



Green Libraries as Model of Sustainability: A Review of Environmental and Economic Benefits

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ABSTRACT

Green libraries have become a significant example of a sustainable approach in the field of library and information science in response to various environmental issues including climate change, depletion of natural resources, pollution and waste management. The review focuses on the development and principles of green libraries and green librarianship and its environmental and economic advantages. A descriptive and analytical review methodology was followed with recently published literature from Web of Science, Scopus, Google Scholar, the journals of the LIS, papers presented at conferences and trusted sources. Energy use, carbon emissions, resource use and waste can be drastically reduced through sustainable collection practices, using green building design, implementing energy efficient technologies, implementing renewable energy, water conservation, waste management, and digital resources. These measures also contribute to economic benefit with lower utilities, maintenance and life-cycle costs, more efficient use of resources and long-term financial sustainability. But financial resources and infrastructure, as well as limited knowledge, poor policy provisions and technology are still hindering implementation. The findings of the study determine that green libraries can combine environmental, economic and social sustainability, contribute to the Sustainable Development Goals, and act as a model of sustainable development in the community.

Keywords - Green Library, Model of Sustainability, Environmental Economic Benefits, Eco-friendly Libraries, Energy Saving Library

INTRODUCTION

Green libraries have become a unique solution of the library and information sector to growing environmental disasters like climate change, resource depletion, and pollution (Putra, 2025). The Green Library Movement gained momentum in the early 1990s, and was centred around the attempts to design, construct, renovate and operate library facilities in a manner that minimizes their environmental impact without reducing the quality of the services they provide to communities (Sakhare, 2025). Further conceptual development has defined green libraries as facilities that incorporate greener policies of building design, day to day activities, collections, technologies, and user interactions, commonly under the umbrella of green librarianship (Barde & Damhare, 2025a). Bibliometric and mapping research indicates that green and sustainable library research has grown worldwide and changed to multidimensional approaches in its focus, though in addition to these other aspects, such as the social and technological aspects of sustainability, are also considered (Li & Yang, 2023) (Rifqi & Puspita, 2025).

Simultaneously with this conceptual development, sustainability has emerged as a core value of librarianship. Libraries are now explicitly included in the roles of promoting the UN 2030 Agenda and the Sustainable Development Goals (SDGs) by international organizations like IFLA and national associations like the American Library Association, where environmental, social, and economic sustainability are interdependent (Tariq et al., 2025) (Gupta, 2020). Increasingly, libraries are taking the role of community sustainability hub, and through collections, programming, and partnerships, are being used to encourage environmental literacy, sustainable behavior, and equity-focused sustainability hubs in local context. The evidence presented in empirical literature of various areas, such as Kenya, Indonesia, and Europe, proves that green libraries can



integrate climate-friendly architecture, energy-saving technologies, and community-building efforts to facilitate ecological responsibility and the well-being of users (Putra, 2025) (Beutelspacher & Meschede, 2020).

Although this growth has taken place, environmental and social dimensions have been the predominant interest of literature and practice where economic returns of green libraries, including energy savings, less maintenance, life cycle efficiencies, and expansionary local economies are frequently discussed but are rarely compiled in a coherent manner. Simultaneously, the lack of sufficient funds, inadequate standards, and ineffective policy frameworks are mentioned as obstacles to adoption time and again, and solid evidence on the economic implications is especially significant to decision-makers (Manohar Ramulu Kondagurle, 2026). A special examination of environmental and economic advantages can thus contribute to filling the gap between theoretical advocacy and practical justifications, providing libraries with more effective reasons to invest, more indicators to evaluate, and patterns of large-scale application.

OBJECTIVES OF THE PRESENT STUDY

- 1) To know the evolution and core concepts of the green libraries and green librarianship.
- 2) To generalize the documented environmental benefits of the green library initiatives, such as energy savings, pollution prevention, and contributions to environmental sustainability efforts.
- 3) To consolidate evidence of economic benefits, such as cost reduction, operational efficiencies, and long term value creation for institutions and communities.
- 4) To identify gaps in research, and practical challenges that should be considered to enhance green libraries as comprehensive models of sustainability within the library and information discipline.

