

A webometric analysis of central university libraries' websites: An Indian scenario

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ABSTRACT

This study conducted a webometric analysis of the library websites of 56 central universities in India, with a focus on the usability of these websites, the quality of their content, and the structure of their link systems. A variety of tools were utilized to collect data on various metrics, including the simple web impact factor (SWIF), the self-link web impact factor (SLWIF), and the external link web impact factor (ELWIF). These tools included Google Search, Website Link Analyzer, and Broken Link Checker. The findings underscored discrepancies in website performance, with Aligarh Muslim University demonstrating proficiency in numerous metrics. Conversely, certain universities encountered impediments, including broken links and inadequate external linkages. The study emphasized the significance of regular audits, link optimization, and content updates in enhancing the digital presence and functionality of library websites. The recommendations encompassed targeted interventions aimed at addressing these identified gaps, with the overarching objective being the enhancement of user experience and the optimization of search engine performance.

Keywords: central universities; Google Search Engine; library websites; search engine optimization; University Grants Commission; web impact factor; web pages; webometric analysis.

1. INTRODUCTION

SINCE gaining independence, India has witnessed a substantial increase in the number of colleges and universities, contributing to the expansion of the higher education sector (Agarwal, 2007). According to the University Grants Commission (UGC), the nation is home to 470 private universities, 482 state universities, and 56 central universities. Additionally, 124 institutions are recognized as universities of national importance, including the Indian Institutes of Technology (IITs), National Institutes of Technology (NITs), and Vellore Institute of

Technology (VIT). The establishment and integration of these universities was governed by a unified legislative framework. The central universities in India are established under the provisions of the UGC Act of 1956. These institutions are subject to the oversight of the UGC, which operates under the aegis of the Ministry of Higher Education. These institutions receive financial support from the Government of India (GOI), which plays a crucial role in their governance. In addition, institutions of national importance receive funding from the GOI, thereby underscoring their strategic role in education and research. Each academic institution

How to cite: Shinde, V., & Hadagali, G. S. (2025). A webometric analysis of central university libraries' websites: An Indian scenario. *AWARI*; 6, 1-16. DOI: 10.47909/awari.863.

Received: 06-05-2025 / **Accepted:** 28-06-2025 / **Published:** 20-08-2025

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is required to submit study proposals on a regular basis for the purpose of evaluation and funding consideration. These institutions play a pivotal role in shaping India's higher education landscape, promoting academic excellence and contributing to national development. The primary objective of this study is to conduct a comprehensive analysis of the websites of Indian central university libraries. The other specific objectives of the study are:

- To identify and evaluate the library websites of central universities in India.
- To identify and categorize the domain of the Indian Central University Library Websites.
- To find out the total number of web pages, self-links, and external links on the university library websites under consideration.
- To measure the simple web impact factor (SWIF), self-link web impact factor (SLWIF), and external link web impact factor (ELWIF) and rank them according to the web impact factor (WIF).

The website functions as the organization's virtual public face offering a portal through which users can access vital information and services (Jayshankar & Ramesh Babu, 2009). In the context of libraries, websites serve as pivotal communication instruments, effectively facilitating the connection between users and the resources they require. In academic settings, the significance of library websites has grown exponentially with the rise of digital and electronic resources, interlibrary cooperation systems, and the infrastructure supporting distance learning. These platforms are indispensable in meeting the information needs of students, researchers, and educators. Despite their significance, library websites frequently encounter challenges in terms of usability and content organization. A substantial body of research has indicated that a considerable number of websites neglect to prioritize fundamental design principles, resulting in suboptimal user experiences. The presence of usability challenges, such as difficulties navigating the website or accessing pertinent information, has been shown to have a negative impact on user retention. These challenges have the potential to dissuade users from returning to websites, regardless of the quality of the content. Consequently, effective website

design must address the needs of its target audience while adhering to usability standards to ensure seamless access to information and resources (George, 2005).

Webometrics offers a structured framework for evaluating the effectiveness and impact of websites. According to Bjornebone and Ingwersen (2004), webometrics is defined as the quantitative analysis of web resources, encompassing web content, link structures, and user behavior. This approach entails the analysis of the WIF, in addition to internal and external linkages, as well as search engine performance. By leveraging these metrics, webometric studies offer insights into the construction and usage of websites, helping to identify areas for improvement. In this study, the websites of 56 Indian central university libraries were analyzed using webometric methods to evaluate their role in the virtual environment. The present analysis is oriented towards an evaluation of the capacity of the websites to deliver effective information services, with a particular focus on three key areas: website usability, content quality, and link structures. The objective of this study is two-fold: first, to underscore optimal practices, and second, to provide actionable recommendations to enhance the user experience and overall functionality of these library websites.

2. REVIEW OF RELATED STUDIES

This study explores the evolving field of webometric studies, emphasizing their application across diverse sectors, including universities, libraries, and digital repositories. It underscores pivotal methodologies for evaluating website visibility, usability, and efficiency, encompassing backlink analysis, WIFs, and search engine optimization (SEO) metrics. By synthesizing the findings from recent studies, the study provides insights into improving online presence and digital strategies in varied domains. Almind and Ingwersen (1997) were the first to apply information-metric methods to the World Wide Web (WWW), thereby establishing the foundation for research on network-based communication through quantitative metrics. The study introduced a methodological framework for informatics research, considering parameters such as document types, web structures, domain analyses, web pages, and inter-website

relationships. Uttkarsh and Sonkar (2020) conducted a webometric analysis of 16 knowledge resource heritage websites under India's Ministry of Culture. To assess the quality of domains, page authorities, internal and external links, lost links, and worldwide traffic rankings, tools such as SEO MOZ, Alexa, and Google PageRank were utilized. Their findings indicated that the Khuda Baksh Oriental Public Library website demonstrated superior performance in domain authority (62), page authority (50), and link metrics. The findings of this study offer actionable insights for the enhancement of website design and optimization.

