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## **Transforming the Dhaka University Library into a Green Library: Opportunities and Challenges**

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### **Abstract**

This study discusses how Bangladeshi libraries have adopted green methods to protect the environment, focusing on the Dhaka University Library (DUL), while exploring the associated opportunities and challenges. As there is no library in the country that is Leadership in Energy & Environmental Design (LEED) certified, this study outlines how the DUL can be transformed into a green library and aims to inspire other libraries to implement similar techniques. The work also provides a framework for libraries that are designing a new green building, renovating existing structures, and educating the public and library professionals about the benefits of creating and operating sustainable green libraries for both the users and the environment.

A mixed-methods research design drives the study with 404 DUL patrons and 15 staff members participating in surveys and face-to-face interviews. This study revealed important perceptions of the DUL users and library professionals toward a green library. Finally, it identifies several challenges, including a lack of knowledge about green technology, budget constraints, low public awareness, and insufficient willingness among users and staff. In addition, the study highlights some opportunities, such as offering a healthy indoor and outdoor environment and initiating a project that could inspire other libraries to adopt green practices, with a particular focus on DUL. The insights gained from this study would help the DUL execute a green library concept and pave the way for further research on green libraries in Bangladesh.

### **Background of the study**

For more than 20 years, there has been a green library movement (Bangar, 2018). The term "green library" is evolving. Libraries' growing interest in environmental

issues generally sparked the beginning of the green library movement in the 1990s and gained popularity in 2003. The Online Dictionary of Library and Information Science (ODLIS) defines green/sustainable libraries as libraries designed to minimize negative impacts on the natural environment and maximize indoor environmental quality through careful site selection, use of natural construction materials and biodegradable products, conservation of resources like water, energy, and paper, responsible waste disposal and recycling, and the use of the latest technology.

Chaudhuri (2015) mentioned that the concept of library greening or sustainability dates back as early as 1880, when William Blade released a book called *Enemies of Books* from London. Many academic libraries in other countries have adopted green library sustainability practices (Vasanthi, 2019). Oyelude and Alabi (2013) emphasized that the green library focuses on the use of natural or renewable energies, such as solar energy, less reliance on fossil fuels, planting trees around the library to reduce overheating and the need for cooling equipment, water conservation, promoting digital libraries and e-books, and providing e-learning platforms to foster the sharing of best practices between students from the global north and the global south. Hauke (2014) observed that "green" is not just about ecological concepts, but also about the awareness of the care and preservation of life on our planet in all its facets. Libraries, as educational partners with social responsibility, play an important role in this context. Green libraries are popular worldwide, and librarians are increasingly greening their libraries. However, in Bangladesh, no academic library or any other library is LEED certified. Libraries worldwide provide a wide range of goods and services that support the accomplishment of every single United Nations Sustainable Development Goal (SDG) (IFLA, 2018).

This study provides guidelines on how the DUL might be managed as a green library and encourages other libraries to implement similar practices. Additionally, it offers libraries a foundation for creating new green library buildings, refurbishing existing buildings, and raising community awareness of the benefits of designing and running sustainable green libraries. The proposed thesis aims to determine the potential opportunities and challenges of converting or creating a green library. The study was conducted using data obtained from the DUL patrons and a few carefully selected professionals. To identify potential opportunities and significant challenges of converting the DUL into a green library, the inquiry examined users' and corresponding staff members' awareness of a green library. The study's scope is limited to the DUL, which is one of its biggest limitations, although it does provide some indication of potential trends.

## **Literature review**

Libraries are not only systems for providing information and fostering social development through education but also serve as environmental organizations. Economy and ecology are the two most crucial factors in creating sustainable, thriving libraries (Kumar, 2019). To reduce the environmental impact of school,

college, and university libraries, librarians are encouraged to create green buildings or transform existing libraries into green ones (Ghorbani, 2017). Al and House (2010) examined how five public libraries in Canada and the United States, as well as North American library associations, have developed "green" policies and practices. Pangail (2015) presents a set of practices to lead more environmentally friendly and ecologically responsible decisions for future generations. The harms done to our environment and planet were first depicted in Rachel Carson's 1962 book, *Silent Spring*. It underscored the need to adopt sustainable lifestyles at home and in the workplace. Consequently, the library community has become aware of the importance of maintaining an eco-friendly environment (Al & House, 2010). Connell (2010) mentioned two levels of green material selection: the first occurs when librarians are aware of green resources and practices, and the second when they gather information about greening to share with their patrons. De Luca et al. (2017) discussed bio-building, emphasizing the use of recyclable and non-polluting materials and modern techniques to develop ecological consciousness.

Kimi Mahawariya (2019) emphasized the importance of reducing the negative impact on the environment and natural resources, responsible waste disposal, and recycling in the concept of a green library. Careful site selection and maximizing indoor library environment quality are essential for the upcoming generation. Antonelli (2008) highlighted several reasons why libraries should construct their buildings sustainably or include green elements. First, it has become economical to build green buildings. Libraries can now construct green structures within traditional budgets. Second, the majority of easily accessible energy sources are finite, necessitating their wise use to protect the environment and the financial stability of libraries.

Vasanthi (2019) argued that green libraries, through their holdings, environmentally responsible infrastructure, and public library programs, inform the public about environmental issues. Green library initiatives have encouraged libraries and their patrons to support ecological sustainability (Akbulut et al., 2017). Luis and Moncayo (2012) outlined three steps for building a green library: people, purpose, and process. Meher (2017) provided valuable insights into what a green library is and the challenges libraries encounter while going green, focusing on Indian libraries. As India is a developing country, the suggested green applications can be adapted for Bangladeshi libraries.