RESEARCH DESIGN AND METHODOLOGY

The research approach is descriptive and analytical review to study the concept and practices of sustainable and green libraries, especially environmental and economic sustainability. Recent academic sources related to the topic were sought using peer-reviewed journals, conference papers, and authoritative web sources. Databases such as web of Science, Scopus, Google Scholar and LIS-specific journals were used. The terms that were used to complete the search process were green libraries, sustainable libraries, environmental sustainability, and economic sustainability. The chosen literature was critically analysed in order to define the common themes, best practices, sustainability indicators, and challenges. The global trends and models of green library initiatives were comprehended through comparative analysis. The results are integrated to provide an overview of the sustainability measures that were taken in the library systems.

Significance of The Study

The significance of the study lies in its contribution to the growing importance on sustainability in the library and information science domain. Through the analysis of the environmental and economic aspects, the paper illustrates the ways libraries can strike a balance between environmental concerns and economic efficacy. It is very useful to library professionals, policy makers and academic institutions that are interested in implementing green practices. It is also a study that promotes informed decision-making by presenting cost-efficient sustainable solutions and benefits in the long term. In addition, it promotes libraries to be a model of sustainability in their respective communities and aids in future research and policy formulation on sustainable library development.

Green Libraries

The Conceptual framework for this review study, which places green libraries as models of the institution that incorporate environmental, economic, and social sustainability and promotes the Sustainable Development Goals (SDGs).



1. Definition and Major Principals of Green Libraries

Green libraries are commonly defined as libraries that have their buildings, operations, services, and collections particularly designed and managed to have minimum adverse effects on the environment and promote to sustainability. The definitions developed by IFLA focus on the choice of location, the employment of natural and low-impact resources, conservation of resources, and responsible waste management, as well as the high quality of the indoor environment (Narendra, 2023) (Fedorowicz-Kruszewska, 2021).

The Online Dictionary for Library and Information Science (ODLIAS) defines “A green library as one designed to minimize negative impacts on the natural environment through careful site selection, use of natural building materials and biodegradable products, conservation of resources, and responsible waste disposal. A library that considers social, economic and environmental sustainability is taken into consideration green and sustainable” (Barde & Dambhare, 2025a).

Based on recent conceptual and empirical literature, the basic principles can be synthesized as:

- Ecological design and operation: buildings which are energy efficient, conserving water, green materials, and low emission interior.
- Sustainable resource management: the use of renewable ones, decreased use of non-renewable ones, less pollution, and maintenance costs.
- Green collections and services: services, collections and programs that promote sustainability literacy and behaviour change.
- Working in the community and in education: libraries as community centers of environmental awareness, participatory programs, and co-designing solutions.

This review considers the concept of green library, sustainable library, and green librarianship as constructs that overlap and the same and which are all based on the same principles.

2. Sustainability Dimensions

Green libraries are conceptualized based on three dimensions that are interrelated and follow the triple-bottom-line and ESG perspectives:

- Environmental sustainability: less energy consumption, better energy efficiency, decreased carbon footprint, less waste generation and recycling, green infrastructure application, and safeguarding both indoor and outdoor environmental quality (Tariq et al., 2025) (Kumar Das & Singha, 2023).
- Economic sustainability: life cycles cost savings due to energy efficient systems, lower maintenance, better utilization of resources (e.g., digital over print where appropriate) and correlation with the principles of the green economy (Kedar & Kedar, 2024).
- Social sustainability: fair access, healthy and ergonomic environments, environmental literacy, resilience of communities, and intergenerational justice through education and inclusion (Mukhopadhyay, 2025).

