

Review Article

Are Academic Libraries Doing Enough to Support the Sustainable Development Goals (SDGs)? A State-of-the-Art Review

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The aim of this study was to assess the role that academic libraries play in realizing Sustainable Development Goals (SDGs). To answer the research question, "How are academic libraries contributing to the attainment of SDGs?" a State-Of-The-Art Review was conducted on SDG contributions from academic libraries. Literature searches were executed using various databases and hand-searching techniques. Inclusion and exclusion criteria were applied, leading to the selection of 25 papers. A majority of these papers represent institutions located in Asia (26.32%), Africa (21.05%), International (15.79%), Europe (10.53%), North America (5.26%), and Oceania (5.26%). During analysis, instances of "SDG washing" (where librarians exaggerated their contribution towards achieving SDGs) were noted. Targets 4:4, 16:10, 4:7, and 12:8 demonstrated closely interlinked relationships, highlighting the importance of providing access to educational resources, job opportunities, and skill development programs, which form an integral part underpinning SDG programming across different library activities depending on leadership roles, organizational culture, individual agency, partnership policies, etc. Furthermore, a Pearson correlation R test revealed positive linear relationships between Target 4:4 and both targets 16:10 & 17:17; these key targets are fundamental for programming under SDG but may vary across different library activities depending on leadership roles, organizational culture, individual agency, partnership policies, etc. It is important to note that evidence from the sample size, consisting only of 164 libraries, should be interpreted with caution as it may not represent all academic libraries globally. The paper highlights the scarcity of sustainability literacy within existing literature, with relatively few examples. Some librarians remain unaware or skeptical about incorporating the SDGs into business as usual library activities. This presents an opportunity for change through awareness-raising efforts and adoption strategies. Moreover, academic librarians must consider various factors when evaluating SDG programs while reporting Global Impact

Framework-based outcomes, as it is a more accurate measurement than goal-level assessments.

Future studies could explore regional differences in achieving GIF-based outcomes, thereby tailoring recommendations accordingly.

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Introduction

The 2030 Agenda for Sustainable Development, themed "leaving no one behind", is anticipated to bring about heightened peace and prosperity for the global population (UNDESA, 2018). The United Nations' (UN) Sustainable Development Goals (SDGs), also referred to as the Global Goals, are enshrined in the 2030 Agenda for Sustainable Development document (Refer to "Fig. 1: Key Elements of the 2030 Agenda for Sustainable Development" and "Table 1: Global indicator framework for the Sustainable Development Goals and targets of the 2030 Agenda for Sustainable Development"). Despite their establishment in 2015, it was not until two years later that nations set objectives for each SDG. The all-encompassing framework that is the 2030 agenda incorporates seventeen SDGs alongside a staggering total of two hundred and forty-eight targets and indicators intended to measure progress towards achieving these goals (United Nations, 2017). All components – including SDGs, targets, and indicators – form part of this overarching agenda. In envisioning its development process, greater partnerships among stakeholders were deemed necessary by UN officials; libraries included amongst them (See Fig.1).

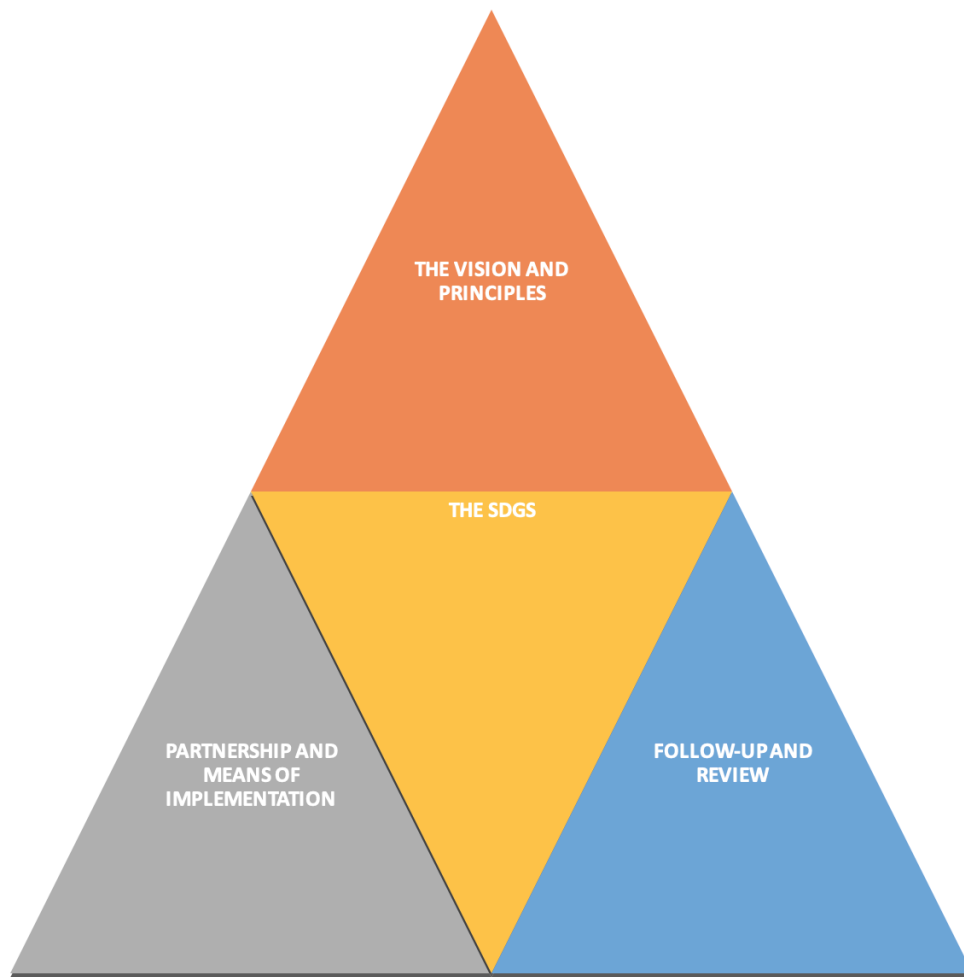









Figure 1. Key elements of the 2030 Agenda for Sustainable Development

Sustainable Development Goals	Icon	Number of targets per goal
Goal 1. End poverty in all its forms everywhere		7
Goal 2. End hunger, achieve food security and improved nutrition, and promote sustainable agriculture		8
Goal 3. Ensure healthy lives and promote well-being for all people of all ages		13
Goal 4. Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all		10
Goal 5. Achieve gender equality and empower all women and girls		9
Goal 6. Ensure the availability and sustainable management of water and sanitation for all		9
Goal 7. Ensure access to affordable, reliable, sustainable, and modern energy for all		5

Sustainable Development Goals	Icon	Number of targets per goal
Goal 8. Promote sustained, inclusive, and sustainable economic growth, full and productive employment, and decent work		12
Goal 9. Build resilient infrastructure, promote inclusive and sustainable industrialization, and foster innovation		8
Goal 10. Reduce inequality within and among countries		11
Goal 11. Make cities and human settlements inclusive, safe, resilient, and sustainable		10
Goal 12. Ensure sustainable consumption and production patterns		11
Goal 13. Take urgent action to combat climate change and its impacts		5
Goal 14. Conserve and sustainably use oceans, seas, and marine resources for sustainable development		10




Sustainable Development Goals	Icon	Number of targets per goal
Goal 15. Protect, restore, and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and biodiversity loss		12
Goal 16. Promote peaceful and inclusive societies for sustainable development, provide access to justice for all, and build effective, accountable, and inclusive institutions at all levels		12
Goal 17. Strengthen the means of implementation and revitalize the Global Partnership for Sustainable Development		19

Table 1. Global Indicator Framework for Sustainable Development Goals

In the age of UNSDGs, academic libraries play a pivotal role in furnishing decision-makers with vital information for socio-economic development. Libraries are inherently positioned to support SDGs given their ability to provide access to resources and information, facilitate learning and education, as well as encourage community engagement. This stems from the traditional humanistic goal of libraries, which is centered on transforming society by providing relevant information that caters to the needs of their respective communities (Cyr & Connaway, 2020). Consequently, it is expected that libraries will strive towards achieving four fundamental pillars of sustainability in their operations: environmental sustainability, economic stability, social sustainability, and cultural vibrancy (refer to “Fig.2).