Gloria Pérez-Salmerón, former President of IFLA, argued that only an inclusive, worldwide response from a united library field can meet and overcome the challenges due to ever-increasing globalization (Vladimir, 1967). Fedorowicz-Kruszewska (2023) highlighted several obstacles to implementing the green library concept, including the ambiguous definition of a green library, the absence of green library evaluation criteria, and the lack of well-developed tools for tracking national progress toward the SDGs in terms of the environment. Libraries that most effectively demonstrate their dedication to environmental sustainability are recognized with the IFLA Green Library Award. The award recognizes achievements in two categories.

Category 1: Best Green Library

Category 2: Best Green Library Project (Gruyter, 2018).

In Bangladesh, hardly any scholarly works have specifically addressed the idea of a green library. However, a number of research proposals and conference papers related to green libraries have been presented at various conferences and symposiums. Although there is significant global interest in the idea of a green library, Bangladeshi libraries have not yet widely explored it.

Moreover, only the Bangladesh University of Science and Technology (BUET) has initiated a project on green or sustainable libraries. Islam and Widén (2022) showed that public librarians employed by various public libraries were generally familiar with SDGs goals. Additionally, the majority of the librarians felt that their public libraries are making progress toward some sustainable goals. Public libraries are doing well on 7 out of the 17 SDGs (Islam & Widén, 2022).

### **Objective of the study**

The main objective of this study is to provide an overview of the opportunities and challenges of converting the DUL into a green library and to propose a framework for this transformation. The additional objectives are as follows:

- a) evaluate the importance of transforming the DUL into a green/sustainable library
- b) identify the challenges and opportunities of transforming the DUL into a green library and provide possible solutions
- c) explain various techniques and methods for greening the library
- d) suggest a framework for transforming DUL into a green Library
- e) explore how libraries can be transformed into green libraries in Bangladesh.

To achieve these objectives, the study has posed one major research question (MRQ) and four subsidiary research questions (SRQs).

**MRQ:** How can the green or sustainable library concept be embodied in the DUL?

**SRQ1:** What benefits may be derived from transforming the DUL into a green library?

**SRQ2:** What are the perceptions of the DUL users towards greening the library?

**SRQ3:** What perceptions are held by the DUL users and professionals regarding the problems and prospects of turning it into a green library?

**SRQ4:** What concrete steps or ideal activities may be taken to transform the DUL into a green library?

### **Imposition of a green concept in the DUL towards sustainability**

In an effort to lessen environmental waste and reduce their "carbon footprint," academic libraries are incorporating more ecologically friendly methods into their daily operations and user services (Jankowska, 2010). When it comes to educating

students and running environmentally responsible institutions, academic libraries support the green mission.

Concerns over widespread resource exploitation and pollution in the United States led two professional library groups, the Special Libraries Association and the American Library Association, to form in the late 1960s (Abbey, 2020). Libraries, community centers, and knowledge hubs all contribute to environmental protection and the preservation of natural resources (Namdeo, 2022). R.Sornasundari & Sara (2016) showed the LEED grading system, which was created in 2000 by the United States Green Building Council (USGBC). The LEED is a nationally and internationally recognized benchmark for the design, construction, and operation of high-performance green buildings (Bangar, 2018). The four layers that contribute to a green building are: Certified = 25- 40 points, Silver = 41-50 points, Gold = 51-60 points, and Platinum = 61-80 points.

The Green Building Council of Australia, which oversees the Green Star system, is currently the most widely utilized certifying body in Australia (Binks et al., 2014). In comparison to conventional structures, the standard Green Star-certified building uses 66% less energy, 51% less water, and emits 62% fewer greenhouse gases than non-certified buildings (Green Building Council of Australia 2009). All these things can be a matter of concern while greening the DUL.

The essential areas presented in Figure 1 were taken into consideration while implementing the green concept in the DUL:



Figure 1. Main elements of a green library.

[Source: The Authors]

**1. Site Location:** Library site selection is crucial. The facility should be accessible by public transportation, and parking lots should prioritize fuel-efficient vehicles. Libraries should be near other service facilities in a densely populated region (Pangail, 2015).

**2. Water Conservation:** Rainwater harvesting can be used for toilets, bathrooms, irrigation, cleaning, and more. Library landscaping and plants can save a lot of water. Waste or stormwater can be used for irrigation. Sensor taps and dual flush toilets need to be used. Waterless urinals reduce bathroom water use.

**3. Energy efficiency:** Solar, wind, and hydro generate power (water). Solar power generates electricity from sunshine. Wind turbines on towers are best for rural or non-urban locations. It is the most important LEED category. Solar panels on the library roof can generate electricity utilizing direct sunlight. Solar and wind power can conserve electricity in the library.

**4. Building Materials:** Up to 40% of landfill space is construction trash. The library should select resources to reduce waste. Using recyclable and environmentally-friendly products is another duty.

**5. Indoor Air Quality:** Lack of ventilation makes buildings expensive to cool and traps dangerous chemicals that damage respiratory systems. Less air conditioning use reduces ozone layer gaps and global warming. The benefits range from physically cleaner air to direct effects on psychological health, task performance, disease reduction, productivity, lower stress, and unpleasant sensations, and noise reduction (Pangail, 2015).

**6. Hardware:** Green PCs and laptops use less power than desktops. Biodegradable dust cloths and old t-shirts are eco-friendly computer cleaning tips. Computers should be recycled instead of thrown away. Recycled ink cartridges should be purchased. Electricity, paper, and money should be saved by connecting many computers to one printer. Online faxing saves paper.