Bulla and Hadagali's (2020) study involved the analysis of 30 state university websites in Karnataka, with a subsequent ranking of these websites based on various webometric factors. These factors included the WIF, the SLWIF, and the revised web impact factor (RWIF). Their study revealed a minimal web impact across the universities, with declining use of internal and external linkages. Despite the prevalence of web pages, the universities exhibited a comparatively modest link inventory. Verma and Jaiswal (2020) assessed the webometric attributes of 30 Indian medical university websites, ranking them using the WIF and the Web Indicators for Science, Technology, and Innovation Research (WISER) indicators. The Aligarh Muslim University demonstrated the highest WISER index value (14.919), while JSS Medical College exhibited the lowest. The SRM Institute of Science and Technology's website demonstrated the optimal load times. The study noted a negative correlation between WIF (in links) and WISER rankings, as supported by link-network diagrams generated using Pajek software. Ismail *et al.* (2021) examined the visibility of institutional repositories in Malaysian public universities. The study employed webometric indicators and found that the University of Malaya and University of Putra Malaysia exhibited a dominant web presence. The findings emphasized the need for enhanced visibility of institutional repositories, particularly among non-research universities. Ghosh and Roy's (2021) analysis of the websites of 36 general degree colleges accredited by National Assessment and Accreditation Council (NAAC) in West Bengal is a noteworthy contribution to the field. Panihati Mahavidyalaya attained the highest SWIF score

(1887.912%), while Banipur Mahila Mahavidyalaya led in SLWIF, in-link web impact factor (INLWIF), and EWIF. In the WISER rankings, Darjeeling Government College was placed at the top. The study emphasizes the significance of user-friendly and informative websites in achieving institutional objectives.

Kadam and Bhusawar (2021) examined the webometric performance of India's top 25 universities. This investigation was based on National Institutional Ranking Framework (NIRF) rankings. The utilization of metrics such as the WISER index, Alexa traffic rankings, and SEO scores is indicative of a systematic approach to evaluating online presence and performance. The Indian Institute of Technology (IIT) Roorkee demonstrated proficiency in SEO scores while the Anna University exhibited a lead in Alexa traffic rankings with a load time of 0.693 seconds. Patel *et al.* (2021) conducted a study that focused on the websites of 15 Indian universities according to NIRF rankings, with a particular emphasis on Anna University's preeminence in terms of page authority and web traffic. The Bharathiar University was found to be the most prominent institution in terms of SWIF, IWIF, and EWIF. Their findings emphasized the role of consistent updates and content quality in enhancing web impact. Patel and Vyas (2021) conducted a comprehensive evaluation of 15 Indian Open University websites, with a particular emphasis on webometric factors such as domain age, internal and external links, WISER index, and social media connectivity. The committee recommended the implementation of creative online resources and frequent updates to improve external links and WIFs. Sarwar *et al.* (2021) conducted a comparative analysis of university websites in North America, Europe, and Asia from 2005 to 2016. The study revealed a more substantial web impact in North American and European universities than in their Asian counterparts, highlighting regional disparities in webometric performance. Udartseva *et al.* (2021) conducted a global ranking of 461 library websites, employing indicators such as backlinks and full-text file counts to assess the performance of these websites. The Library of Congress consistently ranked first, while the Russian National Library and Vologda Regional Universal Scientific Library led the Russian category.

Ghosh and Roy (2022) conducted an analysis of African agricultural digital archives, with a focus on the examination of link structures and web visibility. The Kenya Agricultural Research Institute's repository was identified as the leader in SWIF rankings. The findings yielded valuable insights that informed the enhancement of repository visibility and functionality. Hazarika (2022) examined 20 private engineering institutes' websites in North India, evaluating factors such as page authority and domain authority. The Amity University Noida achieved the highest page authority (84), while the Birla Institute of Technology and Science, Pilani (BITS Pilani) led in domain authority (65). Koulas *et al.* (2022) conducted an investigation into the cyber presence of North Atlantic Treaty Organization (NATO) and European Union (EU) cyber security organizations. Webometric analysis was employed to map cyberspace interlinkages and co-mentions, thereby unveiling collaborative trends among member states. Shah and Hossain's (2022) study involved the analysis of 12 public university library websites in Bangladesh, employing a 61-item checklist as a methodological instrument. The identified areas for improvement included mobile responsiveness and Web-OPAC integration, emphasizing the evolving role of library websites in developing nations. Shah *et al.* (2022) conducted a study of 22 private university library websites in Dhaka, Bangladesh, employing a similar methodological approach. The findings indicated the necessity of enhanced content organization, mobile-friendliness, and maintenance to improve user engagement. Shiau Gee *et al.* (2022) conducted a survey of 350 users to assess the efficacy of university website design processes. The study underscored the significance of content organization, navigation, and live help desks in enhancing usability and user experience.

Dey and Sarmah's (2023) study examined Assamese state university websites, ranking them based on webometric factors. The Dibrugarh University led the WISER index rankings, while the Assam Rajiv Gandhi University of Cooperative Management topped the RWIF rankings. Ziaur and Dinda's (2023) study evaluated nine library and information network websites in India. The study revealed that the Information and Library Network (INFLIBNET), the

National Informatics Centre Network (NICNET), and the National Knowledge Network (NKN) are positioned favorably based on metrics such as SEO scores and web rankings. Aziz and Rashid (2024) examined the web presence of the National Geographic website, observing substantial global traffic and user engagement. The study yielded actionable insights for the enhancement of digital marketing strategies and audience interaction. George and Mohanan (2025) conducted a comprehensive webometric analysis, examining the effectiveness of institutional web presence across five autonomous colleges affiliated with Mahatma Gandhi University. The authors systematically evaluated domain characteristics, authority metrics, link structures, and technical performance indicators to assess digital visibility patterns. Their research contradicted the established hypothesis that WIF correlates positively with NAAC rankings, revealing that institutions with superior academic accreditation demonstrated lower webometric performance indicators.

A review of the extant literature reveals a substantial corpus of studies focused on web content analysis. However, a notable dearth of these studies pertains to the targeted evaluation of central universities. This study serves as a critical juncture in the broader discourse on this subject, as it bridges the existing gap in the literature by providing a comprehensive webometric analysis with a specific focus on central university websites in India. A paucity of studies has employed the Alexa, Wiser, and Gtmetrix tools to evaluate library websites, and the extant research has explored webometrics in the context of state universities, private universities, deemed universities, and specialized institutions. Furthermore, earlier research has highlighted metrics such as domain authority and page ranking. In contrast, this study incorporates a multitude of factors, including the WIF and link analysis. By addressing these gaps, this study establishes a benchmark for improving the digital presence of central university websites, aligning them with global standards.