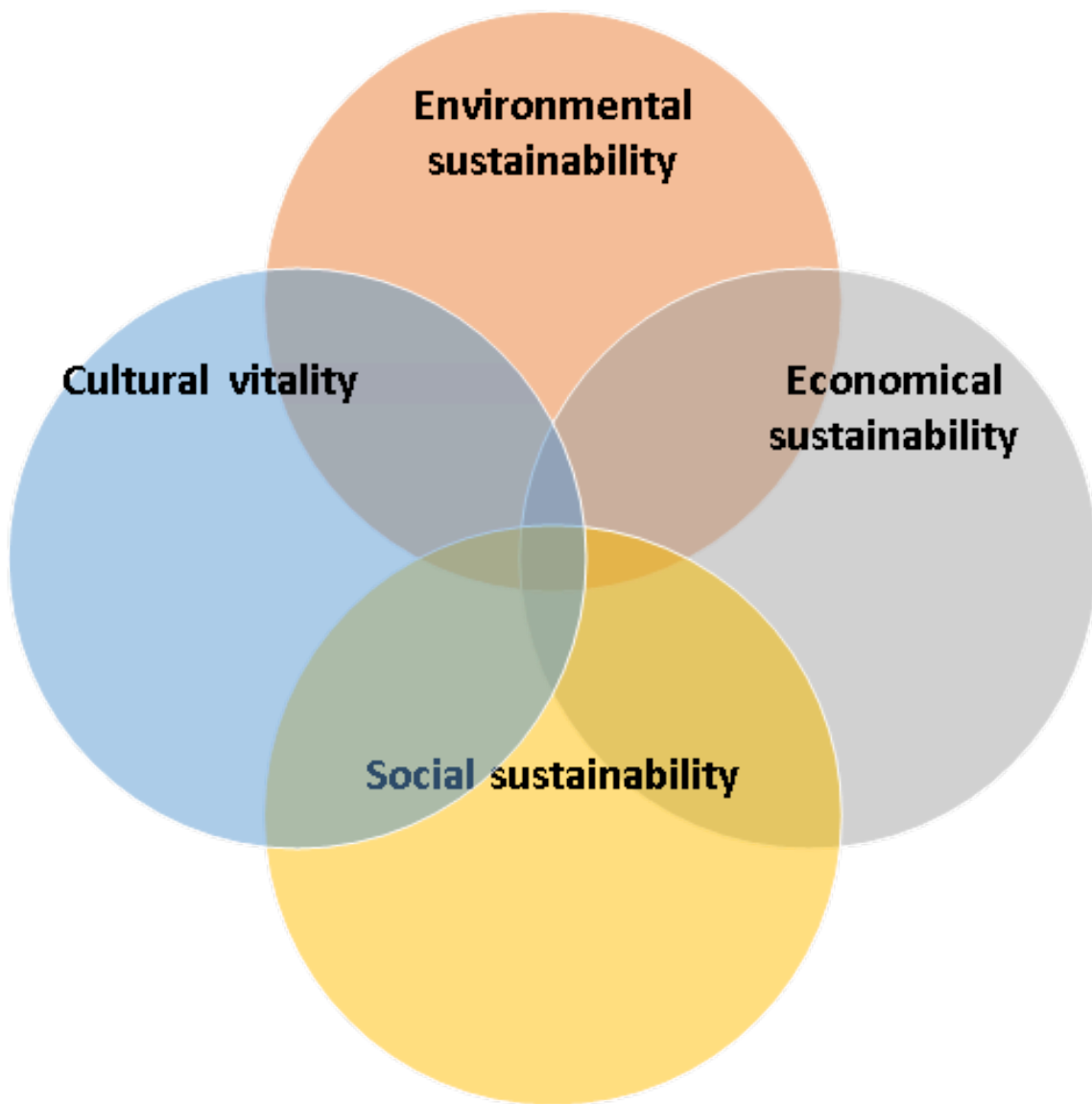


Figure 2. Four pillars of sustainability

The four pillars of sustainability represent the synergetic interaction of sustainable practices in library buildings and operations, collections, services, and practices. As such, libraries realize the four pillars of sustainability and the SDGs using “sustainability literacy”. The UN Department of Economic and Social Affairs (UNDESA, 2018) defines sustainability literacy as “knowledge, skills, and mindsets that allow individuals to become deeply committed to building a sustainable future and assisting in making informed and effective decisions”. Sustainability literacy is important because it empowers people to act towards achieving SDGs.

Academic libraries can contribute to SDGs using various strategies. Library contributions to the SDGs refer to how libraries design and develop programming around the SDGs as an entryway to sustainability literacy. For example, academic libraries can support SDG 4 (Quality Education) by providing access to learning materials and promoting information literacy among patrons. Libraries can also support SDG 13 (Climate Action) by providing access to information and encouraging sustainable practices in communities. Contributions from academic libraries are also needed to develop the Times Higher Education Impact Rankings, which measure the extent to which global universities contribute to SDGs.

Academic libraries contribute to these rankings using scientific productivity, for example, the number of publications, the number of Open Access initiatives, and evidence of best practices, such as learning and teaching support services (Times Higher Education, 2022). Furthermore, academic libraries (a) have a specific focus on research and education, (b) are well-positioned to provide access to information and resources related to the SDGs, (c) have a large and diverse user population, (d) have a strong tradition of collaboration, and (e) usually serve as health science libraries, national libraries, and public libraries in countries with less developed library systems. In this way, academic libraries play a democratic or social inclusion role, bringing together indigenous people, promoting gender equality, and reaching communities beyond their walls (community engagement).

The literature on library contributions to SDGs is fragmented and lacks a focus. The International Federation of Library Associations [IFLA] (2018; 2023) has collected examples of SDG stories from various types of libraries worldwide that demonstrate how libraries contribute to achieving these goals. IFLA measures this programming using (a.) SDG-related activities conducted by patrons at the library or librarians within the library building; (b) community engagement outside the library walls; (c) organizational culture (library-specific sustainability policies linked to the SDGs); (d) library partnerships; and (e) key performance indicators used to measure the SDGs (IFLA, 2018; 2023). However, the IFLA SDG stories are subtle on issues such as (a.) individual agency of academic librarians (e.g., librarians' conceptualization of sustainability literacy), (b.) attitudes and perceptions of the SDGs (e.g., intentions to share SDG information and practices), and (c.) library leadership (characteristics of academic library management). Furthermore, library SDG stories are not holistic (for example, they do not show all library activities and their impact) because they are constructed using voluntary submissions (hence the small number of academic libraries). In some cases, certain library activities that spill into more than one goal have not been reported, and there has been no mention of the specific SDG targets and indicators achieved. SDG stories are also limited because of reporting from the perspective of the library that is

writing the report and may miss out on primary studies, such as surveys and document analyses, which may also provide valuable information.

Another strand of evidence on library SDG contributions employs literature searches to evaluate how libraries in general contribute to sustainability and sustainable development (e.g., Mathiasson and Jochumsen, 2022). However, sustainability and sustainable development are not synonymous with an SDG framework. On one hand, the 2030 Agenda for Sustainable Development consists of the 17 SDGs, 169 targets, and 231 unique indicators, while sustainability refers to meeting present needs without compromising future generations' ability to meet their own. Although the SDG Agenda includes sustainability principles, sustainability extends beyond specific goals outlined. The SDG Agenda should be seen as a specific, attainable, measurable, and time-bound (SMART) framework, while sustainability is broad and has time-bound measurements. As a result, it can be argued that there is insufficient collated evidence on how academic libraries contribute to the SDGs and the entire Agenda 2030 framework. This is not to say that there is no evidence; however, the current focus of some literature syntheses scratches the topic at the surface and does not speak to specific SDGs, targets, and indicators that have been attained by academic libraries. Furthermore, there is no evidence of a study that systematically makes cross-comparisons of various academic libraries' contributions to the SDGs. Comparing academic libraries with each other provides a much richer analysis as they have common characteristics, rather than comparing with another type of libraries.

Aims of the study

Academic libraries can contribute to SDGs through programming and support, as well as by participating in rankings measuring universities' contributions. The literature on library contributions to SDGs is fragmented and lacks a focus, but examples collected by IFLA measure programming using SDG-related activities, community engagement, organizational culture, partnerships, and key performance indicators. However, evidence on academic library contributions to specific SDGs, targets, and indicators is insufficiently collated. There is also no comparison of various academic libraries' contributions to the SDGs. There is a lack of thorough research that specifically addresses the SDGs in academic library settings, despite the fact that academic libraries are increasingly acknowledged as essential to achieving the SDGs. Hence, this State-of-the-Art Review investigates the contributions of academic libraries to the SDGs by systematically comparing SDG design and programming and outlining strategies for coordinating library missions with the SDGs for significant influence; this paper seeks to close this gap.

The state-of-the-art review answered the following question: “**How are academic libraries contributing to the achievement of the SDGs?**”

The main research question was answered using the following sub-research questions.

1. How do library activities, such as collection development, programming, and outreach, contribute to the achievement of the SDGs?
2. How do the actions of individual librarians and library staff contribute to achieving the SDGs?
3. How does the organizational culture of a library support or hinder its ability to achieve the SDGs?
4. How does library leadership play a role in achieving SDGs?
5. How can libraries partner with other organizations to achieve SDGs?
6. How can libraries use key performance indicators to improve their efforts to achieve the SDGs?

Materials and methods

State-of-the-art review

State-of-the-art reviews combine historical and current perspectives (Grant and Booth, 2009). In this manner, this state-of-the-art review is an entry point for library and information science professionals to find possible directions for additional SDG research in academic libraries, as it covers the scope and salient features of the topic.

Database searches

Data were gathered from literature searches in Scopus and the Web of Science (WoS) Core Collection. These are interdisciplinary databases in which LIS concepts are mostly applied (ID). Outside of these interdisciplinary databases, EBSCO LISTA was searched. A test search was performed for the term “sustainability literacy”, and it was found that the literature was quite small (ID). Revisions were made to the search string to ensure that “library”, “sustainability literacy”, and “SDGs” were reflected in the results. Tables 2a–c show the sample search strategies used in this study and their translation to other databases (ID). Title, Abstract, and Keyword searches were performed for all search strings. The expected outcomes of the search strings were not searched but were later exploited to select relevant articles. Boolean “AND” or “OR” operators combined the search strings, while the proximity “NEAR” operator was added to certain terms to increase the relevance of the results. The 2017–present date limit was selected because the SDG targets and indicators were published in 2017. The searches were translated according to

the function of each database. Hand searching (manually searching for grey literature that is not indexed in scholarly databases) was performed using Google Scholar and LitMaps (<https://www.litmaps.com/about>) to avoid publication bias. A hand search retrieved literature on similar concepts such as “green literacy” and “environmental literacy,” while keeping in mind that these concepts had to be applied to the SDGs (ID). LitMaps uses artificial intelligence to identify similar articles. Relevant articles were “seeded” (chain searching) to find matching articles, and the results were reviewed for relevance (ID). Reference sections were also read to identify potentially relevant articles.

#	Search strings	Results
S1	TITLE-ABS-KEY (“sustainable development NEAR/5 goal*” OR “Agenda NEAR/5 2030” OR “sustainable*” OR “SDG*” OR “United NEAR/5 Nations”)	3,851,865
S2	TITLE-ABS-KEY ("libra*")	588,717
S3	S1 AND S2	17,640
S4	TITLE-ABS-KEY ("literacy" OR "educat*" OR "train*" OR "information access" OR "curricul*" OR "teach*" OR "learn*" OR "course*")	8,609,169
S5	S3 AND S4	4,921
	2017-present	3,666
	English only	3,520

Table 2a. Searches on the Scopus database

Last Search: 15 February 2024

#	Query	Results
S6	S3 AND S5	460
S5	S3 AND S4	929
S4	TX "literacy" OR "educat*" OR "train*" OR "information access" OR "curricul*" OR "teach*" OR "learn*" OR "course"	298,980
S3	S1 AND S2	2,829
S2	TX "librar*"	1,071, 171
S1	TX "sustainable development NEAR/5 goal*" OR "Agenda NEAR/5 2030" OR "sustainable*" OR "SDG*" OR "United NEAR/5 Nations"	6,062

Table 2b. Library, Information Science & Technology Abstracts

Last Search: Date 15 February 2024

#	Search Query	Results
S1	ALL=(“sustainable development N5 goal*” OR “Agenda N5 2030” OR “sustainable*” OR “SDG*” OR “United N5 Nations”)	718,514
S2	ALL=(“librar*”)	657,787
S3	S1 AND S2	4,788
S4	ALL=(“literacy” OR “educat*” OR “train*” OR “information access” OR “curricul*” OR “teach*” OR “learn*” OR “course*”)	7,682.885
S5	S4 AND S3	1,467
S6	#4 AND #3 and 2024 or 2017 or 2018 or 2019 or 2020 or 2021 or 2022 or 2023 (Publication Years)	1,156
S7	#4 AND #3 and 2024 or 2017 or 2018 or 2019 or 2020 or 2021 or 2022 or 2023 (Publication Years) and English (Languages)	1,108

Table 2c. Search Web of Science

Last Search: 15 February 2024

Selection of articles

In total, 4,748 records (Scopus database = 3,520, Library, Information Science & Technology Abstracts = 460, and Web of Science Search = 1,108) were found using database searches and hand searching (manually searching for literature that is not covered in databases =43). The searches were imported into Mendeley to identify duplicates. In total, 510 duplicates were removed, leaving 4,238 records for screening in their titles and abstracts. Rayyan , a web-based tool for screening and selecting studies, was then applied. The artificial intelligence features of Rayyan were used to sort the data by keywords, e.g., Sustainable Development Goals, SDGs, Global Goals, Academic Library, College Library, and University Library (Ouzzani et al., 2017). These terms were also searched with variations on sentence cases. Rayyan picks up the identified keywords within the titles and abstracts, sorts them, and highlights where they appear, making it easier to quickly identify relevant articles. At least one reviewer was involved in the selection process (ID). A total of 4,213 records were excluded, leaving 25 articles that met the exclusion criteria (see Table 3: PRISMA representation of the searches and screening process).