**7. Innovative smart technology:** In order to support the green library initiatives and make their libraries as green as possible, library professionals should use innovative smart technology tactics. A study suggests that library professionals should promote technology-enabled systems that have a good influence on the environment more widely (Kalpana & Gopalakrishnan, 2016).

**8. Green Technologies:** When replacing technology, look for those that are more environmentally friendly, resource-efficient, with recyclable waste and by-products. The library may effectively use the four green technologies—biomass power, solar thermal, solar photovoltaic (PV), and wind energy—to make it green (Chaudhuri, 2015).

Thus, the responsible authority for greening the DUL can implement the above techniques by utilizing the mentioned elements. They can also consider some International Standards to assess green libraries. Such as: LEED, BREEAM,

Chicago Illinois Standards, Brown Green Standard, or IGBC Indian Green Building Council Standard.

The green librarian's position is the most flexible and the librarian goes by the name "eco librarian". Choudhury (2019) emphasizes on librarians educating themselves about green resources and practices can be the 1<sup>st</sup> step toward greening libraries (Choudhury, 2019). While showing the activities of librarians in the green library movement Nikam (2017) suggested usage of e-books, e-journals for space-saving methods for making soft copies, microfilming ancient books, and weeding out outdated books, using discussions, seminars, and conferences to promote green library tools, managing library expenditures to assist organizations, employing wooden furniture and biodegradable materials, using wool bricks instead of burnt bricks as construction material, and using solar tiles or panels for library roofing, replacing steel with bamboo, and using rooftop.

Some suggestions from this study can be considered in a planned and systematic way for transforming the DUL into a green library by the followings:

- (a) All colleges and universities should be required by the University Grants Commission (UGC) to obtain approval before constructing green buildings and libraries.
- (b) Libraries can make use of a range of resources to spread the "green concept" and inform users about their green buildings' qualities. These consist of "going green" related library exhibits, books, and programs.
- (c) Through awards and financial assistance to maintain such libraries, the government should take action to encourage green libraries.
- (d) To maintain sustainability, libraries might organize strategic planning and thinking sessions.
- (e) Utilizing electronic storage techniques and technologies and leveraging shared email folders as searchable content and information repositories
- (f) Substituting hazardous chemical cleaners with ecologically friendly alternatives to cleaning
- (g) Finding librarians who are eager to advance green library practices and support them.
- (h) Library students should be taught about sustainability in library construction so that future librarians will adopt these concepts.
- (i) Utilizing cloud-computing services more effectively to reduce your reliance on printed materials.

Future librarians are urged to take on green library initiatives and seize the opportunity to advertise libraries in novel, customer-focused, sustainable ways.



Additionally, this is a good time for the DUL librarians to promote and expand the green library movement in our country.

### **Research population and methodology**

The study area was divided into two-parts: part 1- focuses on the opinion of greening the DUL and its potential challenges and opportunities from the user point of view and part 2- focuses on the opinion of greening the DUL and its potential challenges and opportunities and the ideal activities of a green library from the professionals' point of view.

Participants were chosen from a central public university library in Bangladesh for distributing questionnaires and collecting data. There were two types of questionnaires, one is for the users of the DUL, and another one is for some selective library personnel. This data collection was carried out over one month. There were 404 user respondents and 15 professionals. Different types of data collection techniques were used for collecting data from respective respondents. A qualitative and quantitative survey was conducted to collect basic data from all participants. A closed-ended questionnaire was used for this study, with respondents having to choose from a list of alternatives and there were a few open-ended questions employed. The questionnaire included: demographic characteristics such as gender, highest degree or level of education; awareness of green library and its related issues among participants; their opinions on the potential opportunities of greening the DUL; their opinions on the potential challenges of greening DUL; their perception of the ideal activities of a green library. Moreover, the authors took a remote access account to get access to library materials remotely and review some helpful library materials. Every response to the questionnaire was carefully reviewed after the information had been gathered from users and experts to look for any issues that might render the questionnaire invalid for further investigation. Progressive analysis of the questionnaire then started. The gathered data were examined using the SPSS 25 software. The results of the analysis were presented statistically using percentages, graphs, tables, and charts. In this study, collected data was analysed using the frequency analysis method and a Crosstab Analysis between participants' gender and education had been done to know how many male or female respondents were undergraduates or graduates or postgraduates among the total respondents.

### **Data analysis and result**

The questionnaire was employed to solicit opinions and viewpoints from the DUL patrons and professionals regarding the study. The response was examined using descriptive analysis.

*Data Analysis of Users' Survey:* Table 1 presents demographic information. Among 404 respondents, 168 (41.6%) were male, and 236 (58.4%) were female.

Undergraduates represented 56.44% (228 participants), 19.6% (79 participants) were graduate students, 23.8% (96 participants) were post-graduate, and .2% (1 participant) was a Ph.D. student.

**Participants gender**

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Male	168	41.6	41.6	41.6
	Female	236	58.4	58.4	100.0
	Total	404	100.0	100.0	

**Table 1. Gender of the respondents.**

**[Source: The Authors]**

Table 2 presents gender and education crosstab analysis. 236 participants were women. Female undergraduates dominate. 144 undergraduate women, 44 graduates, 48 post-grads, and 0 Ph.D. Then, among male participants, there were 84 undergraduates, which was the highest, 48 post-graduates, 35 graduates, and only one Ph.D. student.

