

**RESEARCH PAPER****Unveiling the Green Impact: Comparing LEED-Certified and Traditional Libraries in Pakistan's with End User Satisfaction through Environmental Design Insights****<sup>1</sup>Architect Jamshaid Ahmed Khan, <sup>2</sup>Architect Omer Shujat Bhatti\* and <sup>3</sup>Architect Nazia Iftakhar**

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**\*Corresponding Author:** omer.shujat@aiou.edu.pk**ABSTRACT**

Indoor environmental quality of a library setting impacts on the user satisfaction and prioritization of the facility optimized usage. Since these settings are very few and public at large opt for these towards better access to knowledge, their environmental performance acts as a key a factor towards their user satisfaction. Though service provider perspective have been explored in this regard previously, yet end users side prospective view has been missing. The research aimed to explore the end user perspective towards functional optimization & user satisfaction in library settings with comparison between LEED certified and non-certified library settings to enable identification of key factors contributing to better user satisfaction and ease of use. Interviews using questionnaires with focus on environmental and functional prospects resulted in identification of major issues in non-certified building. Proposed strategies to improve these settings have also been proposed.

**Keywords:** Design Interventions, Environmental Design, LEED, Library Optimization, User Satisfaction**Introduction**

With an accepted fact across the globe that education is the foundation of all societies, it is of the utmost importance to create resources that encourage the provision of high-quality education and to centralize & optimize resources using contemporary methods, approaches, and technology towards educational delivery and ease of access to all sects of the society. It is critical that education should pave the way forward for the future generations to be enlightened (Dang & Chen, 2018). As a result of the current global upheaval, low socio-economic conditions as well as financial decline, associated cultural challenges and a lack of accessibility to public educational resources, education is less accessible to all the major developing nations across the globe (Yang, 2017). In order to manage this common challenge in the public realm across any society in the world, public library is one the most critical and resourceful asset that comes handy to help the people at large (Gupta, 2020). Public libraries are essential to society because they empower people of all backgrounds with a plethora of knowledge, services, and opportunities in amiable, accessible environments (Kilic & Hasirci, 2018). These act as a major source of knowledge when the existing educational system either fails to deliver the educational resources to the masses or when the existing targeted knowledge is not accessible to the knowledge seeker primarily at the educational premises (Jalaluddin Haider, 1998). However it is critical to mention that the design of such facilities is mainly ignored and just building the physical spaces to fulfill the requirements merely does not promote healthy educational or learning experiences (Jalaei, Jalaei, & Mohammadi, 2020). Developing countries with multifold

challenges in the form of poor literacy rate and lack of ease to educational system, library acts as a one stop service enabler which may be the only source of knowledge and education through self devotion and commitment. However lack of such facilities and their further poor spatial design acts as a challenge and hurdle to enhance their capability to deliver quality educational resources (Saha & Padhan, 2019). As a leading developing country from South Asia, Pakistan falls in the same dilemma with very few libraries open to public at large and even them not designed to promote healthy indoor spaces (Warraich, Haq, & Ameen, 2016). As a result there was a need to explore how these environmental based design gaps and issues have been impacting the performance of these facilities from the end users perspective and identify those aspects which can contribute to better utilization and optimization towards end users satisfaction with services quality in these physical public settings (Warraich, Malik, & Ameen, 2018). Functional optimization based on the quality of service delivery with focus on environmental parameters became the focus of the study.

### **Literature Review**

In general, public libraries are widely recognized for their commitment to diversity. Libraries welcome people from every culture, regardless of their socioeconomic status, race, ethnicity, or political beliefs, in contrast to other organizations. (Waheed, 2019). These facilities have a string system of educational enhancement through enabling access to general public through educational resources being for the public through their resources. Without prioritization for payments even in most cases, certain dress code of uniform like schools and allied membership requirements, they work on the principles of ethics and equality of education for all while retaining respect and ethical sanctity of the space (Bashir, Soroya, Soroya, & Khanum, 2015). Since libraries are open to anyone, visitors can spend the entire day inside without having to pay for admittance. There are a ton of resources available there, such as computer stations, free Wi-Fi, books, e-books, periodicals, publications, research journals, and assistance with job searches. Inclusion is particularly crucial in a culture where there are racial, ethnic, political, and socioeconomic inequalities. (Mwanzu, Bosire-Ogechi, & Odero, 2022).