Stage	Records	Number of Results
Records identified	Database searches	4,791
	Web of Science (460)	
	Scopus (3,520)	
	EBSCO LISTA (1,108)	
	Hand searching (43)	
Duplicates removed in Mendeley	Duplicates removed (510)	4,281
Records screened		4,222
Full-text assessed for eligibility (via Rayyan)		59
Studies included		25

Table 3. PRISMA representation of the searches and screening process

Inclusion criteria

The following criteria were used to obtain high-quality articles to build an evidence base.

1. Peer-reviewed journal articles representing primary research using written research methods.
2. Articles that investigate specific SDGs, targets, or indicators in academic libraries, academic library employees, academic library policymakers, and communities that use academic libraries.
3. Articles that include elements of sustainability literacy, regardless of whether the concept is fully or partially explained.
4. Investigations of sustainability literacy within the context of the United Nations Agenda 2030 framework, including information literacy on sustainability to reduce information poverty.
5. Library activities focusing on sustainability and sustainable development.
6. Applications of library concepts and practices in the context of sustainability literacy.
7. Publications from 2017 to the present.
8. Only English publications.

Exclusion criteria

1. Articles that discuss sustainability within libraries or LIS without linking the concept to the United Nations SDG/Agenda 2030 framework.
2. Broad LIS concepts, such as knowledge management, open access, and semantic web that are not specifically applied to libraries or library settings' contribution to the SDGs.
3. Bibliometric studies, conceptual papers, news opinion pieces, and systematic reviews.
4. Articles on other types of libraries that include school libraries, public libraries, national libraries, museums, galleries, and archives.

Data analysis

The PDF articles were imported into the Mendeley reference manager and MaxQDA 20[©], a qualitative data analysis software package, for thematic synthesis. This process involved both deductive (a predetermined schema for codes) and inductive coding (open coding), and thematic synthesis was conducted by the researcher (ID or PM). The software aided in identifying the frequency of codes, themes, and cross-case analyses. Meanings in context were based on interconnections between the SDGs, targets, and indicators. This method of analysis enables the identification of both the catalyst and co-dependent relationships in SDG programming. Statistical inferences were made for some data using MaxQDA 20[©].

Thematic synthesis

Thematic synthesis analysis is a qualitative research method that is known for its flexibility, systematic approach, and transparency. It involves the combination of evidence from multiple studies to produce new insights and findings. Unlike a summary, a thematic synthesis requires the "translation" of original texts into meaningful themes through the development of descriptive and analytical themes. Similar codes are then grouped into categories, which are used to develop overarching themes and subthemes. To effectively summarize this information, tables, models, graphs, and charts are often utilized. Additionally, examples such as quotes and references from these studies are incorporated to demonstrate how the findings are grounded in the data. Overall, thematic synthesis analysis provides an effective means for synthesizing qualitative data across multiple studies while maintaining rigor and transparency.

Deductive coding

The SDGs mentioned in the selected articles were deductively coded using a Global Indicator Framework (GIF) (United Nations, 2017). GIF was selected because it covers all 248 indicators and targets. A combination of metrics (scales and their dimensions) and narrative (anecdotal evidence) was used to map statements to SDGs/targets/indicators (see “Table 4: SDG# mapping tool.”) (Ochôa & Pinto, 2020). The SDG# mapping tool works by moving from the right to the left. 1. The author of the work is noted (Sources and notes), 2. verbatim quotations from the article are selected to reflect work done on the SDGs (Indicators/Other), 3. the research design of the article is noted (Research design), 4. the relevant sector in which the SDG is relevant is noted, 5. the relevant SDGs or targets are noted for each statement. The coder can return to Sources and Notes to write any analytical memos observed. In some cases, the IFLA (2019) document and SDGLinked app (<https://linkedsdg.officialstatistics.org/#/>) were used to explore SDGs/targets/indicators.

SDG/Target (Optionally place icons)	CHANGE Dimensions	Research design	Indicators/Other	Sources and Notes
SDG target/number	Sector in which the SDG has an impact [type of impact attained by the study]	What is the overall research design? [how data was collected?]	Verbatim quotations/examples from the study showing how the SDG target/indicator(s) were obtained	Author of the work [Analytical memos on the work showing own observations]

Table 4. SDG# mapping tool

Each article was read, and selected passages were “translated” in line with the SDGs/targets/indicators (ID or PM). Translation occurs when passages have the same meaning but do not express their content in exact words. Hence, a codebook was developed to inform the coders about the inclusion and exclusion criteria to be used when there was an instance of translating passages within the texts (ID or PM).

Inductive coding

The researchers kept an open eye on new codes that emerged as passages were read (ID or PM). Each new code was placed in a bin referring to the sentences in which it occurred. The codebook was updated to capture new codes that were used in subsequent instances where there were similar behaviours, passages, and patterns.

Data transformation

The qualitative codes generated from the thematic analysis were transformed into categorical data, which was used to run statistical tests to predict the interaction of one or more variables.

Cronbach's Alpha

Cronbach's alpha was calculated across the codes to determine the inter-rater agreement on the coding of the SDGs, targets, and indicators. Cronbach's alpha was 0.810, which means that there was strong agreement between the codes applied in the papers.

The previous section discusses the results of a state-of-the-art review.

Results

This article consists of 25 papers, with data from academic libraries. Many academic libraries were located in Asia (26.32%), Africa (21.05%), North America (5.26%), Europe (10.53%), Oceania (5.26%), and International (15.79% , a paper including data from Australia, America, South Africa, United Kingdom). MapChart (<https://www.mapchart.net/world.html>) was used to visualize the selected literature on a world map (see “Fig. 3: Global map showing origins of the selected literature”).

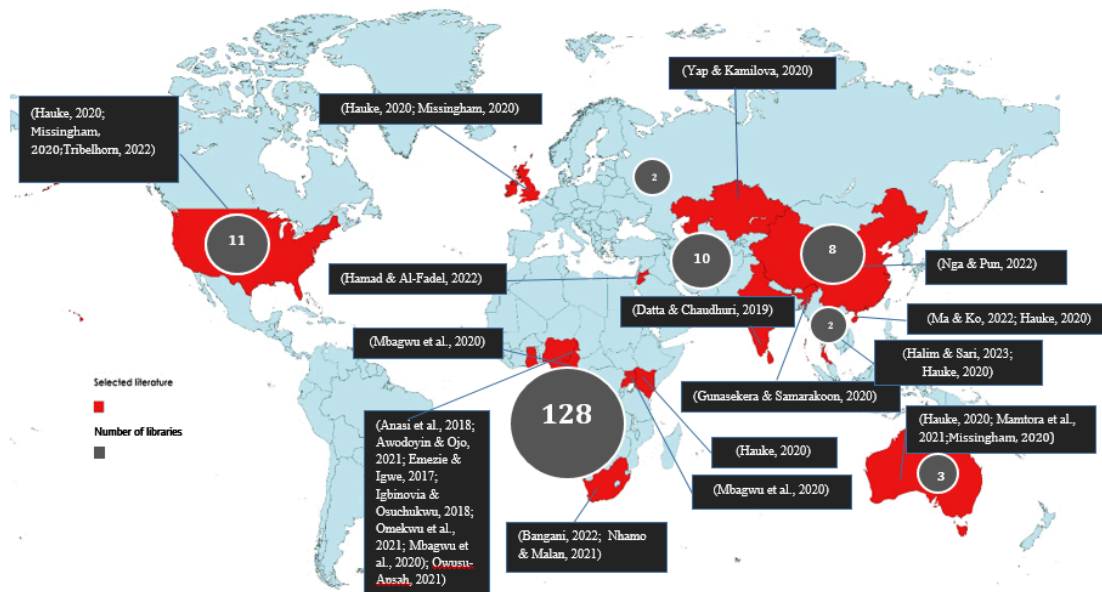


Figure 3. Global map showing the origins of the selected literature (study results drawn using MapChart)

Four Pillars of Sustainability

The data in this review show that academic librarians achieve the four pillars of sustainability through the interaction of sustainability awareness, SDG-related library activities, organizational culture, library leadership, available resources, key performance indicators, government policies, and partnerships (see Figure 4: “How libraries attain sustainability literacy centred on the SDGs”). Library activities went beyond teaching information literacy on the SDGs to conducting activities that impacted one or more targets and indicators.

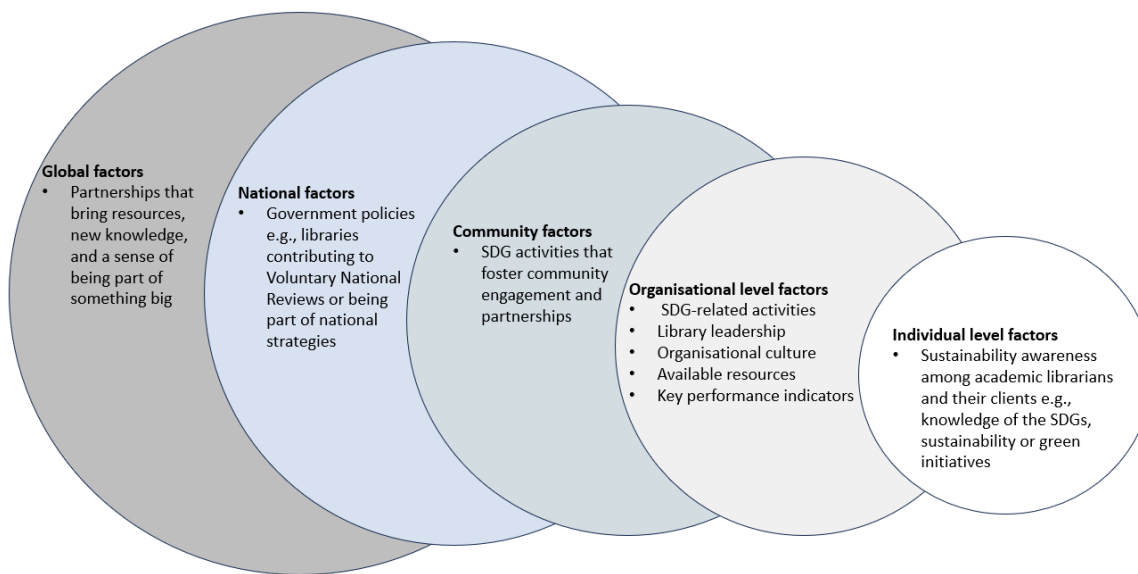


Figure 4. How libraries attain sustainability literacy centred on the SDGs (study results).