**Participants' gender and education level Cross tabulation**

		Undergraduate	Graduate	Post-graduate	Ph.D.	Total
Participants gender	Male	84	35	48	1	168
	Female	144	44	48	0	236
Total		228	77	96	1	404

**Table 2. Cross-tabulation of participants' gender and educational enrolment.**

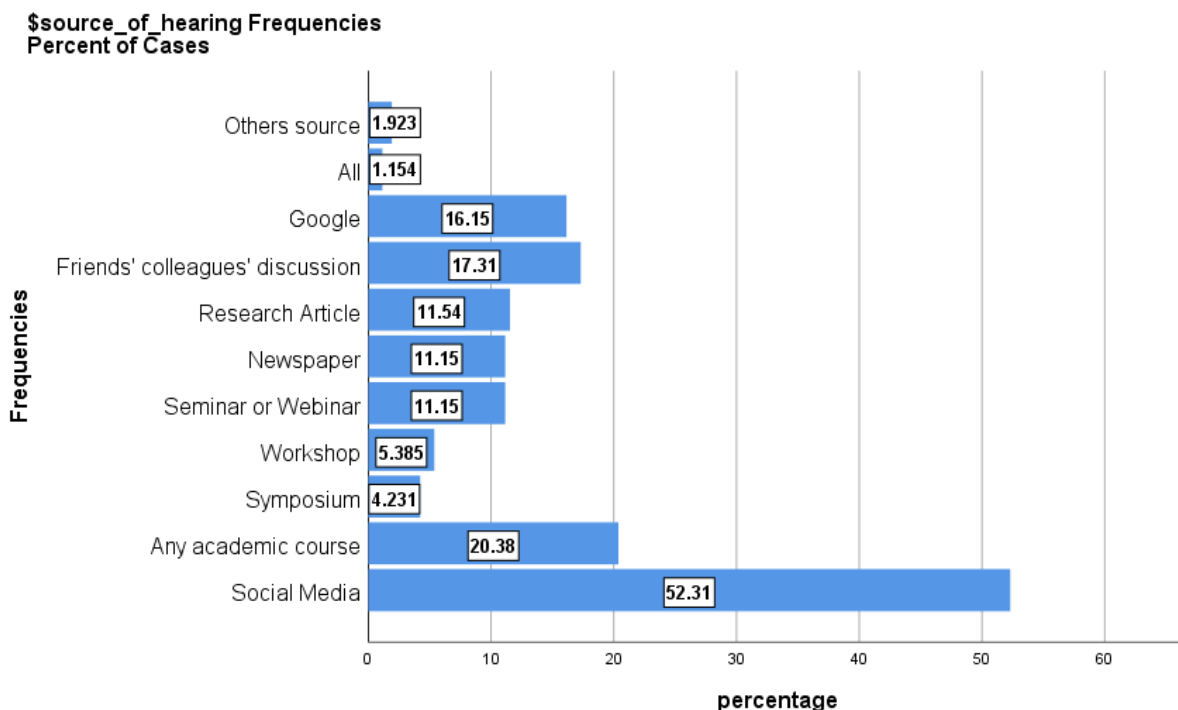
**[Source: The Authors]**

By investigating the frequency of library visits, the authors found that among 404 participants, the majority of the respondents (43.8%) visited the library seldom, followed by only 18.1% every day, 15.6% once a month, and 12.1% once a week. The rest of the respondents (10.4%) were others who visited the library 2 times a month or never.

At the beginning of converting the DUL into a green library, it is very important to know what the users thought, whether they are interested in an eco-friendly library or not. It had been found that 289 of the 404 (71.5%) respondents had thought they were not provided an eco-friendly library and 99 (24.5%) users had thought they were provided an eco-friendly library by the DUL. The rest of the respondents (3.96%) had been thinking the DUL is providing some eco-friendly services.

This study found out the frequency and percentage of how many people heard the term “green library” among the users of the DUL. From the frequency test of the investigation, the study found that only 31.68% (128 participants) heard this term, 34.65% (140 participants) heard about the term very little, and the rest of 33.66% (136 participants) never heard this term at all. The participants who had heard about the green library, from them the study had come to know that different users heard the term from different sources.

Figure 2 revealed that most of the users became aware of the green library from social media (52.31%), while 20.38% of respondents came to know the term from their academic courses, 17.31% from friends and colleagues, and only 16.5% from google. We also came to know that 11.54%, 11.15%, 11.15%, 5.38%, and 4.23% of users heard the term through research articles, newspapers, seminars or webinars, workshops, and symposiums respectively. Only a few (1.92%) mentioned that they came to know about the green library concept from other sources.



**Figure 2. Frequency of the sources of hearing about green libraries. [Source: The Authors]**

Table 3 presents the frequency and percentage of the respondents' responses against some awareness-assessing questions to find out the awareness of green library, sustainability, and its library related issues.

<b>Awareness assessing Questions</b>	<b>Yes, Have sound understanding</b>	<b>Yes, Have moderate understanding</b>	<b>No, Have poor understanding</b>
Do you know about green libraries or sustainable libraries and their functionality?	14.60%	47.77%	37.62%
Do you agree that the green library development is very pertinent?	46.29%	42.57%	11.14%
Do you agree that an eco-friendly environment is equally important and applicable to the library?	69.55%	26.24%	4.21
Do you agree that achieving and fostering sustainable library functions can secure the future of Dhaka university library?	71.29%	21.53%	7.18%
Do you think that transforming DUL into a green library can inspire others to adopt this technique?	70.54%	22.52%	6.93%
Do you agree that we need training campaigns on sustainability issues?	74.26%	19.80%	5.94%
Do you agree that in COVID situation going green, which refers to ecologically responsible decisions and lifestyle, is more important than ever?	66.34%	26.73%	6.93%

