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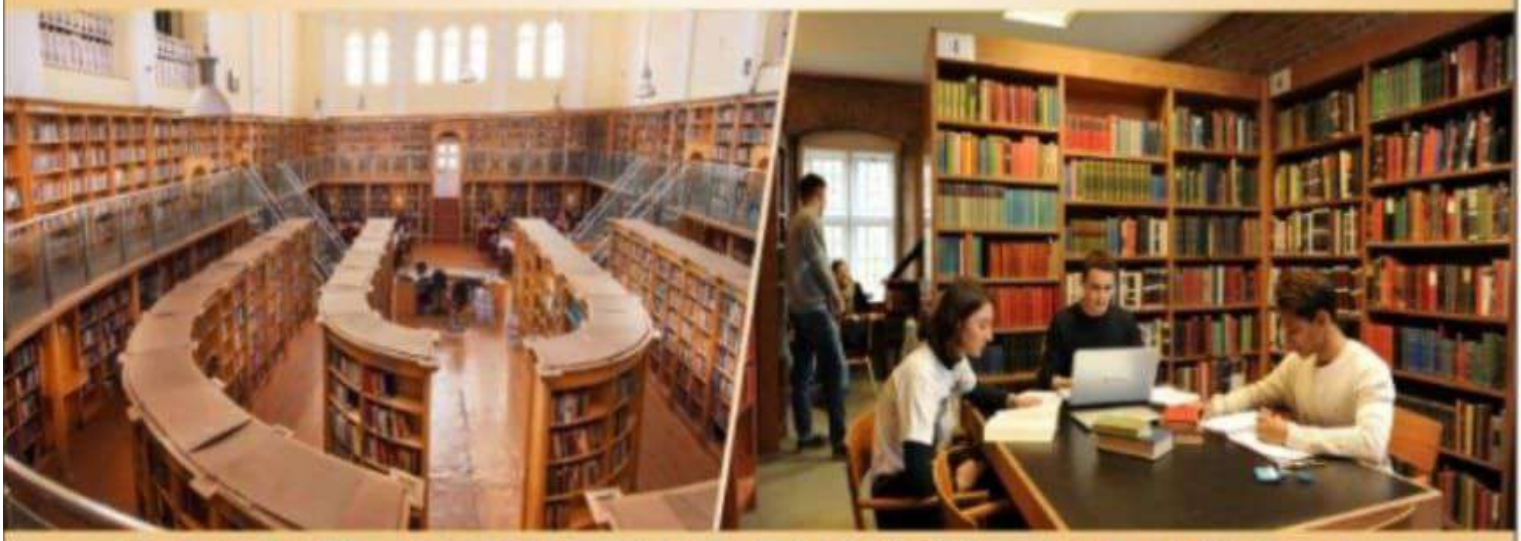

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INFORMATION AND COMMUNICATION TECHNOLOGIES INFLUENCE ON LIBRARIAN'S SKILLS IN NEPAL

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ABSTRACT

This study explores the impact of Information and Communication Technology (ICT) on librarians employed at five specifically chosen university libraries in Nepal. The research used a structured questionnaire as a data collection tool. The research engaged all five university librarians, and all distributed questionnaires were completed and returned. The study's findings indicate that while university librarians demonstrated competence in fundamental ICT applications, there is a recognized need for additional knowledge acquisition to achieve proficiency in specific ICT tools. Moreover, all surveyed librarians strongly agreed that integrating ICT applications contributes positively to the stature of libraries.

The research also identified several noteworthy challenges faced by university librarians in Nepal, including inadequate staff training, insufficient infrastructure, coordination issues among staff members, and financial constraints. Securing ample funding and implementing professional development programs are crucial to enhancing the effective integration of ICT applications into university libraries. Furthermore, the study emphasizes the importance of university librarians staying well-informed about emerging, cutting-edge technologies. This awareness, coupled with the adoption of advanced technologies in daily operations, is pivotal for advancing library services and enriching the experience of intellectual library users.

Keywords: ICT skills; ICT competencies; University Libraries; Library professionals; Nepal.