Overall, most papers observed that the work conducted by academic libraries had a great impact on community engagement (see “Figure 5: VosViewer keyword concurrence found in the selected literature”),

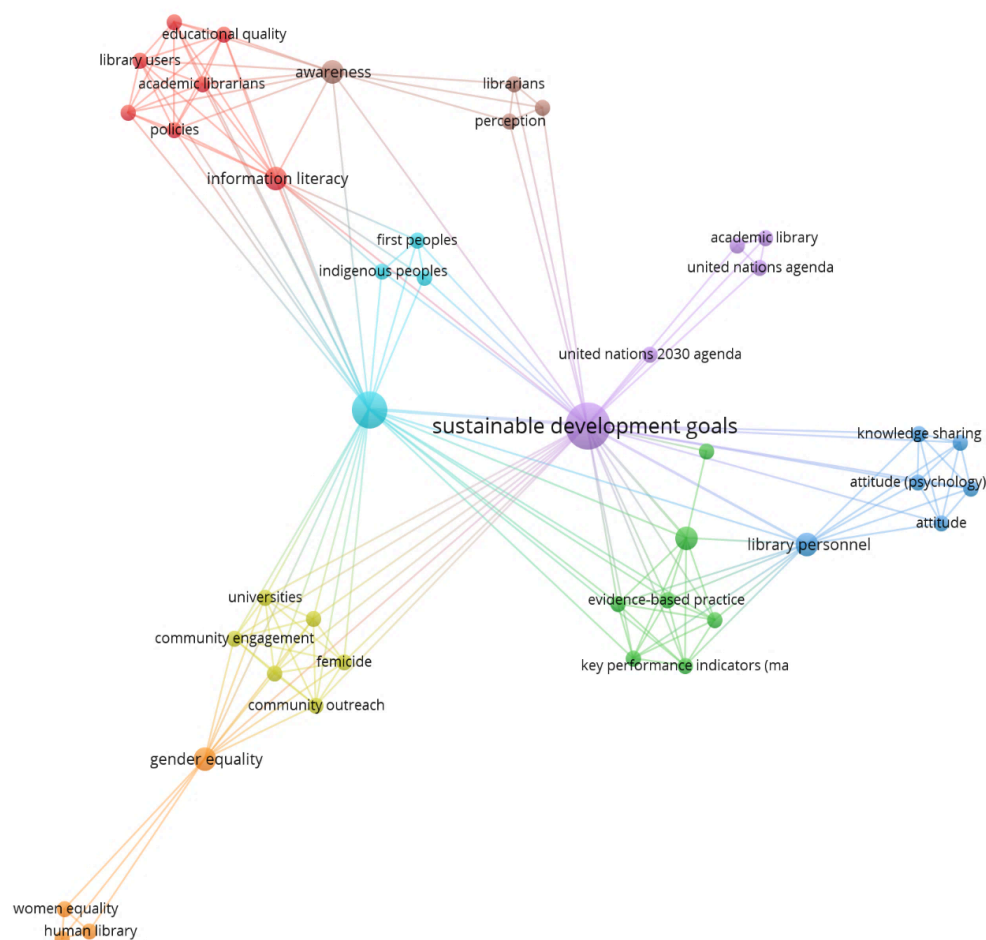


Figure 5. VosViewer keyword concurrence found in the selected literature

Bangani (2022;2023) and Bangani and Dube (2023), and Halim & Sari (2023), are typical examples of library SDG community engagement. Halim & Sari (2023) discuss the Corporate Social Responsibility (CSR) initiatives of Tengku Anis Library (PTA), which is an academic library at UiTM Kelantan, Malaysia. Halim & Sari (2023) include things like initiating (a) reading programs, (b) distributing books, (c) organizing gatherings, (d) establishing mini libraries, and (e) conducting literacy drills. Bangani (2023) observed that South African academic libraries are engaged in activities such as (a) imparting information literacy skills to schools and librarians from other sectors (e.g., school librarians and public librarians), (b) promoting reading and writing for all ages, (c) library visits by school learners, (d) donating school shoes and uniforms to learners, (e) donating computers, and (f) teaching digital literacy training to schools.

The following sections discuss each of the above issues (themes) in greater depth:

Library activities with an impact on SDG targets/indicators

At a broad level, Fig. 6 (“Overall SDGs found in the papers”) shows the SDGs reported in the selected studies. SDG 4 (23.5%) was ranked the highest, followed closely by SDG 16 (18.6%), and SDG 12 (9%). No data were found for SDG 14. Most libraries mapped their activities to broad SDGs rather than specific targets or indicators. In some cases, authors selected goals they wanted to map. For example, Missingham (2020) mapped the activities of academic research libraries from various countries to four SDGs (SDGs 4, 5, 9, and 11), and Thorpe and Gunton (2022) mapped the activities of the University of Southern Queensland, Australia, to eight of the 17 SDGs. The mapping applied in this review found instances of interconnectedness, whereas the original studies did not. For instance, Missingham (2020) maps library activities addressing (a) gender violence to SDG 5, yet the review connects these activities to Targets 5.2 and 16.10, and (b) increasing women’s employment opportunities can be found in Targets 5.5, 8.5, and 10.2.

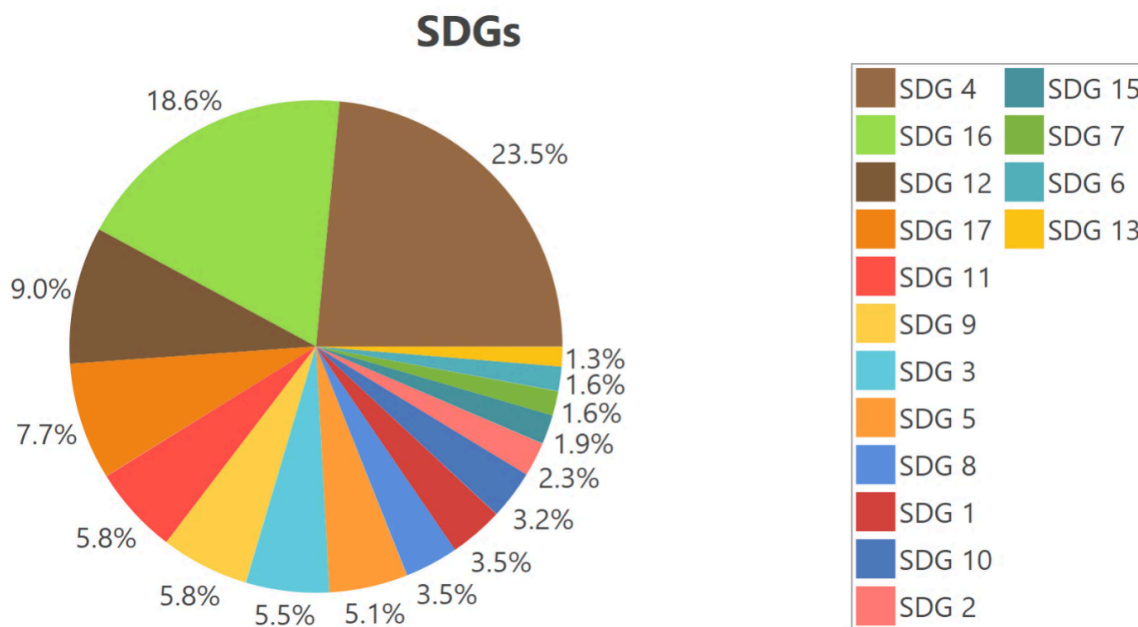


Figure 6. Overall SDGs found in the papers

The most commonly reported targets in the papers are (a.) 1.2, (b.) 3.3, (c.) 3.7, (d.) 4.7, 5.5, (e.) 6.5, (d.) 7.3, (f.) 16.10, (g.) 17.9, (h.) 17.16, and (i.) 17.17. The common indicators in this paper were (a.) 5.5.2, (b.) 6.5.1, (c.) 5.2,

(d.) 7c, and (e.) 9c. “SDG washing” was observed in some cases, where librarians reported activities as contributing to the SDGs, but that may not be the case. Dei and Asante (2022) reported an instance where librarians thought general information literacy activities (e.g., tutorials on reference managers) were the same as delivering sustainability literacy on SDG 4. Another case is Mbagwu et al. (2020), who provided an example of an SDG program that was conducted by the Makerere University Library in 2011 (four years before the SDGs were established).