Libraries help communities with limited access to formal education by bridging the educational gap by giving people access to learning resources (Gupta, 2020). They provide programs, books, and digital materials to meet a range of educational requirements. By providing free access to books, journals, and digital databases, libraries democratize knowledge. Libraries become the main sources of information for study and self-education in places where internet access is scarce (Afacan, 2017). By offering programs for both adults and children, they support literacy initiatives, raising the literacy rate and enabling people to take an active role in society. Libraries use historical records, manuscripts, and archives to conserve cultural heritage. By preserving indigenous knowledge and customs, they help communities feel proud of who they are as individuals in their respective cultures(Warraich et al., 2018).

Pakistan is a South Asian developing nation with one of the lowest rates of literacy. People's access to education is severely constrained as a result of existing cultural barriers and low socioeconomic situations. (Warraich et al., 2016). Since the nation is among the most vulnerable to climate change and has seen numerous large-scale disasters in recent years, survival has taken precedence over education. (Warraich et al., 2018). Therefore, the public library's position in Pakistan is extremely valuable in contributing to the society's educational advancement. In Pakistan, managing a public facility for public availability while creating an appropriate environment is an enormous challenge for any public access building, and public libraries are no exception due to a lack of energy supplies, water scarcity, and exorbitant energy and electricity costs (Bande et al., 2022). In light of the aforementioned, its built form, interior design, and related architectural and environmental design all contribute significantly to improved usability and operational optimization without heavily relying on energy and associated characteristics (Jalaei et al., 2020). One of

the key factor which has been seen contributing to the wellness of the internal spaces within libraries towards their optimal functionality and user satisfaction is based on their design integration of environmental parameters through design evolution through guidance (Jalaei et al., 2020). The role of Leadership in Energy & Environmental Design (LEED) as a guideline for managing these challenges across the globe has been established as a major source of success through initial design evolution (Gupta, 2020). These have resulted in dynamically managing these optimization and functional utilization concerns across the globe (Bande et al., 2022).

Based on the most recent review of the literature and an analysis of the body of knowledge pertaining to current research inquiry, the major variables that follow were established in relation to the objectives of the study that have to be carried successfully (Gupta, 2020). These were as follows:

1. Basic demographics about the librarians and general information.
2. Location & context of the library.
3. Accessibility to the facility.
4. Sustainability parameters and aspects.
5. Built form and its optimization.

## Material and Methods

The overall research methodology followed is shown below in figure 1.

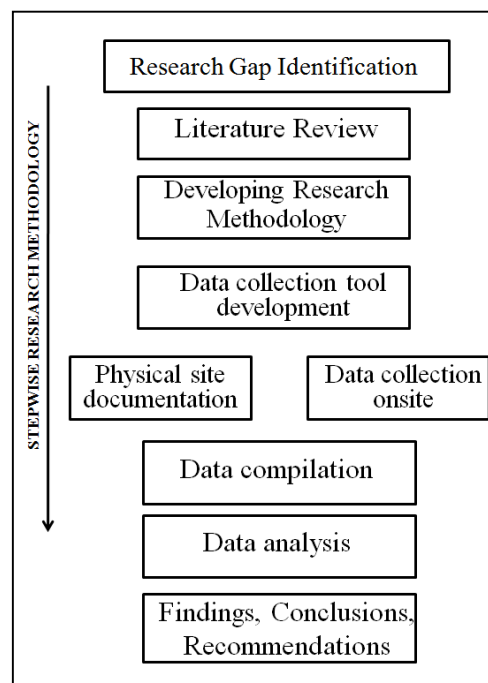


Figure 01 Phase-wise research program and major steps

With the assistance of the detailed review of the literature, a questionnaire based on the primary parameters that were identified and considered has been developed in order to proceed with the research. and then shared with 40 end users in both libraries i.e. library with LEED certification as well as non-certified library. Both libraries end users had different responses based on the design of the facilities and how environmental aspects

have contributed to ease and priority of use. As part of the research exploration, data was collected and later it was analyzed and lead to defining the research major findings, conclusions based on research objectives and future directions.