The study can facilitate comprehension of the manner in which Indian university libraries compare with worldwide guidelines and practices by situating them within a global context. This approach has the potential to

stimulate inventions and advancements that are competitive on a global scale and pertinent to the context. Webometric analysis has been demonstrated to facilitate the identification of gaps and opportunities, thereby paving the way for innovation in the realm of digital library services and the development of novel tools and methodologies. The results have the potential to engage a range of stakeholders, including academic staff, students, and library personnel, by underscoring areas where their contributions and engagement can lead to substantial improvements. Subsequent research on webometric trends, technology uptake, and the evolving role of libraries in the digital era can be developed based on the findings of this study. This research has the potential to enhance university libraries' digital capacities, thereby benefiting the broader research and education environment.

3. METHODOLOGY

The study employed a multifaceted approach to gather webometric data, leveraging website links, SEO tools, and the Google Search Engine to assess the performance of central university websites. The analysis focused on four parameters: the SWIF, the SLWIF, the EWIF, and the broken links (BL). The parameters for this study were determined by the number of links and web pages on the websites of central university libraries in India. Of the 56 Central University Library Websites, the search strategy successfully identified 46 for analysis. This study analyzes the library websites of central universities in India. Specifically, the analysis revealed that 46 out of 56 Central University Library Websites incorporate SEO, a key factor considered in the analysis. Despite the multifaceted nature of India's university landscape, encompassing state universities, deemed universities, and private institutions, the scope of this research was limited to central universities. Based on data from the UGC website as of 01 December 2023, there are a total of 56 central universities included in the study. The study addresses three primary areas related to website analysis:

- Website development analysis: It examines website design and functionality concerning

search engine performance, emphasizing information retrieval and supporting webometric research.

- Web-link structure analysis: It investigates the hyperlink structure of websites, including different types of links such as "external links," "self-links," and "in-links."
- Web usage analysis: It explores web log files to study search and browsing behavior.

Additionally, the study evaluates the WIF to rank the library websites of central universities in India academically. Data collection for the research was conducted in December 2023.

4. TOOLS USED FOR DATA COLLECTION

The following techniques and search strategies were employed for data collection:

- Google Search Engine: The total number of web pages included in the study was gathered using Google. For example, the query format used was site: <https://rvca.edu.in> (site: [sitename]).
- Website Link Analyzer: The tool available at <https://smallseotools.com/website-link-analyzer-tool/> was utilized to analyze simple links, self-links, and external links on the library websites.
- Broken Link Checker: The tool at <https://www.deadlinkchecker.com/website-dead-link-checker.asp> was used to identify and collect BL for the research.

5. WEB IMPACT FACTORS

The following three categories of WIFs are mentioned and covered in the study:

$$SWIF = \frac{\text{Number of linked pages}}{\text{Number of web pages} - \text{Search engines indexed}}$$

$$SLWIF = \frac{\text{Number of self-linked pages}}{\text{Number of web pages} - \text{Search engines indexed}}$$

$$ELWIF = \frac{\text{Number of external linked pages}}{\text{Number of web pages} - \text{Search engines indexed}}$$

6. RESULTS AND DISCUSSIONS

6.1. Domain-wise distribution of the Central University Library Websites of India

The website name and the domain extension constitute the two primary components of a domain name. Table 1 presents the domain-wise distribution of Central University Library Websites in India. An analysis of 46 Central University Library Websites revealed the presence of five distinct domain extensions. A survey of 46 Central University Library Websites reveals that 38 (67.85%) of them utilize the “.ac.in” domain extension, 5 (8.92%) utilize the “.edu.in” extension, 1 (1.78%) utilizes the “.org” extension, 1 (1.78%) utilizes the “.nic.in” extension, and 1 (1.78%) utilizes the “.int” domain extension.

6.2. SWIF of the Central University Library Websites of India

As illustrated in Table 2, the SWIF of the central university libraries of India is demonstrated. The SWIF for each central university library in India was calculated by dividing the number of link pages (B) by the total number of web

| Domain with extension | Number of the Central University Library Websites in India | Percentage (%) |
|-----------------------|--|----------------|
| .ac.in | 38 | 67.85 |
| .edu.in | 5 | 8.92 |
| .org | 1 | 1.78 |
| .nic.in | 1 | 1.78 |
| .int | 1 | 1.78 |

Table 1. Domain-wise distribution of Central University Library Websites in India.

pages (A). The Aligarh Muslim University, Zainul Abidin Road, Aligarh, Uttar Pradesh has the highest SWIF, that is, 615 (with 615 link pages and 1 web page), and is ranked first among the central university libraries in India. The Assam University, Silchar, Dargakona, Cachar, Assam has 378 link pages and 1 web page, which is ranked second with 378 SWIF. In contrast, the Babasaheb Bhimrao Ambedkar University, Vidya Vihar, Raebareli Road, Lucknow has 89 link pages and 1 page altogether, with 89 SWIF ranked third. The study indicates that, in comparison with the well-established central university libraries, the newly established central university libraries demonstrate superior SWIF.