Within this paradigm, environmental policies (e.g., energy saving) are proposed to create economic gains (cost-saving, operations efficiencies) and also enable social gains (comfort, health and learning), which collectively make libraries sustainable institutions.

3. Role of Libraries in Promoting Sustainable Development Goals (SDGs)

Libraries are presented as drivers of sustainable development, especially in the context of the IFLA Environment, Sustainability and Libraries (ENSULIB) agenda and the UN 2030 SDGs (Sarkar, 2020). Green libraries also assist by:



- Embracing SDGs on climate action, clean energy, sustainable cities and responsible consumption by green buildings, renewable energy and resource-efficient operations.
- Promoting quality education, less inequality, and strong institutions by offering inclusive spaces, environmental knowledge, and sustainability oriented programs.
- Being local nodes in the ESG-related governance, connecting the government, the communities, and other stakeholders in the sustainability efforts.

Green libraries are therefore conceptualized within this framework of being integrated sustainability platforms: through their environmental interventions, they create economic and social value and directly contribute to the implementation of SDGs, by localizing them.

Green Library Practices and Initiatives

Green library practices are the implementation of principles of sustainability in the building design, resource use, and day-to-day activities. The literature points out combined approaches in infrastructure, energy, water, collections and services that contribute to the visibility of libraries as models of sustainability.

a) The Green Building Design and Infrastructure

Green libraries use green building principles (e.g., LEED, IGBC) and climate-wall-friendly design, natural lighting and ventilation, native landscaping, and non-toxic and local materials to minimize energy consumption and enhance the comfort of the indoors (Miao et al., 2024). Examples of cases have demonstrated that optimized envelopes, shading equipment, and passive strategies that are specific to extreme cold or hot climates can have significant effects on lighting up loads in libraries buildings.

b) Energy efficiency and Adoption of renewable energy

It is claimed that high-performance envelopes, efficient lighting and HVAC, and building-integrated photovoltaics (BIPV) or rooftop solar have saved majorly, and result in electricity consumption reduction of 35-60% and gross reduction in carbon emissions (Wang et al., 2021) (Araújo et al., 2024). Solar panels, passive design, and net-zero are used in libraries in Sri Lanka, Finland, Singapore, and the US, providing an environmental and economic value of reducing utility bills (Wijerathne, 2025)(Chiagozie Jefferson Ozoadibe & Hilda Eno Obi, 2023).

c) Water Conservation and Waste Management

Water efficient fixtures, rain water harvesting and green roofs are also useful in reducing the use of potable water and storm water effects, in addition to enhancing building performance and preservation conditions. The most commonly used environmental practices in most libraries would include solid waste and 3Rs (reduce, reuse, recycle), source separation, and e-waste management, but recycling infrastructure and policy support are not evenly distributed.

d) Eco-Friendly Operations, Digital Resources and Sustainable Collection Development

Digitization and e-resources decrease the need to use paper and physical storage and waste significantly, and some green libraries provide most of the resources in digital format and claim to reduce waste levels to 60-70 percent (Ritu, 2024) (Wijerathne, 2025). Eco-friendly friendly collection policies, eco-friendly ICT, remote access, and e-circulation will reduce the carbon footprint of services. Eco-friendly practices comprise non toxic cleaning, green procurement, staff training, user programs and awareness activities that facilitate daily sustainable practices.

Best green libraries represent a combination of green building, efficient and renewable energy systems, water, waste stewardship, collections that are digital-oriented and environmentally conscious daily. These combined



efforts reduce the environmental impact, operating expenses, and make libraries useful models of sustainability to their local community.

Environmental Benefits of Green Library

Green libraries serve as significant institutional model of environmental sustainability in the knowledge centre. Through a combination of sustainable design and resource-efficient technologies, and being environmentally responsible they greatly minimize the ecological footprint that is traditionally linked to library buildings and operations. The environmental advantages of green libraries can be put down in a number of various dimensions which are related interdependently.