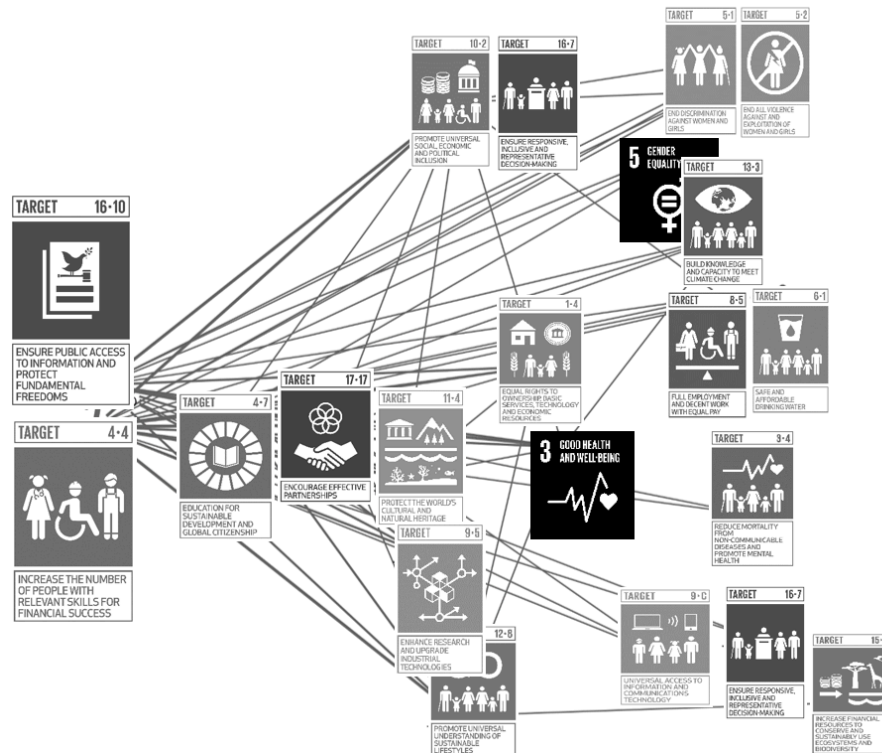


Figure 7. Interconnection of SDG targets and indicators

Fig. 7 (“Interconnection of SDG targets and indicators”) shows an analysis of the data showing interconnecting relationships. The rule of mapping in Fig. 8 is that the larger the line connecting an item or a set of items, the stronger the association. In Figure 7, Target 4.4 (human capital development) had the most associated codes, followed by 16.10 (information access), 4.7 (global citizenship), 17.17 (partnerships), and 12.8 (sustainable lifestyles). The difference between Targets 4.4 and 16.10 was quite small. A Pearson correlation R test was conducted on the entire dataset in Fig. 7 (see “Table 5: One-way analysis of variance on prominent targets and indicators”). Target 4.4 had positive linear relationships with 4.7, 16.10, and 17.17, seven moderately weak relationships, 15 weak relationships, and thirty-nine

weak downhill linear relationships with other SDGs/targets/indicators. Target 16.10 seems to be a reinforcer (a key target that leads to the attainment of other goals/targets or indicators). This is shown by the thick line that conjoins with Target 16.10.

	Sum of squares	df	Mean square	F	p-value	Eta squared
Between groups	171.52	7	24.50	18.68	0.00	0.91
Within groups	17.05	13	1.31			
Total	188.57	20				
Homogeneity of variance						
Levene	2.89					
p-value	0.05					

Table 5. Sample ANOVA conducted on Targets 4.4 and 16.10

Sustainability awareness among academic librarians

In this study, sustainability awareness is brought about by how academic librarians conceptualize sustainability literacy within the context of the SDGs and their attitudes and perceptions toward its attainment.

Only Tribelhorn (2022) defined sustainability literacy within the context of her participants' quotations, describing it as an initiative that supports student learning and strongly links it to environmentalism, social equity, and economic activities. Tribelhorn (2022) observed academic librarians' low awareness of sustainability literacy. She further argued that academic librarians should be given more information on sustainability literacy to understand the concept holistically.

Other variations of sustainability literacy found in the papers are “sustainable information” (Gunasekera & Samarakoon, 2020), “sustainable library” (Datta & Chaudhuri, 2019; Gunasekera & Samarakoon, 2020; Tribelhorn, 2022), and “green library” (Hauke, 2020). Gunasekera and Samarakoon (2020) understood sustainable information to “consist of two distinct parts: information for sustainable development (e.g., seen as a resource for the project of sustainable development) and development of sustainable information (e.g., creating sustainable information and communication technologies)”. Although Datta

and Chaudhuri (2019) mention the term sustainable library corner, they do not properly define it. Rather, it appeared in their questionnaire as a substitute term for “green library” or “eco-friendly library”. Gunasekera and Samarakoon (2020, p.13) define a “sustainable library corner” as a one-stop shop space within the library where users can access information on sustainability programmes around campuses and SDG reference information. An example of a sustainable library corner was found at Makerere University in Uganda (Mbagwu et al., 2020). Tribelhorn (2022, p.3) considered the sustainable library an initiative that shows the “library’s commitment to environmental stewardship, economic feasibility, and social equity”. Hauke (2020) conceptualized a green library as both an ecological building and a social role (information provision) that libraries play in raising awareness of sustainability.

Although the term “sustainability literacy” is not explicitly stated in certain publications, the authors emphasize the significance of literary initiatives and information accessibility in promoting sustainable objectives. Programs aimed at enhancing literacy skills, fostering a culture of reading, and offering educational resources to communities are in line with broader sustainability objectives and the SDGs. These programs promote lifelong learning, bolster critical thinking abilities, and empower individuals to tackle social, economic, and environmental issues.

Awareness of sustainability literacy and SDGs

Awareness of the concept of sustainability and SDGs is closely linked to their conceptualization. Hence, this study determined the level at which participants from various studies were aware of sustainability or the SDGs, and the reasons behind their level of awareness. The results showed mixed reactions across different continents. For instance, Datta and Chaudhuri’s (2019) study in India found that 56.25% of librarians were unaware of sustainable development, and 31.25% were unaware of the SDGs. Datta and Chaudhuri (2019) explained that their participants were unaware of sustainable development because they were unsure if they could engage in activities such as “promotion of local & cultural practices” and “supporting the local economy” (Datta & Chaudhuri, 2019). It was not surprising that 87.5% of these participants agreed that “inadequate awareness, knowledge, and expertise” was the largest barrier to transforming a library into a sustainable one. Similarly, Atta-Obeng and Dadzie (2020) and Dei and Asante (2022) found that Ghanaian librarians’ knowledge of SDG 4 (the papers considered this to be the most basic goal) was at a broad goal level, and they were not familiar with the targets and indicators. Atta-Obeng and Dadzie (2020) also found that academic librarians’ low knowledge is caused by a lack of

participation in SDG advocacy campaigns and a lack of awareness of their social responsibility (Dei & Asante, 2022).

Training as a means of raising awareness of SDGs

Tribelhorn (2022) surveyed academic librarians in the United States and found that sustainability and SDGs were not attained because of a lack of training opportunities. These librarians had a negative attitude towards sustainability and the SDGs because they associated the concepts with environmentalism (a sociopolitical movement to protect and preserve the natural environment and its resources), rather than holistically relating them to the four pillars of sustainability. In contrast, Omekwu et al. (2021) found that 65% of Nigerian academic librarians were fully aware of sustainability and SDGs because they thought it could solve national human development problems. In a separate Nigerian study, Awodoyin and Ojo (2021) found an acute awareness of the SDGs, especially SDG 2 (End hunger, achieve food security, improve nutrition and promote sustainable agriculture).

Culture and Policy

Anasi et al. (2018), Omekwu et al. (2021), and Awodoyin and Ojo (2021) identified the lack of supportive government policy on SDG monitoring and evaluation as one of the barriers to SDG localization in libraries. Both Indian and Nigerian librarians felt that their governments had a bad track record of delivering inaccurate and misleading information (Datta & Chaudhuri, 2019; Omekwu et al., 2021). This mistrust eventually resulted in the low usage of government-related SDG information in libraries. Another related challenge is the lack of institutional policies that support sustainability and the SDGs (Atta-Obeng & Dadzie, 2020; Dei & Asante, 2022; Hamad & Al-Fadel, 2022; Tribelhorn, 2022). In turn, this meant that sustainability/SDG programmes were not funded. Furthermore, the lack of funding is the largest reason why SDG efforts are not implemented.

Of the 164 libraries reported in the papers, 3 have won the IFLA Green Library Award, namely, the Chinese University of Hong Kong Library (CUHKL) (Ma & Ko, 2022), Rangsit University, Thailand (Gupta, 2020; Hauke, 2020), the University College Cork Library, and the Library of the United States International University-Africa (Hauke, 2020). There are good examples where library SDG activities are part of an institutional mandate that fits into national development plans, e.g., Voluntary National Reviews (VNRs). These good examples include the Chinese Hong Kong Library (Ma & Ko, 2022), the University of South Africa Library (Nhamo & Malan, 2021), and the Library of Buddhist and Pali University of Sri Lanka

(Gunasekera & Samarakoon, 2020). However, other studies have mentioned the lack of national policies to support SDG implementation in libraries as a key challenge. In North America, Tribelhorn (2022) reported that libraries practising sustainability/SDGs often include this in their mission statements, policies, and in-house training and have a library committee to oversee implementation. In Europe, Yap and Kamilova (2020) observed that there are instances where libraries face competing or shifting priorities that cause sustainability/SDG initiatives to be shelved. Other reasons for the low uptake of sustainability/SDGs were mostly related to the lack of training, interest among academic librarians, community involvement, and resources (Yap & Kamilova, 2020). African libraries with SDG policies relied on the GIF (United Nations, 2017) as a guide (Dei & Asante, 2022).

Leadership

Data from the selected papers show that library leadership is a key component in developing successful SDG programmes. Academic library leadership was seen to provide strategic direction that could influence policies, provide resources, and advocate for government and partners to buy into library activities. A good example is Halim and Sari (2023), who discuss how the library's leadership was instrumental in planning, preparing, implementing, and evaluating the CSR program. Interestingly, participants from the study by Awodoyin and Ojo (2021) noted that sustainability/SDG programmes were hindered by library leaders who misappropriated funds for training and acquiring resources.

Partnerships to Achieve the 2030 Agenda

Partnerships were encouraged and initiated when academic libraries did not have adequate resources. Target 17.17 has received considerable attention in the codes, showing that partnerships and collaborations are important for mobilizing resources to carry out sustainability literacy efforts. The partnerships discussed were both on campus and with external institutions at the local and global levels. A typical example is the Library of the United States International-Africa, Nairobi, Kenya, which was able to run green library initiatives because of its partnership with North America (Hauke, 2020). The partnerships formed by the academic libraries and local high schools in Bangani and Dube (2023) and Bangani (2023) were possible because they were undersigned with memorandums of understanding (MoUs).

Key performance indicators for measuring sustainability literacy in libraries

Key performance indicators (KPIs) are needed to monitor and evaluate the extent to which a library has implemented sustainability/SDGs. KPIs are mostly measured using qualitative approaches, e.g., SDG stories (14) and survey tools (9) (see Table 6: “Scales for measuring sustainability literacy in the context of the Agenda 2030”). SDG stories are usually obtained using participatory approaches, e.g., Nhamo and Malan (2021). SDG stories may allude to metrics like the number of people participating in library-driven SDG activities, the degree of community engagement, the quality of services rendered, or the degree to which the initiatives aid in the accomplishment of SDGs.