**Table 3. Awareness of a green library and sustainability.**  
**[Source: The Authors]**

Table 3 shows 193 of the 404 (47.77%) of users mentioned that they knew about the concept of green library and its functionality, but they did not have enough knowledge about the concept, 152 (37.62%) of users mentioned they did not know about the concept and its functionality and only 59 users (14.60%) knew about the green library and its functionality. Meanwhile, among the people who knew the concept very well, most of the users thought that green library development is very pertinent, which was 187 of the 404 respondents (46.29%). Among the people having limited knowledge about the green library, 172 users that were 42.57% mentioned that green library development is very pertinent. Of the 45 users (11.14%), they mentioned that they did not know about this at all. Among the 281 or 69.55% of respondents who indicated a sound understanding of the concept of green libraries, most indicated the concept is very important and applicable. However, 106 users (26.24%) mentioned that the green library is very important to those who

were having limited knowledge about the green library. Only 17 users (4.21%) mentioned that they did not know about this at all. Moreover, most of the users had been thinking that accomplishing and fostering sustainable library functions could secure the future of the DUL and who knew the concept very well, which was 288 of the 404 respondents (71.29%). Only 87 users (21.53%) mentioned that green acquiring and fostering sustainable library functions could secure the future of the DUL, who had limited knowledge about the green library and 29 users (7.18%) mentioned that they did not know about this at all. Most of the users had been saying converting the DUL into a green library could inspire other libraries to begin this technique in their library, which was 285 (70.54%). 91 users (22.50%) mentioned that converting the DUL into a green library could inspire other libraries to begin this technique in their library who had limited knowledge about green libraries. 28 users which was 6.93% mentioned that they did not know about this at all. Most of the users 74.26% had been saying they needed training campaigns in this sustainable or green library issue. Of the 80 users that were 19.80% mentioned that they needed training campaigns in this sustainable or green library issue who were having limited knowledge about the green library. 24 users which were 5.94% mentioned that they did not know about this at all. Most of the users 66.34% had been thinking that in COVID situation, going green, which refers to ecologically responsible decisions and lifestyle, is more important than ever. 108 users (26.73%) mentioned that in COVID situation, going green, which refers to ecologically responsible decisions and lifestyle, is more important to those who were having limited knowledge about the green library. 28 users (6.93%) mentioned that they did not know about this at all.

Table 4 shows the level of agreement and disagreement of the respondents regarding the potential opportunities of greening the DUL by investigating the frequency and percentage of the respondents' responses. Table 4 reveals that 63.86% respondents strongly believed that DUL could give a green or eco-friendly library to society. Only 24.26% moderately agreed that DUL could become a green library and 10.89% said they were neutral. Only 1 participant moderately disagreed that the DUL could become a green library and 3 respondents strongly disagreed the DUL could become a green library. While 44.31% of respondents said DUL's green library might be an example to other libraries, 21.53% said they were neutral, and 1.24% moderately disagreed that DUL green library could be an example of other libraries and only 1 participant strongly disagreed that DUL green library could inspire other libraries to use similar greening techniques. Only 28.96% respondents said the DUL green library could inspire other libraries to use similar methods and 10.40% of users said they were neutral while 1.73% moderately disagreed that DUL green library could motivate other libraries to use similar strategies. However, 50.25% users strongly agreed that turning DUL into a green library might promote social justice and equity.

<b>Opportunities</b>	<b>Highly agree</b>	<b>Modeely agree</b>	<b>Neutral/ Do not know</b>	<b>Moderatel y disagree</b>	<b>Highly disagree</b>
Green or eco-friendly library	63.86%	24.26%	10.89%	.25%	.74%
Exemplary library performance	44.31%	32.67%	21.53	1.24%	.25%
Inspire others to begin using similar techniques	58.91%	28.96%	10.40%	1.73%	-
Implement social justice and equity	50.25%	26.98%	20.05%	1.49%	1.24%
Ensure a healthy library indoors and outdoor environment	69.80%	20.79%	6.19%	2.23%	.96%
Increased financial stability for library and community	56.44%	23.76%	15.35%	3.47%	0.99%

**Table 4. Perceptions of potential opportunities for transforming DUL into a green library. [Source: The Authors]**

Meanwhile, 26.98% of the respondents said that turning the DUL into a green library would promote social justice and equity. The 20.05% users said they were neutral.

Only 6 respondents moderately disagreed that making DUL a green library might promote social justice and equity and 5 respondents strongly disagreed. Table 4 shows that 69.80% users strongly believed that the DUL green library would ensure a healthy indoor and outdoor environment when 20.79% respondents said DUL green library would ensure a healthy library indoor and outdoor environment. Only 6.19% of respondents said they were neutral while 2.23% respondents said the DUL green library would ensure a healthy library indoor and outdoor environment, and 4 of them strongly disagreed that DUL green library would ensure a healthy library indoor and outdoor environment. Almost 56.44% (228/404) respondents strongly agreed that DUL becoming a green library would improve financial stability for the library and community and 23.76% respondents said that making DUL into a green library would improve financial stability for the library and community. About 15.35% (62/404) respondents said they were neutral and 3.47% (14/040) said that making DUL a green library would improve financial stability for the library and community. Only 4 of 404 respondents said that making DUL a green library would not improve financial stability for the library and community.

Table 5 displays frequencies of opinions on potential challenges of transforming DUL into a green library.