### Results and Discussion

Physical documentation of both the libraries was carried out using architectural drawings set development including plans, elevation and sectional studies. This later was used to evaluate how far the respondents data was correlating with the observational study.

#### Public Library 01 – BCL (British Council Library), Lahore City



Figure 02 Exterior view of BCL



Figure 03 Location & Context



Figure 04 Exterior passage



Figure 05 Green roof & shades

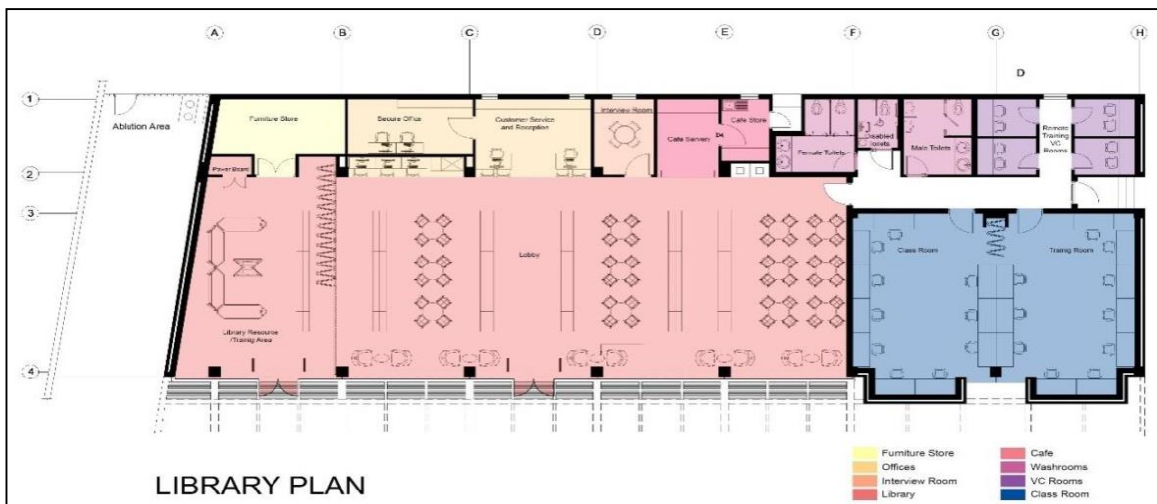




Figure 06 Architectural plan of the BCL



Figure 07 Interior Views

As shown above in the figure 02-07, the newly designed and constructed BCL i.e. British Council Library is located in the center of the city of Lahore, Being the capital city of the Punjab province, Pakistan occupies a central context and location. In the local context and architectural industry of Pakistan, Architects Nayyar Ali Dada and Associates have a huge name as the only Pakistan based architect won the prestigious Agha Khan Architectural Design Excellence award. The building has a precise and clear aim to have a minimum intervention with reference to the extensively diversified cultural rich city of Lahore. The public building was designed in order to keep in tact with the existing structures on the site with diversified functions. The concept of integrating Energy efficiency and green building principles lied at the center of the whole design development as well as its implementation.