| Name of the university | Library website | Number of web pages (NWP) | Link web pages (LWP) | SWIF | Rank |
|---|---|---------------------------|----------------------|-------|------|
| Aligarh Muslim University | https://www.amu.ac.in/libraries/maulana-azad-library | 1 | 615 | 615 | 1 |
| Assam University | https://ausopac.informaticsglobal.com/ | 1 | 378 | 378 | 2 |
| Babasaheb Bhimrao Ambedkar University | https://www.gbl.bbau.ac.in/ | 1 | 89 | 89 | 3 |
| Banaras Hindu University | https://www.bhu.ac.in/Site/UnitHomeTemplate/1_3240_4531_Main-Site-Central-Library | 13 | 380 | 29.23 | 4 |
| Central Sanskrit University | https://www.sanskrit.nic.in/library.php | 12 | 210 | 17.50 | 5 |
| Central Tribal University of Andhra Pradesh | https://www.ctuap.ac.in/facilities/ | 50 | 576 | 11.52 | 6 |
| Central University of Andhra Pradesh | https://cuap.ac.in/library.html | 15 | 169 | 11.27 | 7 |
| Central University of Haryana | https://library.cuh.ac.in/ | 20 | 181 | 9.05 | 8 |
| Central University of Himachal Pradesh | https://cuhpopac.informaticsglobal.com/ | 50 | 264 | 5.28 | 9 |
| Central University of Jammu | https://www.cujammu.ac.in/Default.aspx?option=article&type=single&id=35&mnuid=738&prvtyp=site | 50 | 252 | 5.04 | 10 |

| Name of the university | Library website | Number of web pages (NWP) | Link web pages (LWP) | SWIF | Rank |
|---|---|---------------------------|----------------------|------|------|
| Central University of Jharkhand | http://cuju.ac.in/library-cuj.php | 50 | 138 | 2.76 | 11 |
| Central University of Karnataka | http://cuklibrary.ac.in/index.html | 50 | 131 | 2.62 | 12 |
| Central University of Odisha | http://library.cuo.ac.in/ | 33 | 61 | 1.85 | 13 |
| Central University of Punjab | https://cup.edu.in/library.php | 42 | 53 | 1.26 | 14 |
| Central University of Rajasthan | https://www.curaj.ac.in/library | 162 | 196 | 1.21 | 15 |
| Central University of South Bihar | https://library.cusb.ac.in/ | 135 | 126 | 0.93 | 16 |
| Central University of Tamil Nadu | http://82.180.173.110/ | 50 | 37 | 0.74 | 17 |
| Dr. Rajendra Prasad Central Agricultural University | https://www.rpcau.ac.in/university-library/ | 387 | 130 | 0.34 | 18 |
| English and Foreign Languages University | https://www.efluniversity.ac.in/ramesh_library.php | 568 | 162 | 0.29 | 19 |
| Guru Ghasidas Vishwavidyalaya | https://www.ggu.ac.in/CentralLibrary.aspx | 2950 | 689 | 0.23 | 20 |
| Hemvati Nandan Bahuguna Garhwal University | https://www.hnbggu.ac.in/search/node?keys=library | 2220 | 417 | 0.19 | 21 |
| Indira Gandhi National Open University | http://www.ignou.ac.in/ignou/aboutignou/division/1dd/introduction | 1370 | 239 | 0.17 | 22 |
| Jamia Millia Islamia | https://www.jmi.ac.in/ACADEMICS/University-Library/Services-&-Facilities/Events | 2160 | 360 | 0.17 | 23 |
| Jawaharlal Nehru University | https://www.jnu.ac.in/node# | 2180 | 350 | 0.16 | 24 |
| Mahatma Gandhi Antarrashtriya Hindi Vishwavidyalaya | https://hindivishwa.org/contentdtl.aspx?category=4&cgid=19 | 2200 | 317 | 0.14 | 25 |
| Mahatma Gandhi Central University | https://mgcub.ac.in/library.php | 2160 | 278 | 0.13 | 26 |
| Manipur University | http://mulibrary.manipuruniv.ac.in/ | 2430 | 280 | 0.12 | 27 |
| Maulana Azad National Urdu University | https://manuu.edu.in/University/Centre/Library/Profile | 1120 | 122 | 0.11 | 28 |
| Mizoram University | https://lib.mzu.edu.in/ | 2190 | 202 | 0.09 | 29 |
| Nagaland University | https://library.nagalanduniversity.ac.in/ | 2320 | 204 | 0.09 | 30 |
| Nalanda University | https://nalandauniv.edu.in/library/ | 422 | 37 | 0.09 | 31 |
| National Sanskrit University (previously Rashtriya Sanskrit Vidyapeeth) | https://nasktu.ac.in/index.php/about-library/ | 2160 | 189 | 0.09 | 32 |
| National Sports University | https://ndl.iitkgp.ac.in/ | 3010 | 257 | 0.09 | 33 |
| North Eastern Hill University | https://www.nehu.ac.in/library/index.html | 2160 | 179 | 0.08 | 34 |

| Name of the university | Library website | Number of web pages (NWP) | Link web pages (LWP) | SWIF | Rank |
|---|---|---------------------------|----------------------|------|------|
| Pondicherry University | https://lib.pondiuni.edu.in/ | 2160 | 178 | 0.08 | 35 |
| Rajiv Gandhi National Aviation University | https://www.rgnau.ac.in/en | 2330 | 181 | 0.08 | 36 |
| Rajiv Gandhi University | https://rgu.ac.in/library/ | 3710 | 235 | 0.06 | 37 |
| Rani Lakshmi Bai Central Agricultural University | http://122.185.27.76/ | 2190 | 137 | 0.06 | 38 |
| Shri Lal Bahadur Shastri National Sanskrit University | https://www.slbsrsv.ac.in/library/about-library-o | 2340 | 137 | 0.06 | 39 |
| Sikkim University | https://library.cus.ac.in/ | 2190 | 124 | 0.06 | 40 |
| South Asian University | http://library.sau.ac.in/ | 2170 | 114 | 0.05 | 41 |
| The Indira Gandhi National Tribal University | https://www.igntu.ac.in/clib.aspx | 2160 | 96 | 0.04 | 42 |
| Tripura University | https://stage.tripurauniv.ac.in/Page/LBCResourcesE_Journals | 2190 | 87 | 0.04 | 43 |
| University of Allahabad | https://allduniv.ac.in/facilities/about1 | 2180 | 62 | 0.03 | 44 |
| University of Hyderabad | http://igmlnet.uohyd.ac.in:8000/ | 2160 | 52 | 0.02 | 45 |
| Visva-Bharati | http://visva-bharati-library.in/ | 2160 | 34 | 0.02 | 46 |

Table 2. SWIF of the Central University Library Websites of India.

