increased economic growth and also minimal effects on the environment (USGBC, 2002).

Numerous libraries are also striving to green the current building or build a new one based on the proper attention to the international standards of green libraries. Numerous organizations offer certifications and standards of green building such as LEED (built by the USGBC), BREEAM (UK), International Green Construction Code (IgCC), GRIHA and IGBC (India) in the building of green libraries. Their emphasis is largely concentrating on five top -site location, water efficiency energy and atmosphere, materials and resources and indoor environment quality.

It is stated that LEED certified buildings are the most appropriate building models in the world and it offers a guideline that can be used to develop efficient, sustainable, and cost-effective buildings that will support the environmental and social welfare (LEED Rating System U.S. Green Building Council, n.d.).

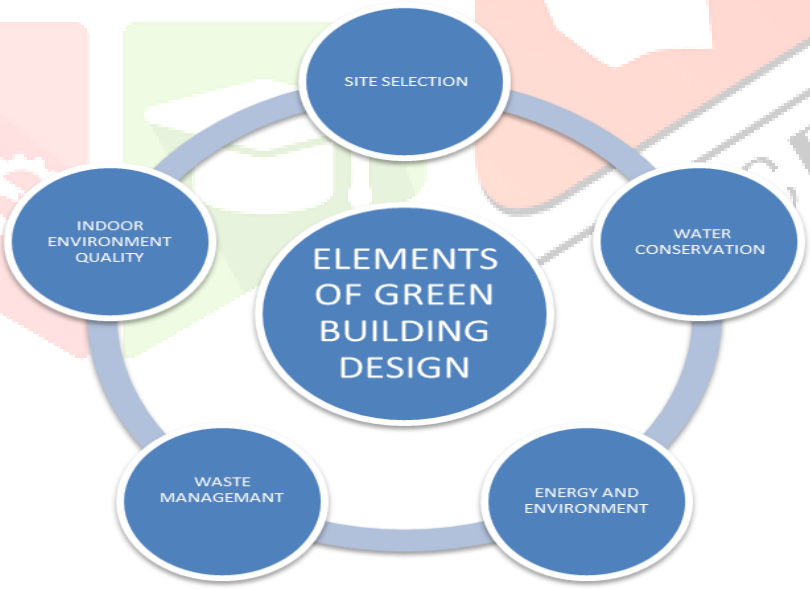

Figure: 1 - The design and construction of green buildings rely on several core principles:

a) Sustainable Site Location: This place must not be disruptive of the natural environment or affect the nearby negatively. It must also influence the surrounding positively (What Is Green Building? n.d.) Sustainable land management and site planning are important in land use minimization. Building sustainable design is the one that will have the least negative impact on ecosystems, maintain biodiversity, and control storm water runoff using the green roofs, permeable pavement, and retention ponds (Berardi, 2013). Access to the public transport routes and community services

also influence site selection and thus alleviate the need to rely on personal transport and ensure sustainable development of cities (Ye et al., 2024). Green buildings can restore the resilience and sustainability of cities through incorporating environmental concerns into the planning of the site.

b) Water Conservation: Water conservation is very much a topical and the green buildings are making a move to conserve and recycle water such as rain water harvesting, grey water recycling, low flow fixtures and automatic taps. These characteristics prove beneficial in saving and reducing the need of fresh water (US Green Building Council [USGBC], n.d). The green design of the construction work is already applied in many countries and more attention has been paid to the conservation of water and adherence to smart water management and the popularization of people about water-efficient technologies. This is a conservation technique of water and reduction in utilizing fresh water, as a means of decreasing the shortage in the future (Das et al., 2015).

c) Energy Efficiency and Environment: Building take up 40 percent of the world energy and make significant contribution to emission of carbon dioxide. That is why the energy efficiency is the essential aspect of the green building design (International Energy Agency [IEA], 2021).In order to decrease the dependency on fossil fuels, the green buildings are designed accordingly including the promotion of insulation system, the use of solar panels, proper ventilation and energy efficient lighting (Urge-Vorsatz et al., 2020). They accomplish it through incorporating renewable energy sources such as solar power, wind turbines, geothermal turbines and biomass energy. They not only neutralize the carbon emission but also help in the construction of more secure and future (Arya & Singhal, 2025).