MEASUREMENT TOOLS				
Survey tools				
Authors	Response options	Context	Test	Country
(Anasi et al., 2018)	4-point Likert scale on 3 dimensions; 3-point Likert scale on 1 dimension	Usage of ICTs in academic libraries to contribute to the SDGs. 77 academic librarians	Means and standard deviations (SDs)	Nigeria
(Awodoyin & Ojo, 2021)	4-point Likert scale on 3 dimensions; 3-point Likert scale on 5 dimensions: 1. Awareness of sustainability (17), 2. Perceptions of SDGs (14), Relevance of libraries (10), 4. Challenges (10) and 5. Strategies to achieve SDGs (10)	Librarians' awareness and perception of SDG attainment. 60 academic librarians	Means and standard deviations (SDs)	Nigeria
(Datta & Chaudhuri, 2019)	3-point Likert on 2 dimensions. 4-point Likert on 3 dimensions: 1. Awareness of sustainability (9), 2. Sources of information (10), 3. Perceptions of Ideal Activities/Relevance of Libraries (20), 4. Challenges (10) and 5. Ideal outcomes (9)	Academic library administrators' awareness and understanding of sustainability. 16 academic librarians	Descriptive statistics	India
(Emezie & Igwe, 2017)	4-point Likert scale on 3 dimensions	Relationship between librarians' perceptions of community information centres and corporate social responsibility to achieve the SDGs. 57 academic librarians	Spearman rank order correlation technique at 0.05 level of significance	Nigeria
(Hamad & Al-Fadel, 2022)	A 3-point Likert scale with the following dimensions: (a.)	Assessing librarians' perceptions of the	Multiway analysis of variance	Jordan

MEASUREMENT TOOLS				
Survey tools				
Authors	Response options	Context	Test	Country
	requirements to achieve the SDGs, (b.) awareness of sustainability/SDGs, perceptions of SDGs, (c.) relevance of the SDGs in libraries, (d.) requirements/strategies to achieve the SDGs, and (e). challenges in achieving the SDGs	library's role in the achievement of the SDGs. 233 academic librarians	(ANOVA) and F tests between the responses based on different variables (gender, job title, educational level, years of experience, and specialization)	
(Igbinovia & Osuchukwu, 2018)	The "Knowledge Sharing Behaviour Scale (KSBS)" consists of 22 items and uses a 5-point Likert scale with the following: 1. Willingness to share knowledge related to SDGs, 2. Initiative to share knowledge related to the SDGs, 3. Frequency of sharing knowledge related to the SDGs, 4. Quality of shared knowledge related to the SDGs, 5. Perception of organizational support for sharing knowledge related to SDGs	Determining the status of knowledge-sharing behaviour among library personnel regarding SDGs. 72 academic librarians	Multiple regression analysis	Nigeria
(Omekwu et al., 2021)	Oral interviews; 4-point Likert scale containing four clusters. Dimensions: 1. Awareness of sustainability (9), 2. Contributions to the SDGs (27), 3. Sources of information (10), 4. Strategies to improve information access (20), 5.	Examining librarians' views on the contributions of access to SDG information. 93 academic librarians	Means and standard deviations (SDs)	Nigeria

MEASUREMENT TOOLS				
Survey tools				
Authors	Response options	Context	Test	Country
	Challenges in accessing SDG Information (11)			
(Tribelhorn, 2022)	3-point Likert scale; 6 dimensions; open-ended questions	Assessing key performance indicators for sustainability and the SDGs used in academic libraries. 12 participants ranging from large private research and PhD awarding institutions, state colleges, and smaller private colleges to community colleges awarding associate degrees	Factor analysis	United States
(Yap & Kamilova, 2020)	5-point Likert scale; 5 dimensions; open-ended questions and multiple choice	Evaluating whether events and services held in libraries are dedicated to increasing women's rights. 67 participants including moderators, resource persons, regular attendees, or volunteers, for example, invited moderators were faculty members who	Descriptive statistics and rich descriptions	Kazakhstan

MEASUREMENT TOOLS				
Survey tools				
Authors	Response options	Context	Test	Country
		are experts in their field.		
Mapping tools				
	Response options	Context	Data analysis	Country
(Atta-Obeng & Dadzie, 2020)	Open-ended interviews	Investigating the role of academic libraries in promoting knowledge and skills for lifelong learning opportunities	Content analysis	Ghana
(Bangani, 2022)	Open-ended interviews	Academic librarians' awareness and practises of SDG 5	Content analysis	South Africa
Bangani (2023)	Online interviews and focus discussions	Contribution of CE initiatives in South African public university libraries to SDG 4	Content analysis	South Africa
Bangani and Dube (2023)	Online interviews and focus discussions	Contribution of CE initiatives in South African public university libraries to SDGs 2, 5, and 13	Content analysis	South Africa
(Dei & Asante, 2022)	Open-ended interviews	Academic librarians' awareness and practises of SDG 4	16 academic librarians	Ghana
(Halim & Sari, 2023)	Observations in the field and interviews with program recipients	Discussing the Corporate Social Responsibility (CSR)	Case study	Malaysia

MEASUREMENT TOOLS				
Survey tools				
Authors	Response options	Context	Test	Country
		program implemented by the Tengku Anis Library at UiTM Kelantan		
(Hauke, 2020)	Document analysis	Examining an Outstanding Sustainable Library	Content analysis	International
(Gunasekera & Samarakoon, 2020)	Key performance indicators: 1. Physical and mental fitness of the university community. 2. Sustainable environment	Highlighting Sri Lankan librarians' actions to achieve SD goals	Academic librarians	Sri Lanka
(Ma & Ko, 2022)	Document analysis	Documenting how the Chinese Hong Kong Library attains the SDGs	Content analysis	China
(Mamtora et al., 2021)	Document analysis	Role of the academic library in contributing to the reconciliation process in Australia through the lens of James Cook University	Content analysis	Australia
(Mbagwu et al., 2020)	Document analysis	Exploring the contributions of academic libraries in achieving SDGs 2 and 3 in Ghana, Nigeria, and Uganda	Content analysis	Ghana, Nigeria, and Uganda
(Missingham, 2020)	Document analysis	Evaluating 4 SDGs across the	Content analysis	International

MEASUREMENT TOOLS				
Survey tools				
Authors	Response options	Context	Test	Country
		International Alliance of Research Universities network using ISO 16439		
(Nhamo & Malan, 2021)	Participatory research and document analysis	How Unisa libraries are achieving SDGs	Content analysis	South Africa
(Nga & Pun, 2022)	Document analysis	Evaluating how open science initiatives lead to SDGs	Document analysis	China
(Owusu-Ansah, 2021)	interviews and the observations	The role of university libraries in Ghana in contributing to Sustainable Development Goal 4 (SDG 4		Ghana
(Thorpe & Gunton, 2022)	Mapping	Mapping library activities and business-as-usual project outcomes and performance to the SDGs	Document analysis	Australia

Table 6. Methods of measuring key performance indicators on the SDGs

There is a similarity in some SDG activities at libraries as they are aligned with one or more SDGs. Of particular note is (a.) Missingham (2020), who used ISO 16439 to evaluate 4 international libraries; (b.) Nga and Pun (2022), who mapped scholarly output from Macao in terms of SDG research throughput

relative to the world; and (c.) Nhamo and Malan (2021), who reported the number of hits on a library web page dedicated to sustainability resources and their reliance and conducted user satisfaction surveys. However, there are no uniform survey tools used across different countries, and each author adapts their questions according to the context and needs.

The most common dimensions of the tools include (a.) information sources used to gain knowledge of the SDGs, (b.) requirements to actualize the SDGs, (c.) awareness of sustainability/SDGs, (d.) perceptions of SDGs, (e.) relevance of the SDGs in libraries, (f.) requirements/strategies to achieve the SDGs, and (g.) challenges in achieving the SDGs (Awodoyin & Ojo, 2021; Datta & Chaudhuri, 2019; Hamad & Al-Fadel, 2022; Omekwu et al., 2021). The authors vary the contents of the listed items in each dimension. In some instances, sustainability or SDGs is used interchangeably. In addition, it is beyond the scope of this paper to evaluate the quality of each tool in meeting sustainable development and the SDGs.

Among the authors who conducted surveys, Igbinovia and Osuchukwu (2018) adapted a tool from Tohidinia and Mosakhani (2010) to study academic librarians' SDG knowledge-sharing behaviour. Tribelhorn (2022) is worth mentioning as the tool assesses the library's key performance indicators on sustainability and the SDGs while linking these activities to mission statements, structures needed to support sustainability and the SDGs, and the means of measuring these. Although librarians in Tribelhorn's (2022) study were not aware of how to measure KPIs for sustainability, they had positive attitudes toward the process (80%). Hence, they felt that certification was an excellent incentive, as it could frame library policies toward the SDGs and raise support from university administrators. Nhamo and Malan (2021) and Gunasekera and Samarakoon (2020) mentioned that participatory awareness-raising and support workshops are needed before the implementation of SDG initiatives. Both studies showed that it is critical to briefly discuss key performance indicators of SDG implementation from the onset.

Discussion

Although the number of retrieved publications fitting into the inclusion criteria was not quite high, this review found more academic libraries reporting on achieving the SDGs than those found by IFLA (2023). This is a clear demonstration that the academic libraries reported by the author are representative of the evidence. In addition, the study presents real-world examples of work done in academic libraries rather than theorizing about it. The discussion below amplifies the available evidence on the attainment of SDGs in academic libraries.

Four pillars of sustainability

There is a sufficient indication from bibliometric studies that sustainability efforts are already practised but have not been categorized according to types of libraries, e.g., Mathiasson and Jochumsen (2022). Another lacuna is that to date, the evidence has not tied academic library activities with the SDGs and their targets or indicators. Hence, Mathiasson and Jochumsen (2022) highlight the need for libraries to be explicit about how their activities connect with sustainability, sustainable development, or the SDGs to adequately measure the four pillars of sustainability. This level of reporting has been attempted and fulfilled in the current review.

This study has found that many African academic libraries are taking part in the SDG agenda compared with other regions. This may be attributed to the fact that there is a high diffusion of the SDGs in Africa because the SDGs are rooted in the Millennium Development Goals (MDGs), which were targeted at developing countries, mostly found in Africa (UNESCO, 2017). From the onset of the establishment of the SDGs, some African libraries received high-level political buy-in from their governments, thereby fitting library contributions into national development plans (IFLA, 2015). This trend is also found in other regions, such as Asia, and may be attributed to the history of the MDGs and the IFLA guidelines (IFLA, 2018, 2019). The evidence from this study is valid because 3 of the identified libraries (one in Africa and two in Asia) have been awarded the IFLA Green Library Award (Hauke, 2020), which signifies a library's commitment to environmental sustainability and environmental education.