6.3. SLWIF of the Central University Library Websites of India

As illustrated in Table 3, the SLWIF of the central university library in India is indicated. The Aligarh Muslim University, Zainul Abidin Road, Aligarh, Uttar Pradesh has achieved the highest ranking with a SLWIF of 589. The Assam University, Silchar, Dargakona, Cachar,

Assam and the Babasaheb Bhimrao Ambedkar University, Vidya Vihar, Raebareli Road, Lucknow attained second and third positions, respectively, with 349 and 71 SLWIF. The authors of the study found that the SLWIF was higher in the recently established central university libraries in India than in those that had been in existence for a considerable amount of time.

| Name of the university | Library website | NWP | SLWP | SLWIF | Rank |
|---|---|-----|------|-------|------|
| Aligarh Muslim University | https://www.amu.ac.in/libraries/maulana-azad-library | 1 | 589 | 589 | 1 |
| Assam University | https://ausopac.informaticsglobal.com/ | 1 | 349 | 349 | 2 |
| Babasaheb Bhimrao Ambedkar University | https://www.gbl.bbau.ac.in/ | 1 | 71 | 71 | 3 |
| Banaras Hindu University | https://www.bhu.ac.in/Site/UnitHomeTemplate/1_3240_4531_Main-Site-Central-Library | 13 | 327 | 25.15 | 4 |
| Central Sanskrit University | https://www.sanskrit.nic.in/library.php | 12 | 177 | 14.75 | 5 |
| Central Tribal University of Andhra Pradesh | https://www.ctuap.ac.in/facilities/ | 50 | 526 | 10.52 | 6 |

| Name of the university | Library website | NWP | SLWP | SLWIF | Rank |
|---|---|------|------|-------|------|
| Central University of Andhra Pradesh | https://cuap.ac.in/library.html | 15 | 157 | 10.47 | 7 |
| Central University of Haryana | https://library.cuh.ac.in/ | 20 | 170 | 8.50 | 8 |
| Central University of Himachal Pradesh | https://cuhpopac.informaticsglobal.com/ | 50 | 257 | 5.14 | 9 |
| Central University of Jammu | https://www.cujammu.ac.in//Default.aspx?option=article&type=single&id=35&mnuid=738&prvtyp=site | 50 | 196 | 3.92 | 10 |
| Central University of Jharkhand | http://cuj.cuj.ac.in/library-cuj.php | 50 | 119 | 2.38 | 11 |
| Central University of Karnataka | http://cuklibrary.ac.in/index.html | 42 | 50 | 1.19 | 12 |
| Central University of Odisha | http://library.cuo.ac.in/ | 162 | 178 | 1.10 | 13 |
| Central University of Punjab | https://cup.edu.in/library.php | 33 | 29 | 0.88 | 14 |
| Central University of Rajasthan | https://www.curaj.ac.in/library | 135 | 106 | 0.79 | 15 |
| Central University of South Bihar | https://library.cusb.ac.in/ | 50 | 36 | 0.72 | 16 |
| Central University of Tamil Nadu | http://82.180.173.110/ | 50 | 29 | 0.58 | 17 |
| Dr. Rajendra Prasad Central Agricultural University | https://www.rpcau.ac.in/university-library/ | 568 | 143 | 0.25 | 18 |
| English and Foreign Languages University | https://www.efluniversity.ac.in/ramesh_library.php | 2950 | 655 | 0.22 | 19 |
| Guru Ghasidas Vishwavidyalaya | https://www.ggu.ac.in/CentralLibrary.aspx | 2220 | 401 | 0.18 | 20 |
| Hemvati Nandan Bahuguna Garhwal University | https://www.hnbggu.ac.in/search/node?keys=library | 1370 | 212 | 0.15 | 21 |
| Indira Gandhi National Open University | http://www.ignou.ac.in/ignou/aboutignou/division/ldd/introduction | 2160 | 324 | 0.15 | 22 |
| Jamia Millia Islamia | https://www.jmi.ac.in/ACADEMICS/University-Library/Services-&Facilities/Events | 2180 | 318 | 0.15 | 23 |
| Jawaharlal Nehru University | https://www.jnu.ac.in/node# | 2200 | 282 | 0.13 | 24 |
| Mahatma Gandhi Antarrashtriya Hindi Vishwavidyalaya | https://hindivishwa.org/contentdtl.aspx?category=4&cgid=19 | 1120 | 122 | 0.11 | 25 |
| Mahatma Gandhi Central University | https://mgcub.ac.in/library.php | 387 | 41 | 0.11 | 26 |
| Manipur University | http://mulibrary.manipuruniv.ac.in/ | 2160 | 225 | 0.10 | 27 |
| Maulana Azad National Urdu University | https://manuu.edu.in/University/Centre/Library/Profile | 2430 | 240 | 0.10 | 28 |
| Mizoram University | https://lib.mzu.edu.in/ | 3010 | 240 | 0.08 | 29 |
| Nagaland University | https://library.nagalanduniversity.ac.in/ | 2160 | 165 | 0.08 | 30 |
| Nalanda University | https://nalandauniv.edu.in/library/ | 2190 | 164 | 0.07 | 31 |
| National Sanskrit University (previously Rashtriya Sanskrit Vidyapeeth) | https://nssktu.ac.in/index.php/about-library/ | 2160 | 153 | 0.07 | 32 |
| National Sports University | https://ndl.iitkgp.ac.in/ | 2160 | 137 | 0.06 | 33 |
| North Eastern Hill University | https://www.nehu.ac.in/library/index.html | 2320 | 143 | 0.06 | 34 |