A. Carbon Footprint Reduction

Green libraries should be designed, built, and used in a way that minimizes greenhouse gas emissions through the reduction of energy requirements, use of materials with low impact, and prolongation of the lifespan of a building (Antonelli, 2020) (Chowdhury et al., 2025). Embodied energy is conserved through adaptive reuse of existing buildings and through eco-friendly building construction materials, which save the requirement of new resource intensive buildings (Kuunifaa, 2021). A combination of high-efficiency systems, optimized building envelopes, and responsible site selection also leads to the reduction of operational emissions. Cases in India, Kenya, and other areas underline that both green library buildings and retrofits are specifically represented as tools to cut the carbon footprint of library buildings and services (Dada, 2021) (Barde & Dambhare, 2025b).

B. Energy Conservation and Efficient Use of Resources

Green library design and management involve energy conservation as a fundamental goal. Some of these measures are high-performance insulation, day lighting, energy saving lighting design (e.g., LEDs), Advanced HVAC design, and smart controls that match up operation with occupancy patterns. Adoption of renewable sources of energy e.g. solar and wind also reduces dependence on fossil fuels and facilitates in low-carbon operations. Simultaneously, water-saving technologies (rainwater harvesting, low-flow fixtures, efficient irrigation) and digitalization of services (paperless transactions, extended e-collections), increase the efficiency of the resources and make their consumption less water, paper, and other inputs (Ritu, 2024)(Wang et al., 2021).

C. Waste Minimization and Recycling

Green libraries are systematic in the management of solid waste in terms of source reduction, reuse, and recycling. Green library standards and definitions are characterized by the responsibility to manage waste through segregation, recycling facilities, and the e-waste management systems that are environmentally friendly. The movement towards online resources and eco-friendly practices of saving paper leads to a decrease in the amount of paper usage, and the practice of repair, refurbishment, and adaptive reuse of furniture and buildings reflects the principles of the circular economy (D. M. Jain, 2023) (Sharma & Vaja, 2020). All of these methods reduce the area of landfill and the ecological effects of extracting and producing materials and disposing of them.

D. Improved Indoor Environmental Quality

A green library is specifically described as one that reduces negative environmental impact and maximizes the indoor environmental quality by careful site selection, attention to natural and biodegradable materials and the use of non-toxic finishes. Sufficient natural lighting, proper ventilation and pollutant control improves the quality of the air and comfort of the user, which complies with LEED and other green-building standards of healthy indoor environments. Studies indicate that the high levels of the indoor air quality and the availability of natural light are the key to the well-being of users and the idea of sustainable library buildings (Rifqi & Puspita, 2025) (Shukla et al., 2020).



E. Contribution To Climate Change Mitigation

In addition to separate buildings, green libraries also help in mitigating the problem of climate change through the integration of low-carbon infrastructures with environmental literacy and education programs. In several areas, libraries have incorporated green building projects, energy saving practices and climate based programs that emulate low-carbon living and encourages pro-environmental practices on users and communities. By adhering to global standards like the UN Sustainable Development Goals and IFLA ENSULIB guidelines, green libraries become carbon-reducing and climate action agents in their broader socio-ecological environments simultaneously (Shukla et al., 2020) (Barde & Dambhare, 2025b).

Economic Benefits of Green Libraries

A) Cost Savings Through Energy Efficient System

Green libraries could benefit the economy through massive economic advantages as they match environmental stewardship with effective resource management. One of the advantages is the saving of costs by using energy-efficient systems. Green buildings can reduce the use of energy by approximately 40 to 50 percent through energy efficient lighting systems, a modernized HVAC system, and a smart building management system that will result in the direct reduction of utility bills and efficiency in operations (Olaiya et al., 2025). Digitalisation and AI-based controls in the library settings also result in less energy consumption due to the optimization of the light and air conditioning according to the occupancy and necessity.