<b>Challenges</b>	<b>Highly agree</b>	<b>Moderately agree</b>	<b>Neutral/ Do not know</b>	<b>Moderately disagree</b>	<b>Highly disagree</b>
Technological barrier	54.46%	32.43%	11.14%	1.24%	0.74%
Institutional rules and norms	41.34%	37.38%	16.34%	3.71%	1.24%
Financial barrier	53.47%	24.01%	13.37%	5.45%	3.71%
Government rules and norms	28.22%	28.47%	28.71%	9.16%	5.45%
Inadequate awareness, knowledge & expertise	53.22%	31.44%	11.14%	1.73%	2.48%
Insufficient willingness of the user	34.16%	29.46%	18.81%	11.39%	6.19%
Insufficient willingness of staff	41.58%	28.96%	17.82%	7.18%	4.46%
Inadequate support & encouragements	55.69%	27.23%	11.63%	3.17%	1.73%

**Table 5. Perceptions of potential challenges for transforming the DUL into a green library. [Source: The Authors].**

It presents that most of the respondents highly agreed that technological barriers, institutional rules and norms, and financial barriers present challenges in

transforming DUL into a green library. Only 28.71% of respondents mentioned that they were neutral that government rules and norms could be a challenge in transforming DUL into a green library. And finally, the majority of respondents highly agreed that inadequate awareness, knowledge and expertise, insufficient willingness of users, insufficient willingness of staff, inadequate support and encouragement could be a challenging issue while greening DUL.

*Data Analysis of professionals' opinion*

The section was created with feedback from 15 professionals working in different positions at the DUL . The analysis included their perceptions and practical experiences regarding transforming DUL into a green library.

*Demographic profile of professional respondents*

Table 6 shows that the respondents were 3 deputy librarians, 5 assistant librarians, 1 librarian, 3 senior cataloguers, 2 research officers, and 1 senior technical officer. Moreover, the collected data revealed that most of the respondents' highest educational qualification was a Master's degree; only two had a doctorate, and one had a diploma.

<b>Present Designation</b>	<b>Highest Academic Qualification</b>
Deputy Librarian	Master's degree
Assistant Librarian	Master's degree
Librarian	Doctorate degree
Assistant Librarian	Master's degree
Senior Cataloguer	Master's degree
Assistant Librarian	Master's degree
Senior Cataloguer	Master's degree
Deputy Librarian	Master's degree
Deputy Librarian	Master's degree
Assistant Librarian	Master's degree
Research Officer	Master's degree
Assistant Librarian	Master's degree
Senior Cataloguer	Master's degree
Senior Technical Officer	Diploma or equivalent
Research Officer	Doctorate degree

**Table 6. Demographic profile of the professional respondents.**

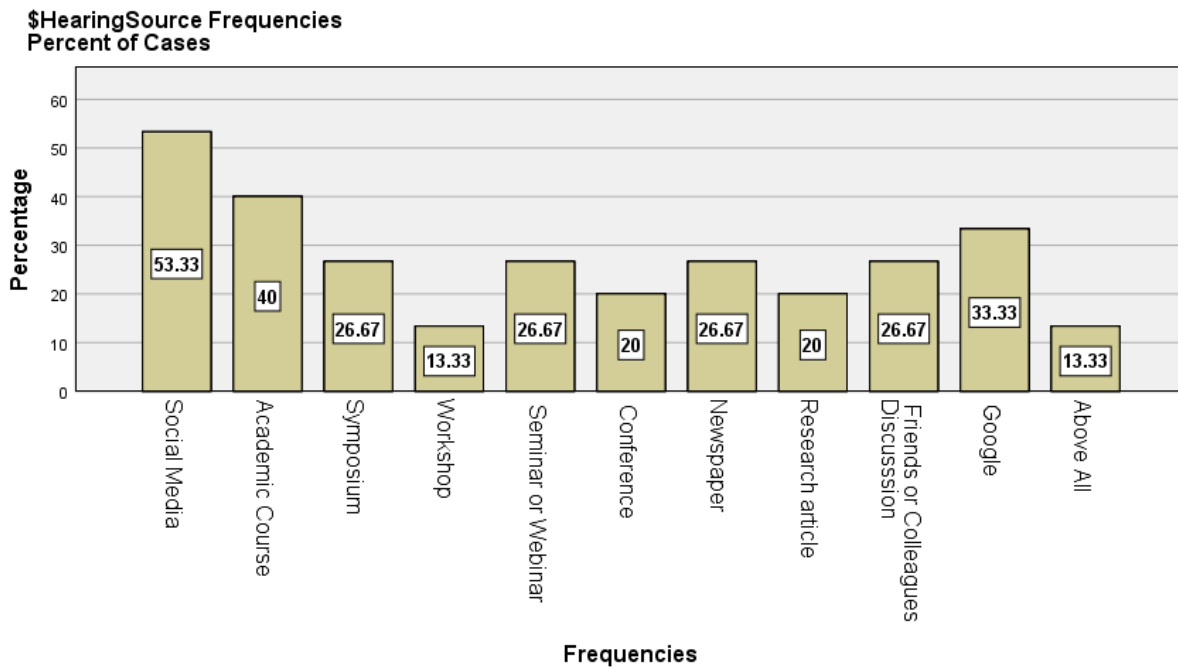
**[Source: The Authors]**

*Knowledge about the green library concept among professionals*

All 15 respondents heard the term green library. All respondents thought that it is very important to implement a green approach in the DUL. When information professionals were asked where they heard the term "green library," the poll found



that most of the professionals heard the term from social media (53.33%), 40% of respondents listened to the term from the academic course, 33.33 % of professionals heard the term from google, 26.67% professionals heard the term from symposium/seminar/newspaper/friends or colleague discussion, and only 20 % heard from research article and workshop.