d) Waste Management: Waste management practices are significant to the green/sustainable building practices since its primary objective is to curb waste both at the construction stage and in the day-to-day operations. Construction and Demolition(C &D) waste constitute approximately 30 to 40 percent of all solid waste in the world. This renders sustainable waste plans very critical to saving the environment and resourceful usage (Lu & Yuan, 2011). The green buildings are focused on waste management, recycling, and proper disposal to meet the sustainability purpose and advance the principles of a circular economy (Ajayi et al., 2017).

e) Indoor Environment Quality (IEQ): IEQ is concerned with the well-being, comfort and the health of occupants within a building. However, its primary sections are that there is sufficient air movement, access to natural light, good acoustics and that materials that contain high levels of dangerous chemicals, referred to as VOCs (volatile organic compounds) are used (Allen et al., 2015). Research has demonstrated that enhanced indoor environmental quality (IEQ) could have a number of positive effects on the workers. It could increase the productivity of its workers, reduce the days of people absenteeism and enhance their capacity to perform cognitively (MacNaughton et al., 2017).

5. GREEN OFFICE PRINCIPLES

Green Office Building refers to sustainable construction and that is constructed in a manner that minimizes adverse effect on the environment and instead promotes healthy working environment. It is with natural lighting system, with HVAC system and primarily aims at minimizing carbon footprints (Ashmawy et al., 2024). Renewable sources of energy, effective water management, sustainable construction materials, and improved indoor environmental quality are some of the distinctions of green office buildings (Kibert, 2016). Day lighting, efficient ventilation and construction materials low in emission boost the comfort and wellbeing of the employees (Seppanen and Fisk, 2006). Green offices that are designed in a strategic manner produce a lot of positive economic and environmental effects. On the one hand, they reduces greenhouse emission, resources used, and operational wastes incurred (Azizi et al, 2015). On the one hand, they minimize operational costs, as well as enhance the work of employees and reputation of the firm (Aries et al., 2010). Moreover, green certified buildings allow employees to be much more satisfied than in office buildings of the conventional type (Altomonte & Schiavon, 2013).

Figure 2: (Principles of green office buildings. Adapted from "Sustainable Design Principles for Green Office Buildings: A Comprehensive Review," by R. A. El Ashmawy, A. A. Ragheb, G. Ragheb, & O. Marouf, International Journal of Sustainable Development and Planning, 19(6), 2024, p. xx.)

6. SUSTAINABLE ECONOMY

Sustainable economy is that one which appreciates and provides equilibrium in usage of resources in the long run as well as in social and environment health. It neglects the vestedness of the short-term profitability and has the efficiency, equity, stability (D'Amato et al., 2017). Another aspect of the sustainable economy is the role of libraries in connecting information literate individuals to

legitimate resources. Resources are accessed with the help of interlibrary loans and on-access repositories, e.g., which does not excessively duplicate resources to be discovered by the community, thus generating less waste of money and resources (Jankowska and Marcum, 2010).

7. SUSTAINABLE LIBRARY SERVICES

Social sustainability deals with social inclusiveness and equity, the community (Colantonio, 2009). Libraries make a difference as they provide an equal access to information, allow technology to promote literacy and provide supportive environments in the community. Classes on sustainability are also often hosted in libraries, a literate approach to climate change and community development will make them active participants in the task of making social resiliency (Bundy 2004). The adoption of green practices during day to day operations of libraries such as digital preservation, green printing, open access resources, use of energy efficient lights, automatic light system, digitized circulation system and catalogue system are one of the key aspects of sustainable library (Ganesamoorthy & Selvakamal, 2025).