| Name of the university | Library website | NWP | SLWP | SLWIF | Rank |
|---|---|------|------|-------|------|
| Pondicherry University | https://lib.pondiuni.edu.in/ | 3710 | 227 | 0.06 | 35 |
| Rajiv Gandhi National Aviation University | https://www.rgnau.ac.in/en | 2190 | 127 | 0.06 | 36 |
| Rajiv Gandhi University | https://rgu.ac.in/library/ | 422 | 21 | 0.05 | 37 |
| Rani Lakshmi Bai Central Agricultural University | http://122.185.27.76/ | 2340 | 104 | 0.04 | 38 |
| Shri Lal Bahadur Shastri National Sanskrit University | https://www.slbsrv.ac.in/library/about-library-o | 2330 | 93 | 0.04 | 39 |
| Sikkim University | https://library.cus.ac.in/ | 2190 | 83 | 0.04 | 40 |
| South Asian University | http://library.sau.ac.in/ | 2170 | 75 | 0.03 | 41 |
| The Indira Gandhi National Tribal University | https://www.igntu.ac.in/clib.aspx | 2190 | 66 | 0.03 | 42 |
| Tripura University | https://stage.tripurauniv.ac.in/Page/LBCResourcesE_Journals | 2180 | 57 | 0.03 | 43 |
| University of Allahabad | https://allduniv.ac.in/facilities/about1 | 2160 | 40 | 0.02 | 44 |
| University of Hyderabad | http://igmlnet.uohyd.ac.in:8000/ | 2160 | 28 | 0.01 | 45 |
| Visva-Bharati | http://visva-bharati-library.in/ | 2160 | 17 | 0.01 | 46 |

Table 3. SLWIF of the Central University Library Websites of India.

6.4. ELWIF of the Central University Library Websites of India

As illustrated in Table 4, the central university libraries in India have been ranked based on the criteria established by the WIF. It has been determined that the Aligarh Muslim University, Zainul Abidin Road, Aligarh, Uttar Pradesh has achieved the highest ranking in ELWIF (29). The Assam University, Silchar, Dargakona, Cachar, Assam was ranked second with 26

ELWIF. The Babasaheb Bhimrao Ambedkar University, Vidya Vihar, Raebareli Road, Lucknow was ranked third with 18 ELWIF. The Banaras Hindu University, Ajagara, Varanasi, Uttar Pradesh has 4.08 ELWIF which ranked fourth. In contrast, the University of Hyderabad in Telangana has 3710 more web pages than the three leading central university libraries in India. However, it is ranked 45th due to its lower number of link pages compared to its web pages.

| Name of the university | Library website | NWP | ELWP | ELWIF | Rank |
|---|---|-----|------|-------|------|
| Aligarh Muslim University | https://www.amu.ac.in/libraries/maulana-azad-library | 1 | 29 | 29 | 1 |
| Assam University | https://ausopac.informaticsglobal.com/ | 1 | 26 | 26 | 2 |
| Babasaheb Bhimrao Ambedkar University | https://www.gbl.bbau.ac.in/ | 1 | 18 | 18 | 3 |
| Banaras Hindu University | https://www.bhu.ac.in/Site/UnitHomeTemplate/1_3240_4531_Main-Site-Central-Library | 13 | 53 | 4.08 | 4 |
| Central Sanskrit University | https://www.sanskrit.nic.in/library.php | 12 | 33 | 2.75 | 5 |
| Central Tribal University of Andhra Pradesh | https://www.ctuap.ac.in/facilities/ | 50 | 95 | 1.90 | 6 |
| Central University of Andhra Pradesh | https://cuap.ac.in/library.html | 50 | 56 | 1.12 | 7 |
| Central University of Haryana | https://library.cuh.ac.in/ | 50 | 50 | 1 | 8 |
| Central University of Himachal Pradesh | https://cuhpopac.informaticsglobal.com/ | 33 | 32 | 0.97 | 9 |
| Central University of Jammu | https://www.cujammu.ac.in/Default.aspx?option=article&type=single&id=35&mnuuid=738&prvtyp=site | 15 | 12 | 0.80 | 10 |
| Central University of Jharkhand | http://cu.j.cuj.ac.in/library-cuj.php | 20 | 11 | 0.55 | 11 |
| Central University of Karnataka | http://cuklibrary.ac.in/index.html | 50 | 19 | 0.38 | 12 |

| Name of the university | Library website | NWP | ELWP | ELWIF | Rank |
|--|---|------|------|-------|------|
| Central University of Odisha | http://library.cuo.ac.in/ | 387 | 89 | 0.23 | 13 |
| Central University of Punjab | https://cup.edu.in/library.php | 50 | 8 | 0.16 | 14 |
| Central University of Rajasthan | https://www.curaj.ac.in/library | 135 | 20 | 0.15 | 15 |
| Central University of South Bihar | https://library.cusb.ac.in/ | 50 | 7 | 0.14 | 16 |
| Central University of Tamil Nadu | http://82.180.173.110/ | 162 | 18 | 0.11 | 17 |
| Dr. Rajendra Prasad Central Agricultural University | https://www.rpcau.ac.in/university-library/ | 42 | 3 | 0.07 | 18 |
| English and Foreign Languages University | https://www.efluniversity.ac.in/ramesh_library.php | 422 | 16 | 0.04 | 19 |
| Guru Ghasidas Vishwavidyalaya | https://www.ggu.ac.in/CentralLibrary.aspx | 2330 | 88 | 0.04 | 20 |
| Hemvati Nandan Bahuguna Garhwal University | https://www.hnbgu.ac.in/search/node?keys=library | 2160 | 79 | 0.04 | 21 |
| Indira Gandhi National Open University | http://www.ignou.ac.in/ignou/aboutignou/division/ldd/introduction | 568 | 19 | 0.03 | 22 |
| Jamia Millia Islamia | https://www.jmi.ac.in/ACADEMICS/University-Library/Services-&Facilities/Events | 2320 | 61 | 0.03 | 23 |
| Jawaharlal Nehru University | https://www.jnu.ac.in/node# | 2160 | 53 | 0.02 | 24 |
| Mahatma Gandhi Antarrashtriya Hindi Vishwavidyalaya | https://hindivishwa.org/contentdtl.aspx?category=4&cgid=19 | 1370 | 27 | 0.02 | 25 |
| Mahatma Gandhi Central University | https://mgcub.ac.in/library.php | 2160 | 42 | 0.02 | 26 |
| Manipur University | http://mulibrary.manipuruniv.ac.in/ | 2190 | 41 | 0.02 | 27 |
| Maulana Azad National Urdu University | https://manuu.edu.in/University/Centre/Library/Profile | 2170 | 39 | 0.02 | 28 |
| Mizoram University | https://lib.mzu.edu.in/ | 2190 | 38 | 0.02 | 29 |
| Nagaland University | https://library.nagalanduniversity.ac.in/ | 2160 | 36 | 0.02 | 30 |
| Nalanda University | https://nalandauniv.edu.in/library/ | 2430 | 40 | 0.02 | 31 |
| National Sanskrit University (previously Rashtriya Sanskrit Vidyaapeeth) | https://nasktu.ac.in/index.php/about-library/ | 2200 | 35 | 0.02 | 32 |
| National Sports University | https://ndl.iitkgp.ac.in/ | 2180 | 32 | 0.01 | 33 |
| North Eastern Hill University | https://www.nehu.ac.in/library/index.html | 2340 | 33 | 0.01 | 34 |
| Pondicherry University | https://lib.pondiuni.edu.in/ | 2160 | 25 | 0.01 | 35 |
| Rajiv Gandhi National Aviation University | https://www.rgnau.ac.in/en | 2950 | 34 | 0.01 | 36 |
| Rajiv Gandhi University | https://rgu.ac.in/library/ | 2160 | 24 | 0.01 | 37 |
| Rani Lakshmi Bai Central Agricultural University | http://122.185.27.76/ | 2190 | 21 | 0.01 | 38 |
| Shri Lal Bahadur Shastri National Sanskrit University | https://www.slbsrsv.ac.in/library/about-library-o | 2220 | 16 | 0.01 | 39 |
| Sikkim University | https://library.cus.ac.in/ | 3010 | 17 | 0.01 | 40 |
| South Asian University | http://library.sau.ac.in/ | 2160 | 12 | 0.01 | 41 |
| The Indira Gandhi National Tribal University | https://www.igntu.ac.in/clib.aspx | 2190 | 10 | 0 | 42 |
| Tripura University | https://stage.tripurauniv.ac.in/Page/LBCResourcesE_Journals | 2160 | 6 | 0 | 43 |
| University of Allahabad | https://allduniv.ac.in/facilities/about1 | 2180 | 5 | 0 | 44 |
| University of Hyderabad | http://igmlnet.uohyd.ac.in:8000/ | 3710 | 8 | 0 | 45 |
| Visva-Bharati | http://visva-bharati-library.in/ | 1120 | 0 | 0 | 46 |