B) Long-Term Financial Sustainability

These savings form the basis of financial sustainability in the long term. Less energy and water uses, as well as fewer requirements in waste management, during the life cycle of a building stabilize operating budgets and release funds to core informational and community services (I. H. Khan & Munawer, 2024). Green building and campus studies provide evidence that efficiency programmes and smart systems generate sustainable financial benefits when incorporated in the long-term operation and maintenance strategies.

C) Lower Operation and Maintenance Expenses

Green design also provides less operational and maintenance costs. Green buildings use durable, high-quality, and low-toxicity materials that normally require less replacement and less effort in terms of their maintenance, which reduces life-cycle costs (Ifechukwu Gil-Ozoudeh et al., 2024). Maintenance is the key cost driver of vegetated and facade systems but with proper planning and management, these recurring costs are compensated by long-term savings of energy and other services.

D) Return On Investment (Roi) Of Green Technology

The return on investment (ROI) of green technologies is generally positive, if one looks at the life cycle cost analysis. Studies on green buildings have shown that initial higher capital costs are offset by reduced energy and water bills, with payback periods in less than a decade in most cases, and benefit-cost ratios of more than one in most cases (Olaiya et al., 2025)(Ifechukwu Gil-Ozoudeh et al., 2024). Certifications to indicate superior environmental performance can also improve the value of assets and increase the availability of funding, indirectly enhancing financial positions.

E) Optimizing The Budget Through Sustainable Practices

Budget optimization through sustainable practices such as digital collections, AI-driven process automation, resource-efficient operations and smart O&M frameworks minimizes the consumption of resources and extends the life of assets, allowing institutions to fund such savings towards educational, technological and community programmes. In this manner, green libraries become models of environmental as well as economic sustainability.



Case Studies and Best Practices (Review Based)

National and international case studies reveal the way green libraries can be practiced as models of sustainability. Academic and public libraries in Kenya have implemented green renovations, energy efficient infrastructure, and user centred environmental programmes through professional umbrella bodies, but in each case with partial implementation and limited resources (Mwanzu et al., 2023a)(Mwanzu et al., 2023b). The implementation of climate responsive building, management of rainwater and wastewater, and energy efficient technologies to libraries in Indonesia have incorporated local materials and open green spaces, in order to optimise thermal comfort and resource utilisation (Putra, 2025). In the international arena, the best practice libraries supported by the IFLA Green Library Award including Rangsit University Library integrate green building, online services, and environmental literacy to promote the Sustainable Development Goals (Zakaria & Hendi, 2025).

In contrast, libraries in developed conditions, like Vancouver Public Library and Seattle Public Library, have employed LEED certified design, rooftop gardens, rainwater harvesting and efficient lighting to substantially decrease energy consumption and carbon emission, and become visible urban sustainability flagships (Maina & Mwit, 2024). By contrast, Ghana, South Africa, Kenya, and Nigeria libraries are concentrated on incremental steps solar panels, water saving systems, waste management, and sharing resources that will result in tangible environmental benefits although subject to financial and infrastructure constraints (Adeyemi et al., 2024)(Maina & Mwit, 2024)(Mwanzu et al., 2023a). In the Library of Universitas Sebelas Maret (UNS), the user focused studies reveal that libraries that embrace greener practices are perceived to be greener and help to increase user awareness of the environmental practices, although wider lifestyle attitudes might not be achieved spontaneously (Haryanto et al., 2025).

A number of cross cutting lessons come out of these successful implementations. To begin with, the most effective solution is an architectural and technological intervention, which should be entrenched within institutional policies and planning, including green campus policies or UI GreenMetric membership (Haryanto et al., 2025). Second, as an important tool of increasing the environmental and social impact, education and outreach should be prioritised by many IFLA Green Library Award winners (Zakaria & Hendi, 2025). Third, participatory practices involving users in waste reduction, paperless services, and environmental campaigns enhance the ownership and behaviour change in communities (Ajani et al., 2024)(Mwanzu et al., 2023a). Lastly, case studies emphasize the need to have long-term funding, staff capacity, and effective performance indicators that can support and sustain green practices in the long term.