Key Components of Sustainable Library Services

a) Energy Efficiency and Green Infrastructure

The contribution that library can make to minimize the negative effects on environment can be listed as follows: utilizing energy efficient resources and infrastructure, open access resources and print on demand with digital transformation (McCord et al., 2025).

b) Digitization and Open Access Resources

Digitization of library materials forms a much-needed segment of library and it has numerous sustainable advantages that drive diminution in physical storage by 80, reduction in paper intake by 70 and also increases remote access at lower cost of upkeep (Madhura et al., 2024).

c) Sustainability Awareness

The existence of numerous libraries in the society, which offer educational materials without fee, assists individual in learning tricks on critical thinking and problem solving, is of central role in enhancing social sustainability. Since the public libraries are social institutions, it also offers the community interaction and discourse as social problems (Aregbesola, 2023).The objective of library is no longer to get books but to offer appropriate information to the users at the appropriate time. This can only be achieved with the advent of technologies in libraries in the forms of IoT (Internet of Things), Open access resources, mobile apps and AI (Augmented Reality) and Virtual Reality (VR). These emerging technologies are eco-friendly and can be used to improve user experience (Adigun, 2024).

8. REVIEW OF RELATED LITERATURE

Environmentally Friendly Building and Sustainability in Libraries -

(a) Sustainable Libraries in International Perspectives

Sustainable practices in library environments are the subject of research that indicates that there is an increasing global concern of the ecological responsibility and green strategies. Jain, Kashyap, and Jhamaria (2025) give a detailed account of the global green library efforts and the way sustainable

efforts have changed and the issues that libraries encounter in trying to adopt it. Their work reveals the unequal adoption levels among regions and the need to align the work of libraries with sustainability goals with the rest of the environment, including the United Nations Sustainable Development Goals (SDGs).

Certain sustainable practices in libraries have also been explored by librarian and environmental scholars as energy conservation, waste management, and adoption of environmentally friendly technologies. A case in point, Ritu (2024) addresses the methods of increasing the level of energy efficiency and minimizing the ecological footprint of library buildings, including design development initiatives and the operational best practices implemented across the world.

A number of researches examine the application of green concepts in library practices in non-physical infrastructures. The comparative analysis of Mishra reflects the tendencies of the differences in the usage of traditional and green library in relation to their involvement in the community, environmental education and the implementation of sustainable policies.

Green library study also crosses the technological and leadership aspects. Ganesamoorthy and Selvakamal (2025) discuss the use of green technologies, i.e. green building systems and environmental control tools, to make libraries one of the most environmentally friendly and sustainability-oriented.

(b) Environmental Practices and Green Libraries

In addition to physical infrastructure, other environmentally conscious activities in libraries include environmental services and user interaction. Singh and Mishra (n.d.) explain that libraries also embrace green services including green copying and printing services as a way to minimize carbon footprints and to encourage environmental concerns among customers.

Some other models of service that have been environmentally sustainable in libraries include promotion of 3Rs (Reduce, Reuse, Recycle) and availing of programs that help to educate the users on matters of the environment as a study conducted on libraries in various states of the U.S. has revealed. This study underscores the relevance of regular sustainability policies and education functions of libraries (Ren, 2024).

(c) Local and Area Surveys on Libraries Sustainability

The green concepts are subject to regional applications in some research. Sarkar and Chaudhuri (2023) examine the implementation of green principles in West Bengal by local libraries (energy conservation and environmental consciousness programs) and cover the local attempts at acquiring sustainable practices in libraries.

The article by Soren (2025) addresses the topic of sustainable development principles and their implementation, not only in libraries but in the world in general and in India specifically and provides information about the frameworks of the concept of sustainable development, including the three pillars of sustainability which are social, economic, and environmental, and standards and systems associated with sustainability, including LEED and other rating systems and their relationship with libraries.

Other researchers also reported that although LIS research encompasses a wide subject in the Indian repositories such as Shodhganga, there is still a lack of explicit attention to sustainable infrastructure and green library buildings practices which points to a research gap in the LIS doctoral and postgraduate corpus.

9. RESEARCH METHODOLOGY

9.1 Research Design

The current research relies on a descriptive and analytical review research design and is completely grounded on secondary data. The method would be applicable in generalizing the available literature, finding trends, focusing points, and gaps in research concerning green building concepts, principles, and components in Library and Information Science (LIS) settings. Descriptive and analytical reviews provide an opportunity to systematically assess the available literature and repositories to learn how sustainability is theorized and used in libraries (Krippendorff, 2018; Braun and Clarke, 2006).