Library activities with an impact on SDG targets/indicators

In attaining the SDGs, academic libraries concentrate more on the activities linked to Target 4.4 (human capital development), 16.10 (information access), 4.7 (global citizenship), 17.17 (partnerships), and 12.8 (sustainable lifestyles). These targets can be considered as pillars for any sustainability literacy programme. For instance, Target 4.4 is closely tied to the university's mission, which is to develop persons with skills that can fit into different industries. Hence, academic libraries can build on Target 4.4 to achieve other targets and indicators if their programming is focused on the SDGs. However, this must be closely connected with obtaining Target 16.10. The interlinkage shows that public access to information on educational resources, job opportunities, and skill development programs reinforces the attainment of Target 4.4. This means that sustainability literacy activities often have a symbiotic relationship if these targets are conjoined, thereby leading to other targets and indicators. However, Pearson's test indicates that this interconnectivity does not work in some circumstances. Figures 5, 6,

and 8 highlight the fact that targets and indicators may have better synergies depending on the organizational culture and policies, library activities pursued, sustainability awareness, library leadership, partnerships, and the key performance indicators being sought. This means that the results of this study cannot be generalized without taking these points into account.

Possibly, the differences between this study's findings and the targets and indicators found in the Lyons Declaration could be that the former is empirical, collecting data from academic libraries, while the latter was a conceptualization with no particular library and SDG programming in mind. Target 16.10 is common in both instances, whereas targets related to quality education (Target 4.4 and 4.7) are not found in the Lyons Declaration but are needed for Education for Sustainable Development (ESD). Although Target 11.4 and indicators 5b, 9c, and 17.8 are found in this study, they have weak relationships with other indicators and targets. This may show that the implementation of the Lyons Declaration did not have clear outcomes. Unfortunately, no further comparisons can be made because there is a lack of empirical literature on the declaration, although 600 libraries have given their signature to date.

The review found that most academic libraries map their activities to broad SDGs rather than specific targets or indicators. While some libraries claim to have achieved all 17 SDGs, mapping these activities using target and indicator levels has provided a more accurate picture and uncovered cases of "SDG washing". A rule from systems thinking is that the whole is greater than the sum of its parts, yet many parts (targets and indicators) remain unattained for every goal. Reporting at the goal level may be thought of as SDG-washing, which is when institutions put up an image that they are engaged in all the SDGs, often to please a funder or the government, yet they have no full commitment (Heras-Saizarbitoria et al., 2022). Another related problem is that libraries are selective in what they report instead of taking a holistic approach to the process. Bangani (2023) encourages academic libraries to be explicit about their contributions to the SDGs so that they are relevant to both the public and the authorities.

Academic librarians' sustainability awareness

Although there is a low usage of the term "sustainability literacy" in the papers where it is employed, its conceptualization is similar to that in Hauke (2018). Quite notably, academic libraries have a low interest in green libraries in the pursuit of SDGs. Instead, they adopted a holistic approach, as demonstrated by the complex interconnection of several SDG targets/indicators. Green libraries are appropriate if the library is defined as a place that does not lead to SDG attainment, whereas a holistic approach looks at the library as a place that provides services. Mathiasson and Jochumsen (2022) argue that library activities

with a holistic understanding of sustainability and sustainable development recognize SDGs as complex problems that require complex solutions. In this sense, academic librarians are attempting to solve complex societal problems vis-à-vis the SDGs.

Conversely, there are mixed results on the awareness of sustainability literacy and SDGs among libraries. Some librarians are aware of the two concepts, but some have reported a low level of awareness and lack of clarity about the library's involvement. This finding is not relative to a particular region but occurs across different continents. The level of awareness cannot be viewed in a vacuum because it is influenced by the complexity of factors such as the availability of resources, organizational culture, overarching government policies, library leadership, and library activities (using sustainability literacy centred on the SDGs). In this manner, the academic librarian is embedded within the nexus of these issues and has to navigate each of them in a much more complex manner. Dabengwa et al.'s (2019) model (which attributes academic librarians' agency at various levels of embedding information literacy programmes) can be adopted to explain why there are various levels of awareness in practising sustainability literacy for the SDGs. Dabengwa et al. (2019) posited that academic librarians embed information literacy in 4 stages (aspiring, intermittent, partially, and transcending blended librarians) because of the degree of access to resources, organizational culture, and library activities. While Dabengwa et al.'s (2019) model is generalized and was not constructed for any particular course, it can show that embedding SDG information literacy is both an evolutionary and revolutionary process. There could be instances where librarians evolve into any stage, or this could happen through revolutionary processes when there is a need to do so. For instance, the SDG implementation at the CUHKL and UNISA saw existing library programmes being transformed to align with the SDGs while adding new programmes as well (Ma & Ko, 2022; Nhamo & Malan, 2021). In other instances, there are differences between SDG implementation in the reported academic libraries, even from the same country or region. However, it is beyond the scope of this paper to categorize each academic library's SDG implementation according to the model because there is insufficient evidence to make such a distinction from the retrieved studies. However, it is important to note that an academic librarian's level of awareness is not binary but can have different levels, each with unique characteristics.

Organizational Culture and Policy

The lack of resources and supportive policies for sustainability and the SDGs shows the low uptake of sustainability thinking. In some cases, this is part of a larger national problem in which academic

libraries are not included in national development plans, e.g., VNRs. Additionally, librarians may not play an active role in contributing to policy development and advocacy regarding the SDGs. In the literature, Balôck (2020) decries the lack of a supportive national framework in support of SDG localization among Cameroonian libraries. As a result, there are no identified strategic objectives (implementation plan), general objectives (summary of the overall activities), or operational objectives (day-to-day activities aligned with the SDGs) that integrate libraries into the GIF. Islam et al. (2022) found that policymakers failed to include libraries in the SDG agenda because of a lack of awareness, misunderstanding of the importance of libraries, negative attitudes, and general unwillingness. When libraries do not have policies closely linked to the SDGs, the use of the GIF has been encouraged to link library activities (Dei & Asante, 2022).

Leadership

The role of library leadership is central in guiding policy and advocating and liaising with government agencies responsible for SDG localisation. However, it is unfortunate to note that there are cases where library leaders misappropriate resources that are critical for SDG attainment (Awodoyin & Ojo, 2021).

Partnerships to Achieve the 2030 Agenda

Partnerships are essential to achieve the 2030 Agenda framework because no one library can afford to perform the activities needed to contribute to the SDGs. In some cases, academic libraries may lack the capacity to advocate for the SDG agenda. Good partnerships then provide resources and lobbying, especially at national forums in which the SDGs are discussed, e.g., SDG steering committees and VNRs. Although partnerships are critical, the data show that there must be mutual trust between the library and potential partners. It is possible that MoUs can support such trust, e.g., Bangani (2023).

Key performance indicators for measuring SDGs in libraries

Most studies used SDG stories to determine key performance indicators. Thorpe and Gunton (2022) stated that mapping approaches are more appropriate than measurement or assessment approaches in determining library contribution to the SDGs. Perhaps mapping studies are preferred because there is no standardized tool to measure the SDGs in libraries. The current tools lack content validity because they do not measure the same statements, although some may have similar dimensions. Hence, there is a need to construct a standardized tool that can be applied to academic libraries, or perhaps any type of library. This tool should include (a.) information sources used to gain knowledge of the SDGs, (b.) requirements

to actualize the SDGs, (c.) awareness of sustainability/SDGs, (d.) perceptions of SDGs, (e.) relevance of the SDGs in libraries, (f.) requirements/strategies to achieve the SDGs, and (g.) challenges in achieving the SDGs.

Whether an academic library uses a mapping approach or survey tool, it is important to bear in mind that its mission statements should be aligned with achieving sustainability/SDGs. Business-as-usual activities should align with sustainability/SDGs, and appropriate structures must be established (e.g., dedicated staff, library SDG committees, and resources).

Limitations of the study

This study attempted to comprehensively cover the available peer-reviewed literature on the application of SDGs in academic libraries. However, coding SDG activities is not an exact science and can be complex because a single activity can be found in more than one goal/target/indicator (Thorpe & Gunton, 2022). There could be a possibility that some sentences were missed or assigned codes to which they did not belong. This limitation is possible with all qualitative syntheses. In this study, two coders (ID or PM) independently coded the included articles and then exchanged their findings to arrive at a common understanding. Another limitation is the amount of studies that were found compared to studies like Mathiasson and Jochumsen (2022). However, this is because this particular study focused on academic libraries only, rather than other types of libraries, for ease of comparing results. This is akin to comparing apples with apples, rather than apples with oranges. Also, Mathiasson and Jochumsen (2022) have reviewed articles on sustainability together with those of the SDGs, yet these two concepts are not necessarily the same, though they are related. Of which, the Mathiasson and Jochumsen (2022) had fewer SDG-specific studies as compared to this study.

Conclusions

Although the evidence stems from 164 libraries across different countries, it is important to exercise caution as these libraries may not accurately represent the practices of other academic libraries that were not included in this study. This paper highlights the scarcity of explicit mentions of sustainability literacy within the context of SDGs in academic literature. While some papers do cite examples such as sustainable library corners and green library activities for teaching environmentalism, their rarity does not weaken this paper's argument but rather reflects the current state of affairs among select academic libraries. The review also reveals that certain academic librarians discussed in cited papers are unaware

of SDGs and skeptical about incorporating them into business as usual library activities. However, this observation should not discourage other, more SDG-aware libraries with related programs from pursuing their goals. The fact remains that issues concerning SDG uptake exist among sampled papers' academic libraries, presenting both a challenge and an opportunity to effect meaningful change within communities through awareness-raising efforts and adoption strategies by those institutions committed to making a positive difference towards achieving components aligned with sustainability's four pillars. Academic librarians must carefully examine complex interactions between various factors - including organizational culture/policy, partnerships, key performance indicators (KPIs), leadership roles - when evaluating sustainability literacy programs at their respective facilities. Decisions regarding whether these complex interactions can be integrated into specific stories related to SDGs or if survey tools combined with storylines would be best suited for evaluation purposes must be made following careful consideration. Importantly, however, reporting on library activities using the Global Impact Framework (GIF) represents an accurate measure of attaining SDGs compared to goal-level assessments susceptible to underreporting or "SDG washing." Given how broad/complex implementing an effective contribution plan might seem while balancing regular business-as-usual operations within an institution like an academic library setting, GIF-oriented solutions are all the more critical.

Future studies ought to explore how different types of regional libraries contribute toward achieving GIF-based outcomes, informed by observations highlighting differences between regions and leading ultimately towards context-specific recommendations tailored accordingly.