Challenges in Implementing Green Libraries

The implementation of green libraries faces challenges such as Financial, infrastructural, knowledge, policy and technological barriers.

The most notable impediments are always found to be the financial and infrastructural limitations. At the systematic and empirical level of research, the constraint of finances has been demonstrated to limit investment in energy efficient buildings, renewable technologies and retrofitting of old facilities, especially in the developing world (Tuble, 2025)(S. Jain et al., 2025). Except when the building is old and requires replacement, high initial capital requirements in redesigning architecture and converting a building to green facilities and monitoring systems, and outdated or unsustainable infrastructure, large-scale transitions to facilities that are sustainable are hindered (Osman & Dango, 2024)(Sivaprasad et al., 2024).

The second significant obstacle is the absence of awareness and expertise. Indonesian, Indian, Ghana and Kenya reviews and case studies indicate a lack of awareness on the green library concept among librarians, managers and users as well as lack of technical knowledge required to design, operate and evaluate sustainable buildings and services (Osman & Dango, 2024). Poor training opportunities and lack of incorporation of environmental issues in the LIS curricula also further limit professional capacity. Within a specific environment, the perceptions of libraries have been outdated and the general public is less aware of the potential that libraries have in achieving environmental sustainability diminish the acceptance of green initiatives.



Adoption is also slowed down by policy and administrative issues. Research claims that there are no clear sustainability policies, guidelines, and evaluation criteria on the institutional and national levels, in addition to fragmented or ineffective support at management levels (Tuble, 2025)(Haryanto et al., 2025). Another uncertainty that arises among library leaders is related to regulatory complexity and unfamiliarity with legal compliance concerning green buildings and environmental requirements. The administrators and staff resistant to change, the attitudinal holds up implementation efforts, and conflicting institutional priorities.

Lastly, technological constraints have an impact on environmental performance and service innovation. Unstable internet, lack of equipment in the libraries and underdeveloped information system in libraries particularly in rural or resource poor locations make it difficult to implement energy efficient technologies, green computing, and provision of digital services that may lighten the burden on resource consumption. The fact that the technological change is rapid, and not only is it poorly trained and there are no written IT sustainability policies, makes it hard to choose, fund, and upkeep the right green technologies within a long period of time.

Role of Librarians and Library Managers

Librarians and library managers are at the forefront of making green libraries stand as dynamic models of sustainability, other than as efficient buildings.

i) Librarians As Sustainability Advocates

In the USA, Europe, Africa, and Middle East, research indicates that librarians are beginning to consider the importance of environmental sustainability as a part of their professional mission, which is in line with IFLA and ALA recommendations of supporting the SDGs and regarding sustainability as a value of librarianship (Ren & Lu, 2025)(Jackson, 2022). Librarians often position themselves as providers of information, educators, and community builders which can naturalize sustainability behaviours and shape up local policy discussions. There are many such reports of positive attitudes towards sustainability even where practices are lower than desired as a result of constraints.

ii) Training and Capacity Building

Empirical research on best practices in the UAE, Ghana, Nigeria, India, and Ghanaian academic libraries identifies staff training as among the most effective levers to successful green initiatives (Z. I. Khan, 2025)(Cocodia & Ogunbodede, 2025). Training enhances knowledge of green concepts, design and operation of energy efficient services and paperless services, and culture of environmental responsibility among the library staff. Absence of systematic professional development is one of the primary obstacles and has been promoted why sustainability should be incorporated in the LIS curricula and ongoing in-service training.

iii) Community Involvement and User Awareness

Librarians are responsible for user-facing programmes, collections of curated sustainability, displays, lending facilities such as energy meters, workshops and climate literacy events. Partnerships with schools, non-governmental organisations, and municipalities are used by the public and academic libraries to carry environmental education further and promote behaviour change outside the library building (Beutelspacher & Meschede, 2020)(Hamad et al., 2024). Successful interventions are based on practical work, teamwork, integration, and connection to an overall vision of community resilience.