9.2 Data Sources

Academic repositories and peer-reviewed academic publications were used as secondary data collection tools. In the case of national sources the research utilized Shodhganga, the official Indian archive of theses and dissertations that is powered by INFLIBNET Centre (INFLIBNET Centre, n.d.). In the case of international sources, the repositories like Theseus (Finland) and UNT Digital Library (USA) were searched. Moreover, journal articles that were peer reviewed on green libraries and sustainable practices were also included to help the analysis in case LIS theses are not available.

9.3 Selection Criteria

Sources used were selected based on the following criteria:

- The reference should be a thesis or even a scholarly paper that is available in a recognised repository or peer reviewed journal.
- The study needs to fall under LIS or be interdisciplinary with an immediate bearing to the sustainability of libraries.
- The study needs to deal with green buildings concepts, environmentally friendly practices, or green libraries.
- Only the materials in English language were selected.

9.4 Data Analysis

Content analysis and thematic analysis allowed studying the collected theses and scholarly articles and finding recurrent themes and classifying the results based on the themes of sustainability, energy efficiency, green building principles, and environmentally responsible library infrastructure (Krippendorff, 2018; Braun and Clarke, 2006).

9.5 Sources Reviewed: National and International LIS Theses -

9.5.1 National LIS Theses

A Shodhganga search identified many LIS theses in India, but each of them was not confirmed as one that specifically talks about green building or sustainable library infrastructure. According to

bibliometric studies, although Indian LIS research is quite varied, elements associated with the environmental sustainability are infrequently in the spotlight. This demonstrates a research gap of the national LIS that relates to green building and sustainable library practices.

9.5.2 International LIS Theses

Various LIS theses can be found in international repositories, such as Theseus, the UNT Digital Library, and so forth, but hardly any of them deals directly with green buildings or sustainable library facilities. More specifically, to give an example, Xiong (2015) examined the green design and building technology on the general environmental grounds, which can give conceptual information on the sustainability of library infrastructure, although not LIS-specific. Sustainable design plans are also informed using peer-reviewed works on green libraries worldwide where evidence at the thesis level is to be limited (Jain et al., 2025; Kedar and Kedar, 2024; Sarkar and Chaudhuri, 2023).

10. REVIEW OF INDIAN THESES

(a) *Athulya (2023)* compared the universities or chosen institutes of South India according to the green library initiatives. In this study, the researcher aims at analyzing the awareness, attitude and adoption of green and sustainable library concept by academic institutions. It assesses the degree of environment-friendly activities undertaken in libraries and examines the obstacles that have been presented in the process of changing to sustainability. Systematic approach and approach are the methodology applied. Purposive sampling approach was adopted and librarians of institutes were interviewed to get the data. The questionnaire is split into two sections Part I that will be concerned with demographic data and Part II that will be concerned with the process of identifying greenness of respected library. Part II will be broken down into 8 parts to get information on basis of design considerations, water efficiency, energy efficient resources, on-site energy generation mechanism, Initiatives for going green, waste management steps and any other steps. The collected data was analyzed with the assistance of SPSS and it was also restricted to South India. The results of this research is subcategorized based on the information gathered using questionnaire and development of green and sustainable libraries is presented using proper structure.

(b) *Singh (2023)* presents and evaluates an idea model to help a transformation of the academic libraries into the green libraries in Uttar Pradesh. The paper will seek to determine the degree of awareness of academic libraries in Uttar Pradesh on the issues of environmental sustainability and green libraries. It also discusses the necessity to adopt sustainable practices, analyzes the current strategies and their effects on managing libraries, and presents a conceptual model to facilitate sustainable operations (environmentally-friendly) in academic libraries. The research design was descriptive research, and survey method, and the data was gathered by applying a structured questionnaire. This questionnaire touched upon three major spheres of concerns such as awareness of sustainability and green libraries, strategies of sustainable practices (resource efficiency, services, collection development, waste management, and design adaptation), and necessity of adoption of such practices. They were coded and analyzed in SPSS (version 20.0) by means of descriptive