Data availability

Dabengwa, Israel (2023), "A thematic synthesis of sustainability literacy in academic libraries using the Global Indicator Framework for the Sustainable Development Goals", Mendeley Data, V1, DOI: 10.17632/mpgfpd5cbt.1

References

- Anasi, S. N., Ukangwa, C. C., & Fagbe, A. (2018). University libraries-bridging digital gaps and accelerating the achievement of sustainable development goals through information and communication technologies. *World Journal of Science, Technology and Sustainable Development*, 15(1), 13–25. <https://doi.org/10.1108/WJSTSD-11-2016-0059>

- Atta-Obeng, L., & Dadzie, P. S. (2020). Promoting Sustainable Development Goal 4: the role of academic libraries in Ghana. *International Information & Library Review*, 52(3), 177–192. <http://10.0.4.56/10572317.2019.1675445>
- Awodoyin, A. F., & Ojo, O. (2021). Sustainable Development Goals attainment: examining librarians awareness and perception in selected university libraries in Ogun State, Nigeria. *Samaru Journal of Information Studies*, 21(1), 24–37.
- Balôck, L. L. (2020). Public libraries and goal 16 of the SDGS in Cameroon: which actors for a national policy? *Global Knowledge, Memory and Communication*, 69(4/5), 341–362. <https://doi.org/10.1108/GKMC-06-2019-0068>
- Bangani, S. (2022). Academic libraries' contribution to gender equality in a patriarchal, femicidal society. *Journal of Librarianship and Information Science*, 1993, 1–12. <https://doi.org/10.1177/09610006221127023>
- Bangani, S. (2023). Academic libraries' support for quality education through community engagement. *Information Development*, 2016, 026666692311528. <https://doi.org/10.1177/02666669231152862>
- Bangani, S., & Dube, L. (2023). Academic libraries and the actualization of Sustainable Development Goals two, three and thirteen. *Journal of Librarianship and Information Science*, 096100062311746. <https://doi.org/10.1177/09610006231174650>
- Cyr, C., & Connaway, L. S. (2020). Libraries and the UN Sustainable Development Goals: the past, present, and future. *Proceedings of the Association for Information Science and Technology*, 57(1), 1–5. <https://doi.org/10.1002/pa2.237>
- Dabengwa, I. M., Raju, J., & Matingwina, T. (2019). Academic librarian's transition to blended librarianship: a phenomenology of selected academic librarians in Zimbabwe. *The Journal of Academic Librarianship*, 45(4), 343–357. <https://doi.org/10.1016/j.acalib.2019.04.008>
- Datta, A., & Chaudhuri, S. K. (2019). The awareness and understanding of sustainability by the academic library administrators: a micro level investigation in Kolkata, India. *Library Philosophy & Practice (e-Journal)*.
- Dei, D.-G. J., & Asante, F. Y. (2022). Role of academic libraries in the achievement of quality education as a sustainable development goal. *Library Management*, 43(6/7), 439–459. <https://doi.org/10.1108/LM-02-2022-0013>
- Grant, M. J., & Booth, A. (2009). A typology of reviews: An analysis of 14 review types and associated methodologies. *Health Information and Libraries Journal*, 26(2), 91–108. <https://doi.org/10.1111/j.1471-1842.2009.00848.x>

- Gunasekera, D., & Samarakoon, M. (2020). The Reflective Practice for Sustainable Future. *International Journal of Librarianship*, 5(2), 45–60. <https://doi.org/10.23974/ijol.2020.vol5.2.171>
- Gupta, S. (2020). Green Library: a strategic approach to environmental sustainability. *International Journal of Information Studies and Libraries*, 5(2), 82–92. https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3851100
- Halim, Y. A., & Sari, D. K. (2023). Social Inclusion of Academic Library in Realising Sustainable Development Goals (SDGs) through Corporate Social Responsibility (CSR) Program: A Case Study in Tengku Anis Library UiTM Kelantan. *International Journal of Information & Knowledge Management* (22318836), 13, 35–46. <http://0-search.ebscohost.com/innopac.wits.ac.za/login.aspx?direct=true&AuthType=ip&db=lxh&AN=175018399&site=ehost-live&scope=site>
- Hamad, F., & Al-Fadel, M. (2022). Advocacy of the Sustainable Development Goals in Jordanian academic libraries. *IFLA Journal*, 48(4), 492–509. <https://doi.org/10.1177/03400352211038300>
- Hauke, P. (2018). From information literacy to green literacy: training librarians as trainers for sustainability literacy. *IFLA WLIC 2018 – Kuala Lumpur, Malaysia – Transform Libraries, Transform Societies in Session 116 – Library Theory and Research with Information Literacy*, 1–10. <https://library.ifla.org/id/eprint/2147/>
- Hauke, P. (2020). Academic libraries of the world: exemplars, educators, enablers for sustainable development. *Proceedings of the 9th Eurasian Academic Libraries Conference*. <https://nur.nu.edu.kz/handle/123456789/4994>
- Heras-Saizarbitoria, I., Urbieto, L., & Boiral, O. (2022). Organizations' engagement with sustainable development goals: from cherry-picking to SDG-washing? *Corp Soc Responsib Environ Manag*, 29(April 2021), 316–328. <https://doi.org/10.1002/csr.2202>
- IFLA. (2015). *Cape Town Declaration*. <https://www.ifla.org/news/cape-town-declaration-2015/>
- IFLA. (2018). *Access and opportunity for all: How libraries contribute to the United Nations 2030 Agenda*. Bibliotekovedenie [Library and Information Science]. <https://doi.org/10.25281/0869-608x-2016-65-4-445-450>
- IFLA. (2019). *Libraries can drive progress across the entire UN 2030 Agenda*. Access and Opportunity for All: How Libraries Contribute to the United Nations 2030 Agenda. <https://www.ifla.org/files/assets/hq/topics/libraries-development/documents/sdgs-insert.pdf%0Ahttps://www.ifla.org/publications/node/10546?og=7409>
- IFLA. (2023). *Sustainable Development Goals & Libraries*. <https://librarymap.ifla.org/stories>

- Igbinovia, M. O., & Osuchukwu, N. P. (2018). Predictors of knowledge sharing behaviour on Sustainable Development Goals among library personnel in Nigeria. *IFLA Journal*, 44(2), 119–131. <https://doi.org/10.1177/0340035218763445>
- Islam, M. A., Sultana, R., & Widén, G. (2022). Ascertaining the place of UN sustainable development goals in public libraries: how much progress have public libraries made in Bangladesh? *Global Knowledge, Memory and Communication*. <https://doi.org/10.1108/GKMC-03-2022-0072>
- Ma, L. F. H., & Ko, L. Y. (2022). Supporting the Sustainable Development Goals: the role of the Chinese University of Hong Kong Library. *The Journal of Academic Librarianship*, 48(4), 102562. <https://doi.org/10.1016/j.acalib.2022.102562>
- Mathiasson, M. H., & Jochumsen, H. (2022). Libraries, sustainability and sustainable development: a review of the research literature. *Journal of Documentation*, 78(6), 1278–1304. <https://doi.org/10.1108/JD-11-2021-0226>
- Mbagwu, F. C., Lyaka, M., Nyantakyi-baah, L., & Holmner, M. (2020). Achieving Sustainable Development Goals Two and Three: role of academic libraries. *Library Philosophy & Practice (e-Journal)*, August.
- Missingham, R. (2020). Sustainable Development Goals: insights from research libraries. *International Journal of Librarianship*, 5(2), 13–25. <https://doi.org/10.23974/ijol.2020.vol5.2.167>
- Nga, P., & Pun, I. (2022). Building sustainability and open science in academic libraries through alliances: The case of Macao SAR Sustainability in Libraries. *87th IFLA World Library and Information Congress (WLIC), Dublin, Ireland from 26–29 July 2022, July*, 22–23.
- Nhamo, G., & Malan, M. (2021). Role of libraries in promoting the SDGs: a focus on the University of South Africa. In G. Nhamo, M. Togo, & K. Dube (Eds.), *Sustainable Development Goals for Society Vol. 1* (Vol. 1). Springer International Publishing. <https://doi.org/10.1007/978-3-030-70948-8>
- Ochôa, P., & Pinto, L. G. (2020). Gathering evidence for sustainable development goals: An alignment perspective. *Evidence-Based Library and Information Practice*, 15(1), 164–169. <https://doi.org/10.18438/EBLIP29638>
- Omekwu, C. O., Ugwu, F. N., & Ejikeme, A. N. (2021). Access to information for sustainable development in the digital age: librarians' perspectives in two Nigerian universities. *Information Development*, 026666692110562. <https://doi.org/10.1177/02666669211056292>
- Owusu-Ansah, S. (2021). Reshaping Strategies of University Libraries in Ghana towards Sustainable Development Goal 4. *Mousaion*, 39(1), 1–25. <https://doi.org/10.25159/2663-659X/7126>

- Ouzzani, M., Hammady, H., Fedorowicz, Z., & Elmagarmid, A. (2017). Rayyan — a web and mobile app for systematic reviews. *Systematic Reviews*, 5(2016), 1–10. <https://doi.org/10.1186/s13643-016-0384-4>
- Thomas, J., & Harden, A. (2008). *Methods for the thematic synthesis of qualitative research in systematic reviews*. 10, 1–10. <https://doi.org/10.1186/1471-2288-8-45>
- Thorpe, C., & Gunton, L. (2022). Assessing the United Nation’s Sustainable Development Goals in academic libraries. *Journal of Librarianship & Information Science*, 54(2), 208–215. <http://10.04.153/09610006211005528>
- Times Higher Education. (2022). *How to participate in Times Higher Education rankings*. <https://www.timeshighereducation.com/how-participate-times-higher-education-rankings>
- Tohidinia, Z., & Mosakhani, M. (2010). Knowledge sharing behaviour and its predictors. *Industrial Management & Data Systems*, 110(4), 611–631. <https://doi.org/10.1108/02635571011039052>
- Tribelhorn, S. K. (2022). *Key Performance Indicators for Assessing Sustainability in Academic Libraries*. University of Southern California.
- UN Department of Economic and Social Affairs (UN DESA). (2018). *Raising awareness and assessing sustainability literacy on SDG 7*. <https://sustainabledevelopment.un.org/sdinaction/hesi/literacy#:~:text=%22Sustainability Literacy%22 is the knowledge, effective decisions to this end.>
- UNESCO. (2017). *Unpacking Sustainable Development Goal 4 Education 2030: guide*. <https://www.sdg4education2030.org/unpacking-sustainable-development-goal-4-education-2030-unesco-2017>
- United Nations. (2017). *Global indicator framework for the Sustainable Development Goals and targets of the 2030 Agenda for Sustainable Development*. Work of the Statistical Commission Pertaining to the 2030 Agenda for Sustainable Development. https://unstats.un.org/sdgs/indicators/Global Indicator Framework after refinement_Eng.pdf
- United Nations Department of Economic and Social Affairs (UNDESA). (2018). *History*. <https://sdgs.un.org/goals?msclkid=5a0e9824cf9711ec9a2b3285eb7eccb5>
- Yap, J. M., & Kamilova, Y. (2020). Toward becoming an inclusive library: Integrating Sustainable Development Goal 5 in the library agenda. *Library Management*, 41(2/3), 53–66. <http://10.04.84/LM-08-2019-0057>

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