Table 4. ELWIF of the Central University Library Websites of India

6.5. Broken link web impact factor of the Central University Library Websites of India

As illustrated in Table 5, the broken link of the websites belonging to the central university library in India has been calculated, and the resulting findings are displayed. A study of university websites reveals that Aligarh Muslim University, Zainul Abidin Road, Aligarh, Uttar Pradesh is in the first rank with 0.17% broken link, followed by Assam University,

Silchar, Dargakona, Cachar, Assam, which is in the second rank with 0.28% broken link. The Babasaheb Bhimrao Ambedkar University, Vidya Vihar, Raebareli Road, Lucknow has been ranked third with 0.38% broken link. Conversely, the Banaras Hindu University, Ajagara, Varanasi, Uttar Pradesh attained fourth position with 0.39% broken link. The Visva-Bharati, Santiniketan, Birbhum, West Bengal has been ranked 46th with the highest broken link of 94.59%.

| Name of the university | Library website | LWP | BL | Percentage (%) | Rank |
|---|---|-----|----|----------------|------|
| Aligarh Muslim University | https://www.amu.ac.in/libraries/maulana-azad-library | 576 | 1 | 0.17 | 1 |
| Assam University | https://ausopac.informaticsglobal.com/ | 360 | 1 | 0.28 | 2 |
| Babasaheb Bhimrao Ambedkar University | https://www.gbl.bbau.ac.in/ | 264 | 1 | 0.38 | 3 |
| Banaras Hindu University | https://www.bhu.ac.in/Site/UnitHomeTemplate/1_3240_4531_Main-Site-Central-Library | 257 | 1 | 0.39 | 4 |
| Central Sanskrit University | https://www.sanskrit.nic.in/library.php | 252 | 1 | 0.40 | 5 |
| Central Tribal University of Andhra Pradesh | https://www.ctuap.ac.in/facilities/ | 189 | 1 | 0.53 | 6 |
| Central University of Andhra Pradesh | https://cuap.ac.in/library.html | 181 | 1 | 0.55 | 7 |
| Central University of Haryana | https://library.cuh.ac.in/ | 169 | 1 | 0.59 | 8 |
| Central University of Himachal Pradesh | https://cuhpopac.informaticsglobal.com/ | 162 | 1 | 0.62 | 9 |
| Central University of Jammu | https://www.cujammu.ac.in/Default.aspx?option=article&type=single&id=35&mnuid=738&prvtyp=site | 615 | 4 | 0.65 | 10 |
| Central University of Jharkhand | http://cuj.cuj.ac.in/library-cuj.php | 126 | 1 | 0.79 | 11 |
| Central University of Karnataka | http://cuklibrary.ac.in/index.html | 417 | 4 | 0.96 | 12 |
| Central University of Odisha | http://library.cuo.ac.in/ | 689 | 9 | 1.31 | 13 |
| Central University of Punjab | https://cup.edu.in/library.php | 378 | 5 | 1.32 | 14 |
| Central University of Rajasthan | https://www.curaj.ac.in/library | 122 | 2 | 1.64 | 15 |
| Central University of South Bihar | https://library.cusb.ac.in/ | 53 | 1 | 1.89 | 16 |
| Central University of Tamil Nadu | http://82.180.173.110/ | 350 | 8 | 2.29 | 17 |
| Dr. Rajendra Prasad Central Agricultural University | https://www.rpcau.ac.in/university-library/ | 235 | 7 | 2.98 | 18 |
| English and Foreign Languages University | https://www.efluniversity.ac.in/ramesh_library.php | 196 | 6 | 3.06 | 19 |
| Guru Ghasidas Vishwavidyalaya | https://www.ggu.ac.in/CentralLibrary.aspx | 317 | 11 | 3.47 | 20 |