**Figure 3. Sources of learning the concept of green library among professionals. [Source: The Authors]**

*Awareness of green library, sustainability, and its related issues among professionals of DUL*

The opinion of professionals revealed that 53.3% of respondents had a sound understanding of the green library functionality, 33.3% had a moderate understanding, and the rest of them had a poor understanding of its functionality. Moreover, 60.0% of respondents agreed that an eco-friendly environment is equally important and applicable to the library, but only 26.7% had an idea of how to transform the DUL into a green library. Also, more than 60% of professionals thought that accomplishing and maintaining sustainable library functions could secure the future of DUL and it could inspire other libraries to adopt green techniques. In addition, 53.3% thought they had the need for training campaigns on sustainability issues, and 46.75 respondents agreed that in COVID situation, going green, which refers to ecologically responsible decisions and lifestyle, is more important than ever.

*Perception of ideal activities of a green library*

Twelfth professional mentioned that collecting, using, and implementing green or eco-friendly materials and technologies could be ideal activities for a green library. They also said that carbon footprint reduction (through less paper use, rooftop and

backyard gardening, library automation, increased virtual and online services, etc.) could also be an approach to greening DUL. Nearly 86% of respondents agreed that waste management, water efficiency, confirming sustainable indoor environment quality (proper lighting, thermal, acoustics, ergonomics), securing health and hygiene within the library, sustainable preservation and conservation, sustainable and effective collection development could be the functionalities of the green library. However, very few mentioned extension services to socioeconomically marginalized people as the activity of a green library.

#### *Perceptions of potential opportunities for transforming DUL into green library*

Professionals were asked to give their opinions on potential opportunities while transforming the DUL into a green library. Almost 80% of respondents highly agreed that a green library would help to grow sustainability awareness, create an eco-friendly library, inspire other libraries to begin using similar techniques, and ensure the indoor and outdoor environment. Nearly 50% of total respondents said the DUL green library would contribute towards the UN 2030 agenda.

#### *Opinions on potential challenges for transforming DUL into green library*

Professionals of the DUL were asked to give their opinions on potential challenges while transforming DUL into a green library and 46.7% of the total respondents mentioned that technological barriers could be a barrier to greening the DUL. Almost 60% mentioned that institutional rules and norms, inadequate awareness, knowledge and expertise, and inadequate support and encouragement would be challenges in transforming DUL into a green library. Only 20% of professionals thought the government's rules and norms could be a barrier to greening DUL. Moreover, most of them were thinking of staff and users; both groups were willing to give and take the facilities of a green library.

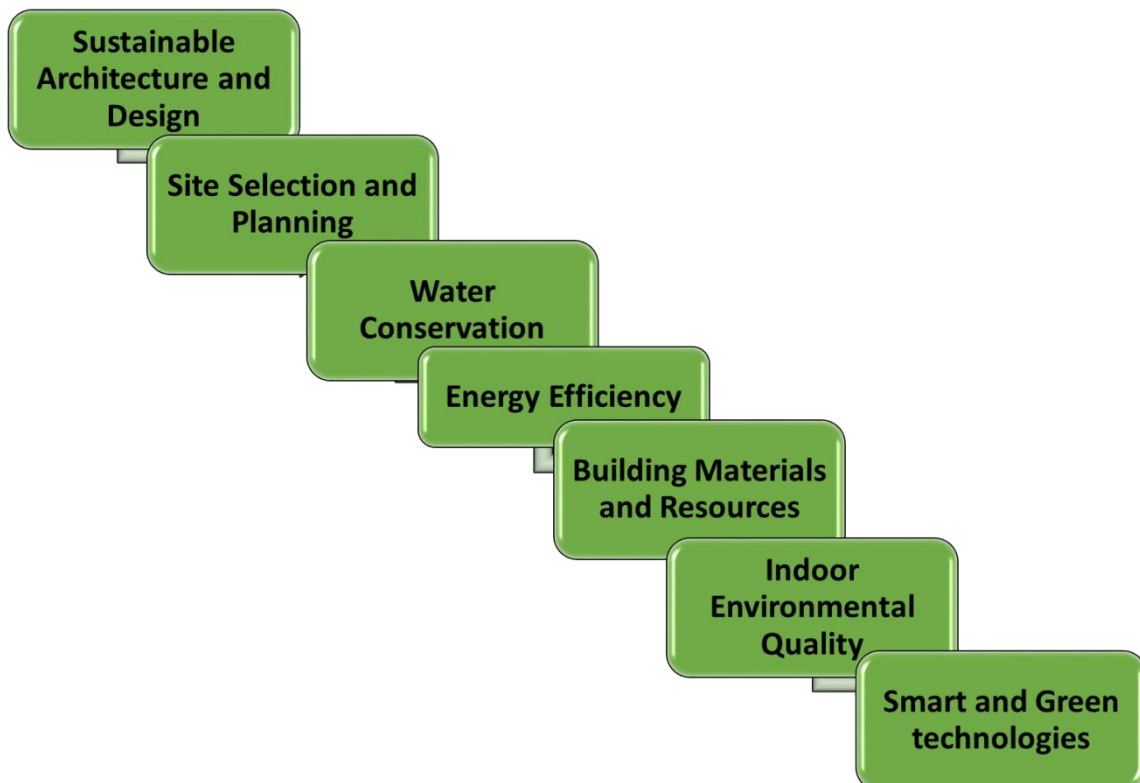
Professionals of the DUL were asked to suggest any other important factors that responsible authority should also take into consideration while transforming DUL into a green library. The different staff members mentioned their different suggestions. They indicated that the responsible authority should make a maximum effort to use electronic resources and omit carbon-based materials and documents, increase their use of electronic media, they should increase the use of solar light, and give more focus to the conservation of water as well as the use of star rating devices to save electric energy, which would be beneficial to the library and the environment.