statistics, reliability tests, correlation, factor, and regression analysis, and the responses were ranked by means of a modified scaling system. Data analysis showed that the majority of professionals working in libraries had heard about the concept of sustainable development, environmental sustainability and the concept of green library and associated activities like waste management, energy saving and conservation of resources. Although Uttar Pradesh has been observed to have some sustainable practices in the university libraries, there is still lapses in the water management, reduction of CO2, automatic lighting, application of green products, and budget allocation towards environmental protection. The results emphasize the fact that sustainable library management is positively affected by the environmentally sustainable strategies. Therefore, the research postulated a conceptual model that the libraries can follow to be green. It also highlighted the purpose of the library as a hub of environmental education where librarians are encouraged to support greener practices and spread environmental knowledge as well as incorporate sustainability into their day-to-day operations.

(c) *Dixit (2023)* examines the role of National Institutes of Technology (NITs) in India in adopting sustainability concepts in the management and operations of the libraries. It dwells on the analysis of existing practices, policies and facilities that can facilitate the change of traditional libraries into green libraries. The study offers a substantive insight into the gaps that exist and the way forward in the future development of the libraries towards being sustainable in higher institutions of learning. The primary purpose of the research was to discover the existing situation with green library programs in NITs and how NITs implement them to make libraries green. The scope is limited to 29 NIT's. The survey methodology is employed because the information about green library was obtained with the assistance of questionnaire and data was gathered. The questionnaire is categorized into twelve sections that will gather information on each of the NITs based on the aspects of green libraries. The data was entered in form of codes and examined using MS excel. The results indicate that the majority of the librarians are introduced to the green libraries though they are not experiencing significant challenges to adopt them compared to some NITs which are trying to become green.

(d) The survey of the green libraries in India was conducted by *Gundawar (2020)*. The study would focus on several studies in the area of eco-friendly libraries including different ways in which libraries can be environmentally friendly, the features in the design that lead to the creation of green and energy efficient infrastructure, and the steps taken to ensure continuity in being eco-friendly in the running of libraries. It also aims at exploring how current libraries can be converted into green buildings, examine the difficulties and hindrances of planning and undertaking such initiatives and look at the national and international guidelines on green buildings that may be utilized in the design and building of libraries. To find out whether eco-friendly practices exist in Indian university libraries, a survey method was employed in a qualitative analysis to describe the situation and determine that the survey will allow identifying the presence of the mentioned practices. A questionnaire was designed to collect data among the professionals of a university library. It had two

sections, Part I, was a demographic and institutional section and Part II covered green aspects of libraries and included building design, energy and water efficiency, green initiatives, and ICT applications. Closed- and open-ended questions were also provided, and the questions ended with those related to NAAC-related green activities and recommendations on how planning sustainable libraries. A total of 254 respondents were used to come up with the sample size that was used to conduct the study because the table given by *Krejcie and Morgan (1970)* was used. The simple random sampling method (lottery method) was used in which 35% of the population of each zone was selected. The data analysis was carried out using MS Excel. The analysis of the questionnaires has revealed the significant areas that have been used to achieve environmental sustainability in the Indian university libraries such as building design, waste management, operations and maintenance, energy efficiency, audits, ICT application, digitization, and green-oriented policies and services.

(e) In a study, *Patel (2019)* has looked into the adoption of green practices in libraries of higher learning institutions and research centers in Gujarat and how the traditional libraries could be converted to Green Knowledge Centers. The research analyzed the different elements in designing library buildings, ICT infrastructure, collection development, operations, services, and waste management in regard to the issue of environmental sustainability. The results of Patel emphasized the fact that as the level of awareness regarding the green library concept was increasing, there were minimal practices being implemented based on the infrastructural and financial limits. The study also found out the difficult situations encountered by librarians to include lack of institutional support, funding, and training in sustainable technologies. Moreover, the research suggested the development of the green library policies and standards in accordance with the requirements of the academic and research institutes. Patel took an empirical approach to the subject matter by applying a descriptive survey technique where data were obtained using questionnaires, observations, and interviews, as a result of which, the researcher was able to draw relevant empirical information on the state of green initiatives in 63 libraries in Gujarat.