| Name of the university | Library website | LWP | BL | Percentage (%) | Rank |
|---|---|-----|----|----------------|------|
| Hemvati Nandan Bahuguna Garhwal University | https://www.hnbg.ac.in/search/node?keys=library | 137 | 5 | 3.65 | 21 |
| Indira Gandhi National Open University | http://www.ignou.ac.in/ignou/aboutignou/division/idd/introduction | 137 | 5 | 3.65 | 22 |
| Jamia Millia Islamia | https://www.jmi.ac.in/ACADEMICS/University-Library/Services-&-Facilities/Events | 380 | 14 | 3.68 | 23 |
| Jawaharlal Nehru University | https://www.jnu.ac.in/node# | 210 | 8 | 3.81 | 24 |
| Mahatma Gandhi Antarrashtriya Hindi Vishwavidyalaya | https://hindivishwa.org/contentdtl.aspx?category=4&cgid=19 | 181 | 7 | 3.87 | 25 |
| Mahatma Gandhi Central University | https://mgcub.ac.in/library.php | 124 | 5 | 4.03 | 26 |
| Manipur University | http://mulibrary.manipuruniv.ac.in/ | 280 | 14 | 5 | 27 |
| Maulana Azad National Urdu University | https://manuu.edu.in/University/Centre/Library/Profile | 239 | 12 | 5.02 | 28 |
| Mizoram University | https://lib.mzu.edu.in/ | 178 | 9 | 5.06 | 29 |
| Nagaland University | https://library.nagalanduniversity.ac.in/ | 96 | 5 | 5.21 | 30 |
| Nalanda University | https://nalandauniv.edu.in/library/ | 114 | 6 | 5.26 | 31 |
| National Sanskrit University (previously Rashtriya Sanskrit Vidyapeeth) | https://nsktu.ac.in/index.php/about-library/ | 278 | 15 | 5.40 | 32 |
| National Sports University | https://ndl.iitkgp.ac.in/ | 202 | 11 | 5.45 | 33 |
| North Eastern Hill University | https://www.nehu.ac.in/library/index.html | 89 | 5 | 5.62 | 34 |
| Pondicherry University | https://lib.pondiuni.edu.in/ | 138 | 9 | 6.52 | 35 |
| Rajiv Gandhi National Aviation University | https://www.rgnau.ac.in/en | 179 | 12 | 6.70 | 36 |
| Rajiv Gandhi University | https://rgu.ac.in/library/ | 87 | 6 | 6.90 | 37 |
| Rani Lakshmi Bai Central Agricultural University | http://122.185.27.76/ | 62 | 6 | 9.68 | 38 |
| Shri Lal Bahadur Shastri National Sanskrit University | https://www.slbsrsv.ac.in/library/about-library-o | 37 | 4 | 10.81 | 39 |
| Sikkim University | https://library.cus.ac.in/ | 61 | 7 | 11.48 | 40 |
| South Asian University | http://library.sau.ac.in/ | 34 | 4 | 11.76 | 41 |
| The Indira Gandhi National Tribal University | https://www.igntu.ac.in/clib.aspx | 131 | 16 | 12.21 | 42 |
| Tripura University | https://stage.tripurauniv.ac.in/Page/LBCResourcesE_Journals | 52 | 7 | 13.46 | 43 |
| University of Allahabad | https://allduniv.ac.in/facilities/about1 | 204 | 32 | 15.69 | 44 |
| University of Hyderabad | http://igmlnet.uohyd.ac.in:8000/ | 130 | 23 | 17.69 | 45 |
| Visva-Bharati | http://visva-bharati-library.in/ | 37 | 35 | 94.59 | 46 |

Table 5. Broken link of the Central University Library Websites of India.

The study's primary observations revealed significant disparities in the webometric performance of various Central University Library Websites. It has been observed that there is a considerable degree of variability in WIF scores, with older, well-established universities often demonstrating superior performance in simple and self-link metrics. The prevalence of BL on numerous websites has been identified as a substantial concern, given its potential to adversely impact user experience and the efficacy of SEO. It has been observed that there is a discrepancy between the number of web pages and linked pages, particularly for universities such as the University of Hyderabad and the English and Foreign Languages University. The study posits that enhancing the quality of links is imperative for improving search engine visibility and usability. This can be achieved by reducing the number of BL and increasing both self-links and external links. The study initiates regular updates to the websites; this is crucial for maintaining the relevance of the content and enhancing the overall user engagement. In addition, it is imperative to enhance the architecture of websites to facilitate seamless navigation and ensure that users can effortlessly access and locate the desired information and resources. The authors present a comprehensive plan of action, which involves the implementation of regular audits utilizing tools such as the Broken Link Checker to identify and rectify BL. In addition, the implementation of a well-defined and methodical strategy is imperative to augment the quantity of self-links and the caliber of external links. Collaboration with academic institutions and publishers is imperative to establish reciprocal links. It is recommended that dedicated resources be allocated for periodic content updates, including the integration of emerging technologies such as AI chatbots for enhanced user interaction.

7. CONCLUSION

The findings of this study underscore the importance of webometric analysis in evaluating and improving the effectiveness of Central University Library Websites in India. The Aligarh Muslim University demonstrated superior performance across multiple metrics, exhibiting excellence in SWIF, SLWIF, ELWIF,

and maintaining minimal BL. Conversely, Visva-Bharati was identified as one of the underperforming institutions due to a high percentage of BL. The study underscores critical deficiencies, including inconsistent web design, BL, and inadequate external linkages, which collectively impede the overall effectiveness and accessibility of library websites. Addressing these issues through targeted interventions, including regular website audits, content optimization, and link-building strategies, can significantly enhance user experience and search engine performance. This study underscores the importance of webometric methodologies for central universities, demonstrating that their adoption can lead to significant advancements in several key areas. These advancements include the enhancement of digital presence, alignment with global best practices, and the optimization of services for academic communities. To maintain relevance in an increasingly digital academic landscape, continuous improvements to these websites are essential.

Conflict of interest

The authors declare that there are no conflicts of interest.

Contribution statement

Vaishali Shinde: Research conceptualization, review of related studies, data collection, analysis and interpretation.

Gururaj S. Hadagali: Framing the study concept, need and methodology, discussion part, overall supervising the manuscript.

Statement of data consent

The data generated during the study have been included in the article. ●

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