### Public Library 02 – National Assembly Library (NAL), Islamabad

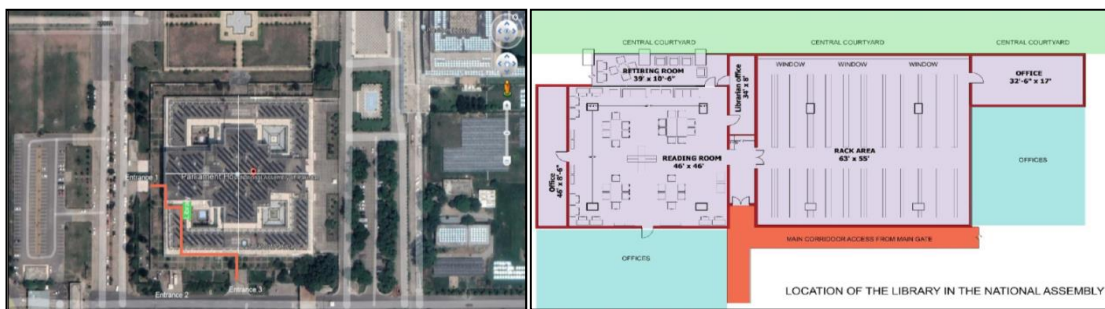


Figure 08 Location &amp; Architectural map of NAL



Figure 09 Reading hall &amp; offices of NAL

As shown above in the figures 08-09, the non-certified library selected for the comparison with the LEED certified library was the public senate library in the national assembly of Pakistan located in the center of the capital city and also occupies prime location of national assembly Pakistan in Islamabad. The building of national assembly was designed originally by an architect from USA Edward Durel Stone.

The respondents data collected and along with its diagrammatic presentation is shown below:

**Table 1**  
**General Information & Demographics of the library settings**

<b>Aspect 01 - General Information &amp; Demographics</b>			
<b>S.No</b>	<b>Aspect / Question</b>	<b>British Council Library</b>	<b>National Assembly Library</b>
1	Typology	Public with limited access	Public with limited access
2	Location	65 Mozang Road, Juiblee Town, Lahore	First floor , national assembly / senate building, constitution avenue, Islamabad
3	Type of development	New structure	Old, built in 1960
4	Gross building area	5177 SFT	7600 SFT
5	Number of floors	1	1
6	Number of users	12-14 per hour	20 -25 per hour
7	Number of staff	9	12
8	Size of collections	85,000	more than 85,0000
9	Total seating	100	50
10	Shelves	1392 SFT	880 SFT
11	Computer stations	7	6
12	Reading Desks	28	36
13	Group study tables	12	4
14	Meeting room	5	1
15	Lounge/s	4	8
16	Librarian Room	1	1

As evident from the comparison done in the table 01 above, British Council Library in Lahore is a new addition to an existing built site with almost the same seating capacity as the National Assembly Library in Islamabad city. NAL was built in 1960 while BCL is few years old. BCL area is almost 68% of the NAL while its seating capacity as per its new planning has enhanced the overall count for end users, though NAL has number of users per hour as compared to BCL. BCL also has an edge over NAL with lead in physical assets to serve end users in form of shelves, tables to have study materials and allied meeting rooms. Collected data from the respondents is shown below:

**Table 2**  
**Respondents Profile and Demographics**

<b>Demographic Data</b>	<b>Structure / Aspects</b>	<b>NAL, Islamabad</b>	<b>%</b>	<b>BCL, Lahore</b>	<b>%</b>
<b>Gender</b>	Male	30	75%	19	48%
	Female	10	25%	21	53%
<b>Age</b>	Less Than25Years	12	30%	25	63%
	25-35Years	23	58%	9	23%
	Above35Years	5	13%	6	15%

Professions	Library Staff	6	15%	3	8%
	Students	15	38%	23	58%
	Architects	5	13%	2	5%
	Engineers	7	18%	4	10%
	Others	7	18%	8	20%

As shown above in the table 02 and highlighted in grey color, BCL majority was female end users while in NAL it was male. In BCL, 63% were less than 25 years of age while in NAL majority was between 25-35 years of age. Major professionals or category to visit in both the cases were students.

**Table 03**  
**Respondents data related first three aspects**

Sr	Perceptive Aspects & Variable 1-3	BCL				NAL			
		Yes	%	No	%	Yes	%	No	%
1	Are the Library Building Design and Materials used responsive to the local Climatic Conditions?	36	90	4	10	9	23	31	78
2	Is the Library Building Interior has enough Natural Ventilation?	38	95	2	5	6	15	34	85
3	Is the Library Building Interior has enough Natural Light?	37	93	3	8	4	10	36	90
4	Is there any Noise Pollution inside the Library Building? Discuss	8	20	32	80	15	38	25	63
5	Is there a sufficient level of Artificial Lighting inside the Library?	31	78	9	23	34	85	6	15
6	Are Heating/Cooling Facilities Providing Sufficient Comfortable Environment?	37	93	3	8	37	93	3	8

As evident from the above table 03, BCL was able to dominate in the aspects of building design and materials selection choice, natural ventilation, natural lighting with respect to NAL where these capabilities were completely ignored. Hence it was evident that LEED certification requirements set forth the ground for better energy and performance criteria right at the project design initiation phase. However both were able to satisfy / qualify in the domain of ample artificial lighting and HVAC (Heating, Ventilation & Air conditioning mechanical systems). Though these also highlighted that natural aspects were considered at a better prospects in certified library on the LEED criteria.