11. REVIEW OF INTERNATIONAL THESES

(a) *Xiong (2015)* tried to identify the impact of green design aspects and technologies in building environment - in terms of lighting, noise, temperature, humidity, vibration, and general occupant comfort - using the Zero Energy Research (ZOE) Laboratory at the University of North Texas as a study sample. The study utilized both a qualitative field measurement of environmental factors and a questionnaire survey of the occupants to determine their subjective levels of comfort using a mixed-method research technique in a case study design. The measurements of the parameters of the indoor environment and the user feedback on the comfort and perceptions of the green features of the design were made to obtain the data. The results showed that the ZOE Lab achieved a number of environmental performance standards that had a positive effect on the energy efficiency and sustainability targets, although differences in occupant comfort - such as temperature and noise - demonstrated some trade-offs. *Xiong* was able to conclude that although the green design and technology have a high level of contribution to the quality of the environment and energy

performance, the user comfort and behavior should be carefully considered to ensure a holistic sustainability.

(b) *Karioja (2013)* was targeted to explore the implementation of sustainable development and ecological sustainability by libraries comparing between Finnish libraries and international libraries in relation to environmental management, environmental economy and environmental burden reduction, environmental awareness and environmental communication. The study was a quantitative survey-based comparative study, which consisted of an online survey that was done in the IFLA WLIC 2012 conference at Helsinki and followed up with emails to the international respondents, as well as a survey of Finnish national libraries. The data was gathered using structured and mostly closed ended questionnaire items, where Finnish and international libraries were used as respondents. Results showed that libraries in Finland and internationally had much to improve to become more sustainable, and more specifically, the reduction of environmental burden scored higher than environmental communication, and the small international sample prevented statistical power in the study.

(c) *Frederiks (2020)* was interested in assessing the role of public libraries in making their communities more environmentally literate. The study employed a mixed methodology design that involved a quantitative survey of library employees and qualitative interviewing to have a comprehensive information. The results showed that although libraries can be considered as rich resources in terms of facilitating sustainability, a significant gap exists between the potential and actual role of the libraries in environmental education. The thesis also ends with suggestions of measures that the libraries can take to integrate sustainability in their services more effectively thus produce a more environmentally aware society.

(d) According to *Glapiak (2020),* the vision of a child-centered, ecologically responsible learning environment of a public library is reimagined. The main aim of the study was to incorporate the principles of sustainability in space and experience design of a kid's library in Chwaliszewo, Poland: energy efficiency, passive design, and re-use of material. The author presented the question of how daylight, architecture, ventilation, and natural materials might help in improving user well-being, as well as environmental performance. Site analysis, climate responsive design modeling, and architectural simulation were used as the methodology. The project stressed the application of natural light by use of skylights and big windows, thermal comfort by use of cross-ventilation and recycled and locally available building materials. Besides, the thesis suggested flexible learning environments where children can interact and create, which connects the environmental education to sustainable architecture. Among the most important contributions to the present body of literature, it has been shown that sustainable design in libraries does not just mean technical efficiency but also the establishment of emotionally charged and educative spaces. The design undertaken combines play, reading and environmental education, hence making the library a green building as well as a pedagogical resource. The thesis can be useful in studies relating sustainability to architecture and

user-centered design, particularly with the creation of environmentally friendly educational buildings.

(e) *Metibogun (2022)* researches one of the less explored and yet vital issues in the sustainable library design - thermal discomfort and overheating in green buildings. As a research study of the master degree level in New Zealand, the aim was to determine the thermal performance of three green certified public libraries in Auckland and to determine whether design decisions were in line with the reality of environmental performance. The researcher was using a case study methodology and included monitoring of the environment, surveys of the users and building of simulations. The cases used entailed intensive monitoring of temperature change, energy use and comfort of occupants during varying seasons. The results showed that although design solutions like big glass facades and natural ventilation added to the benefits of better daylight access and lowering of artificial lighting expenses, they resulted in the negative effect of unwanted overheating during hot periods of year. The paper reaches the conclusion that green design approaches need to be on a local scale, something that is effective in temperate climates might not be effective in wet or hot climates. The studies suggest adaptive shading systems, better insulation, as well as dynamic ventilating systems based on the local climatic situations. The work has immense implications to the architectural researchers and library planners because it puts to question the notion of all the green strategies naturally improving the comfort. Rather it promotes a performance based sustainable design.