### **Findings and recommendations**

One major research question and four subsidiary research questions were addressed in this study and produced a diverse range of findings.

MRQ#1: From this study, the authors have come to learn in this stage that a large budget is not necessary for the development of a green library. To make a library green, it requires understanding of green practices and some effort of knowledgeable participants.

By considering some areas, elements, standards and gradual steps a green library can be embodied in the DUL. For this reason, this study suggest the following framework:



**Figure 4. Considerable framework for transforming DUL into a green library. [Source: The Authors]**

The authors have found that almost 99% of respondents gave their positive opinion towards turning the DUL into a green library. Most of the respondents were interested in receiving the library's green service. From the professional respondents, the authors came to know that there are so many challenges that might be faced while greening the DUL. Most participants mentioned financial barriers, smart green technological barriers, and government rules and norms barriers (20% respondents). However, staff were willing to give the green library facilities and do something for the environment by greening the DUL. They also suggested making an effort in using electronic resources, solar lights and excluding carbon resources.

There are many standards (LEED, BREEAM, Brown Green, IGBC Indian Green Building Council Standard) that should be considered in transforming the DUL into a green library.

By considering the above framework, some standards of a green library could be embodied in the DUL. Given Bangladesh's current environmental situation and the need to protect its natural resources, green practices are now essential to the country's sustainability. As a premier institution, the DUL must take the lead in raising public knowledge of green practices.

SRQ#1: This study found some significant importance that might be derived from transforming the the DUL into a green library:

Even while there is a logical connection between the green library and the larger green building movement, libraries have unique requirements that generate problems. While building a green library the responsible authority should keep their concerns about the potential challenges that might face. This study found that there would be so many challenges or problems faced while greening the DUL. Most of the respondents (around 60%) think (1) technological barrier, (2) financial barrier, (3) inadequate awareness and knowledge and expertise, (4) inadequate support and encouragement all of these can be potential challenges. The authors also found that few respondents were thinking (5) government rules and norms, (6) insufficient willingness of the user and staff; these are potential challenges while transforming DUL into a green library.

SRQ#4: Nearly 90% of respondents highly agreed that collecting, using, and implementing green or eco-friendly materials and technologies could be ideal activities for a green library. They also agreed that a decrease in carbon footprint (through less paper use, rooftop, backyard gardening, library automation, increased virtual and online services) could also be an approach to greening the DUL.

From the above study, the authors made a list of ideal activities that might be taken to transform the DUL into a green library:

- Green certification and sustainability evaluation for the library
- Building a green library through design and development
- Energy efficiency and considerations for the use of renewable energy
- Waste management
- Water efficiency
- Use and purchase of environmentally friendly products and technologies
- Reduction of carbon footprint through using less paper, rooftop and backyard gardening, automation of libraries, expansion of virtual and online services, etc.
- Assuring sustainable indoor environment quality (proper lighting thermal, aural), health and hygiene. Moreover, ensuring infrastructure and access for people with disabilities.
- Collaborations and engagements with outside groups for sustainability
- Judicious use of funds and pursuit of new opportunities for allocations of funds and encouragement of the local economy

The implementation of a green environment can be accomplished in the library by emphasizing energy savings, efficient use of resources, increasing natural environmental exposure, environmental load reduction, and sustainability concerning the friendly environmental library (Hafit & Abdullah, 2018).

Based on the literature analysis and the results, this study has proven to be one of a kind in Bangladesh. Analysing the data of the DUL users and professionals the following measures should be fruitful to develop a green library. The following actions should be successful in creating a green library after analysing the information provided by DUL users and professionals:

- Information workers, library staff, and patrons should all be made aware of and responsive to the green facilities offered by the green library.
- This investigation will also raise awareness among library experts and practitioners on the benefits and use of a sustainable green library.
- Researchers, scholars and professionals in this particular field will be able to practice and operate libraries as per the category recognized by IFLA green library award and will be more conscious about the sustainable library.
- Then, through library seminars, workshops, guest lectures, handbooks, websites, notices, brochures, and other means, the green library concept can be extensively disseminated. Professionals in libraries should therefore make it a point to spread this message on a national and international scale. Each person must carry out their own responsibilities and uphold the law of the land. It is obvious that "becoming green" should begin at the ground level. The entire mission will then be a huge success.

By its choices and preferred possibilities, the library is able to provide environmental leadership for a sustainable future. By acknowledging its green function, libraries can also encourage their users and society at large to actively practice environmental consciousness.

### **Conclusion**

This study assessed public opinion in Bangladesh about the greening of libraries. The goal of gathering professional and user perspectives is to give library patrons and staff across the nation a greater knowledge of the value and application of a green library. As a result, this study suggests the following items for the library's authorities to take into account in order to successfully implement green practices:

- UGC (University Grants Commission) should provide funding to academic institutions to upgrade their library buildings and turn them into green libraries.
- Libraries can make use of a range of resources to spread the "green concept" and inform users about their green buildings' qualities. These consist of becoming green related library exhibits, books, and programs.
- The government should take action to support green libraries by giving them awards and funding to keep them operating.

- The next librarians can be asked to take up tomorrow's green library initiatives and seize the opportunity to advertise the library in a novel, client-centered, and environmentally friendly manner.
- Librarians can investigate the “IFLA Green Library Award” recipients' experiences.

The future might not be smooth for green libraries in Bangladesh, however, it is crucial to plan green libraries, and Bangladesh has to learn about it. IFLA in its statement, recognizes the significance of a commitment to sustainability to meet the needs of the present without sacrificing the capacity of the future (IFLA,2002).

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