**Table 04**  
**Respondents data related to user satisfaction**

Sr	Questions - Variables 4-5	Highly Unsatisfied		Unsatisfied		Neutral		Satisfied		Highly Satisfied	
			%		%		%		%		%
<b>BCL</b>											
7	How far are you satisfied with Energy Efficiency Level in this Library Building?	0	0%	1	3%	4	10%	31	78%	4	10%
8	Satisfaction Level on the Overall Functions and Uses of the Library	1	3%	1	3%	7	18%	26	65%	5	13%
9	Satisfaction Level on the Availability of Facilities in the Library	0	0%	0	0%	6	15%	31	78%	3	8%
10	General user satisfaction with the Library	2	5%	4	10%	4	10%	26	65%	4	10%

NAL											
7	How far are you satisfied with Energy Efficiency Level in this Library Building?	3	8 %	15	38 %	15	38 %	4	10 %	3	8%
8	Satisfaction Level on the Overall Functions and Uses of the Library	3	8 %	21	53 %	15	38 %	1	3%	0	0%
9	Satisfaction Level on the Availability of Facilities in the Library	2	5 %	6	15 %	21	53 %	8	20 %	3	8%
10	General user satisfaction with the Library	3	8 %	5	13 %	12	30 %	18	45 %	2	5%

As shown above in the table 04, in all major four aspects BCL was in the satisfactory range while NAL only had one aspect in the satisfactory range while two were in unsatisfactory and one in neutral range. The results clearly show that evidence support the case for LEED certification for better user performance and end users satisfaction.

## Conclusions

As per the observational study and the respondents data, British Council building had better design integration with respect to the climatic conditions and managing the facility as compared to the National Assembly Library. The observational study and documentation did correlated with the respondents data too where the issues were mainly found to be higher in the National Assembly Library as compared to British Council Library where people better utilized the facility and were more satisfied. Hence it was concluded that LEED certified building had better environmental consideration. It also has better performance and was better accepted by the end users as well was easily managed and better services were provided by the librarians as they have better energy efficiency and environmental control systems integrated in the building overall design. Though both libraries have different context, yet both were compared and have shown significant differences based on the major environmental and design consideration. LEED certified building not only had better energy efficiency and performance but was also better conceived and used by end users. This build's a strong case for better LEED based criteria to be integrated for allied building typologies where public usage is extensively done. National Assembly Library has major issues associated with energy, lighting, ventilation, performance and usage and hence was marked way lower than British Council Library.

## Recommendations

Following are the major aspects to be considered with respect to new library building design in future for Green design integration:

1. Building design brief should be based on GREEN principles.
2. Site analysis must be incorporating climatic data.
3. Design should focus on managing the operational and energy usage perspectives of future.
4. Applicable GRREN design approaches and strategies must be explored at the very early stage.
5. Opt for local materials and prioritization in design and construction processes.
6. Integrate design and energy evaluation at multiple stages even after construction to ensure targeted outcomes should be matched.



7. Design must incorporate local climatic conditions and should be optimized for end user satisfaction and user experience enhancement.
8. Reduce carbon footprint as well as pollution creation.
9. Overall design must integrate environmental aspects based on the scale, size, context and functionalities to optimize the utilization as well as energy and allied environmental parameters best performance.