12. FINDINGS

The review of domestic and global LIS thesis and other academic literature indicates some valuable findings about the approach to green building concepts, principles, and factors in the Library and Information Science literature.

To begin with, the review reveals that there is an implicit emphasis on the areas of green building and sustainable library infrastructure on LIS theses, especially in national repositories like Shodhganga. Although LIS studies in India span the whole range of subjects, the issues of sustainability and green buildings are either poorly represented in a study or they are discussed indirectly instead of serving as the main focus of a thesis-level study. This validates the previous literature findings that the sustainability-oriented LIS research is still nascent and under-represented (Jain et al., 2025).

Second, the sources on sustainability are more conceptually active in the international market, albeit not always in LIS-specific dissertations. Even when the research study is not LIS-centric, such studies as Xiong (2015) also focus on the principles of green design: energy efficiency, indoor environmental quality, occupant comfort that can be directly applied to the library buildings. This implies that LIS studies may afford to borrow green building frameworks interdisciplinary, out of architecture and environmental design fields.

Third, the results show that the concepts of green libraries are more often discussed in the peer reviewed articles, than in the LIS theses. The literature on green libraries has been in agreement over

the years in the fundamentals of green libraries such as energy-saving buildings, green office, sustainable economic planning, and an environmentally responsible library service (IFLA, 2022; Ritu, 2024; Sarkar and Chaudhuri, 2023). Nevertheless, such debates are rather theoretical and descriptive, and have little empirical evaluation of the long-term consequences or standardized models of implementation.

Fourth, the review demonstrates that the implementation issues, including the lack of financial resources, institutional policies, inappropriate awareness, and lack of standardized guidelines, are common themes, particularly in the developing country settings (Jain et al., 2025; Sarkar and Chaudhuri, 2023). These obstacles do play a major role in the disproportionate implementation of the green building principles within library facilities.

Last but not the least, the findings reveal the definite gap in the research: one cannot fail to note the deficiency of LIS theses that would have a systematic approach to incorporating green building theory, sustainability principles, and real-life library implementations into a single analysis framework. This gap suggests that future LIS research needs to shift the focus of the discussions to an evidenced, evaluative, and policy-focused research.

13. CONCLUSION

This paper aimed at reviewing the concept of green building, principles and components of green building, as manifested in national and international LIS theses. The discussion indicates that although the notions of sustainability and green libraries are getting recognition in the LIS community, they are sufficiently underrepresented in the research on the theses level.

The conclusion made based on the findings is that the study of LIS has not yet adopted green building as a fundamental area of academic research though the world is increasingly focusing on sustainability. International literature offers firm conceptual frameworks and transferable principles of building designs but this understanding is not always put in perspective in the academic studies of LIS, especially in the Indian scenario. This dislocation argues that there is a space that LIS scholars can use interdisciplinary sustainability models in library-centric research.

Moreover, the focus IFLA (2022) puts on the green buildings, green office concepts, sustainable economy, and sustainable library services makes it clear that sustainability in libraries is multidimensional, and it is not only the physical infrastructure that can be discussed in this context but also the operational principles and community interaction. Nevertheless, the fact that very few LIS theses focus on these aspects suggests that research agendas and institutional support should be structured.

Finally, the paper concludes by stating that to improve the research on green building and sustainability in LIS, the following is necessary:

- More attention to research at the thesis level with a specific focus on green library infrastructure,
- The use of interdisciplinary research methods, and

- Creation of generalized frameworks and assessment models applicable within the library settings.

By filling these gaps, the future LIS research will be able to make a significant contribution to sustainable development objectives and make libraries active participants of environmental responsibility and innovation.

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