iv) Institutional Policy Support and Leadership Management

Management of libraries determines whether advocacy becomes practice. Research emphasizes the necessity of clear sustainability policies, special budgets, and implementation in line with institutional frameworks like UI GreenMetric or university green campus plans. The role of the managers is to provide roadmaps, metrics and reporting systems such that green services (e.g., digital, paperless and waste-reduction) can be considered a strategic contribution, not a project on its own (Patil et al., 2025)(Osman & Dango, 2024). In a place where



leadership and policy backing is poor, the enthusiasm of staff is not likely to translate into long-term environmental and economic advantage.

Future Directions and Opportunities

Green technologies are emerging and will have a lot of influence in future development of green libraries. Smart systems, IoT, AI, big data and building management technologies can be integrated to maximise energy consumption, minimise waste and help to teach sustainability immersively using technologies like augmented and virtual reality. Smart libraries that integrate smart technologies, smart services and smart people are pointed as a major direction to the green and efficient library future.

A. Strategic and Policy Dimensions

The reinforcement of policy frameworks and strategic planning is once again found to be necessary. Indonesian, Kenyan, and worldwide surveys suggest more precise regulation, institutional sustainability policies, alignment with IFLA checklists and SDGs, and creation of assessment tools and metrics to lead and measure the green library initiative (Mwanzu et al., 2023a)(Putra, 2025)(Narendra, 2023). Collaboration with environmental organizations and cross sector collaboration are also strategic and increases impact.

B. Research, Innovation and Education

According to bibliometric reviews and systematic reviews, it can be observed that green technology in libraries is a developing area and there are some uncharted areas of research like carbon footprint, e waste and in-depth modelling of energy efficiency that provide significant opportunities of research and development.

The integration of sustainability in library and information science education is a decisive chance. The absence of sustainable development materials in LIS curricula is mentioned as a key issue, whereas recent efforts on green librarianship and environmental education introduce sustainable development as a new librarianship paradigm. The long term consolidation of green libraries is perceived to be achieved by preparing librarians as environmental sustainability advocates, innovators, and educators.

CONCLUSION

The green libraries prove that information institutions are able to significantly lower ecological footprint and increase the economic resilience. Environmentally, they reduce negative effects on the natural environment by using eco-friendly building design, renewable energy, minimising waste, conserving water and using digital services to reduce paper and resource usage. They contribute to climate action, enhancement of indoor environmental quality and environmental literacy and pro-environmental behaviours among users. From an economic point of view, green and smart libraries reduce maintenance and operating costs; they improve the efficiency of the use of the resources provided; they are part of a sustainable “green economy” paradigm based on efficient consumption and minimisation of externalities.

Therefore, green libraries act as palpable examples of sustainability, in which environmental, social and economic aspects are combined. They serve as community hubs, where the green infrastructure is integrated with the climate information, outreach and lifelong learning, to support multiple SDGs, such as quality education and climate action. Experience from Kenya, Indonesia, India and elsewhere shows that libraries can help drive campus-wide and community transitions to more sustainable practices even in the face of financial and infrastructural limitations.

Libraries and policymakers have a number of recommendations to make. Libraries should incorporate sustainability into their plans, design their buildings to be energy efficient and climate responsive, provide pap-

erless and digital services, and develop an environmental and economic monitoring plan based on existing checklists (e.g., IFLA or GreenMetric framework). Governments and Governmental entities should ensure dedicated funding for green buildings, establish standards and incentives for green buildings, train professional

green librarians and train professional green ITS and acknowledge libraries as partners in the national sustainability and climate strategies. There is a need for further strengthening of institutional collaboration, user participation and evidence based evaluation to perpetuate green libraries as sustainable models that can be scaled up.

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