Following are the major aspects to be considered with respect to an existing library or an existing library in any building with focus on GREEN design interventions:

1. Building energy audit must be done.
2. End users evaluation and satisfaction to be done prior to any design planning.
3. Evaluate the contextual conditions and usage potential along with major operational as well as expansion or futuristic issues anticipated.
4. List down all major aspects which can be evaluated towards retrofitting and upgrading the existing building.
5. Post occupancy evaluation will also be a great tool to help identify the future and current states difference and how these could be matched.
6. Design intervention must be thoroughly sort out through multiple communication based interaction sessions and end user engagement to be ensured.
7. All those aspects / parameters which could be addressed must be explored based on the objectives set forth as well as integrate the time, cost and scope constraints.
8. Develop strategies to minimize interventions and damage to the current building design and optimize it through addition/revisions/interventions only.
9. Avoid demolition of the structure unless and until no other option is left out.
10. Evaluate alternates and opt for multi-criteria decision analysis and evaluation to choose the best option through pro's and con's based evaluation using end users.
11. Develop the best available design choices through integration and then opt for execution.

The future direction of research should be to enhance the gaps identified through development of design solutions which may help address these gaps and then their evaluation as well as simulation to test their performance. Another major aspect should focus on the development of policy aspects and guidelines for future libraries to enhance and integrate the Green design principles and integration of LEED in the very initial design stage till completion and usage of the project itself.

## References

- Afacan, Y. (2017). Sustainable Library Buildings: Green Design Needs and Interior Architecture Students' Ideas for Special Collection Rooms. *Journal of Academic Librarianship*, 43(5), 375–383. <https://doi.org/10.1016/j.acalib.2017.07.002>
- Bande, L., Hamad, H., Alqahtani, D., Alnahdi, N., Ghunaim, A., Fikry, F., & Alkhatib, O. (2022). Design of Innovative Parametric/Dynamic Façade Integrated in the Library Extension Building on UAEU Campus †. *Buildings*, 12(8). <https://doi.org/10.3390/buildings12081101>
- Bashir, F., Soroya, S. H., Soroya, M. S., & Khanum, A. (2015). Emerging trends of acquisition in public libraries of Pakistan: Challenges and issues. *Library Collections, Acquisition and Technical Services*, 39(1–2), 40–44. <https://doi.org/10.1080/14649055.2016.1170471>
- Dang, T. H., & Chen, W. (2018). The importance of physical elements and their influences on users' concentration of academic library. *Advances in Intelligent Systems and Computing*, 588, 382–389
- Gupta, S. (2020). Green library: A strategic approach to environmental sustainability. *International Journal of Information Studies and ...*, 5(2), 82–92
- Jalaei, F., Jalaei, F., & Mohammadi, S. (2020). An integrated BIM-LEED application to automate sustainable design assessment framework at the conceptual stage of building projects. *Sustainable Cities and Society*, 53(November 2019), 101979.
- Jalaluddin Haider, S. (1998). Public libraries and development planning in Pakistan: a review of past efforts and future needs. *Asian Libraries*, 7(2), 47–57. <https://doi.org/10.1108/10176749810368937>
- Kilic, D. K., & Hasirci, D. (2018). Daylighting Concepts for University Libraries and Their Influences on Users' Satisfaction. *Journal of Academic Librarianship*, 37(6), 471–479.
- Mwanzu, A., Bosire-Ogechi, E., & Odero, D. (2022). The Emergence of Green Libraries in Kenya: Insights From Academic Libraries. *Journal of Academic Librarianship*, (August), 102601. <https://doi.org/10.1016/j.acalib.2022.102601>
- Saha, P., & Padhan, H. (2019). *Green libraries effect to the academic institutions: A special study on US based libraries*. Library Philosophy and Practice
- Waheed, Z. (2019). The British Council Lahore's Green and LEED-certified Library Building. *Green Behavior and Corporate Social Responsibility in Asia*, 17–25.
- Warraich, N. F., Haq, I., & Ameen, K. (2016). Status of Public Libraries in Rawalpindi District, Pakistan. *Public Library Quarterly*, 35(1), 72–82.
- Warraich, N. F., Malik, A., & Ameen, K. (2018). Gauging the collection and services of public libraries in Pakistan. *Global Knowledge, Memory and Communication*, 67(4–5), 244–258.
- Yang, Z. (2017). Research on natural lighting in reading spaces of university libraries in Jinan under the perspective of energy-efficiency. *IOP Conference Series: Earth and Environmental Science*, 94(1).