1. Introduction

The emergence of the Internet and Information and Communication Technology (ICT) has opened up new avenues for acquiring, managing, and disseminating technical and scientific information. University libraries have effectively harnessed cutting-edge information technologies to enhance and integrate their resources and services, reinforcing their specific roles. However, in Nepal, there is a pressing need for university libraries and the Library and Information Science (LIS) profession to adapt to this dynamic change.

In today's landscape, users possess a heightened level of computer and Internet proficiency for research purposes and anticipate seamless access when needed. Consequently, the LIS profession within university libraries must proactively update their skills and competencies in emerging technologies. This adaptation is essential to

establishing a comprehensive information support system for society.

1.1 Brief Description of Studied Universities in Nepal

(i) Tribhuvan University (TU)

Tribhuvan University (TU) stands for Nepal's pioneering and largest comprehensive central university, with its establishment dating back to 1959 (TU, 2022). At the heart of TU's academic support infrastructure is the Tribhuvan University Central Library (TUCL). Renowned as the foremost library in Nepal, TUCL distinguishes itself through its expansive user base, vast collection, and diverse services. The library's extensive collection boasts an impressive aggregate of over four lakh volumes of documents, complemented by a wealth of electronic resources. In line with its stature as a university library, TUCL offers a spectrum of services tailored to cater to the diverse needs of its users.

TU is Nepal's first and largest extensive central university, established in 1959 (TU, 2022). It has one central library named Tribhuvan University Central Library (TUCL). It is considered the most extensive library in Nepal in terms of users, collection, and services. The library collection has reached more than four lakh volumes of documents and massive e-resources. Being a university library, it provides various services to users (TUCL, 2022).

(ii) Kathmandu University (KU)

Kathmandu University (KU) is a self-governing, autonomous, not-for-profit public institution founded through a parliamentary act in December 1991 (KU, 2023). The university has a central library in Dhulikhel, complemented by seven branch libraries distributed across different school buildings. The central library at KU boasts a substantial collection of 65,000 volumes encompassing various documents, such as journals, audio cassettes, CDs, magazines, and various subscribed electronic resources. To enrich the academic resources available to its community, Kathmandu University Central Library (KUCL) maintains subscriptions to multiple databases to disseminate electronic resources (KU, 2023).

(iii) Pokhara University (PU)

Pokhara University (PU) had its inception in 1986, and it officially came into existence as a university in 1997. The university wholly relies on government capital expenditure grants (PU, 2023). At the heart of its academic support system is the Pokhara University Central Library (PUCL), complemented by additional branch libraries housed in separate buildings. Presently, PUCL houses an extensive collection boasting over 40,000 volumes of diverse documents, which includes books, periodicals, magazines, theses, dissertations, CDs, and newspapers (PU, 2023).

(iv) Patan Academy of Health Science (PAHS)

PAHS is an independent, not-for-profit entity founded in 2008 (PAHS, 2023). As an accredited university, it boasts the highly-regarded Patan Academy of Health Sciences Library (commonly referred to as the PAHS Library), surpassing its counterparts among Nepal's medical libraries. With a vast collection comprising over 12,900,000 books, 30,000 journals, and an extensive array of medical-related databases (PAHS, 2023), the PAHS Library is a formidable resource for healthcare information.

(v) The Nepal Open University (NOU)

The National Open University (NOU), established in 2016 through the "Act of Nepal Open University 2016," operates with complete government funding. Its primary mission is to broaden the accessibility of higher education to individuals who have traditionally been excluded from conventional higher or tertiary education avenues. As an open university, NOU maintains a relatively modest physical collection. However, to cater to the needs of remote learners, the university has made substantial investments in online databases, ensuring a wealth of information

and resources are readily available to its user base (NOU, 2023).

2. Review of Related Literature

Effective utilization of information and communication technology (ICT) introduces a novel approach to enhancing connections between library users and libraries, optimizing the delivery of library services. Several prior research studies provide valuable insights into the subject at hand:

A study by Naveed et al. (2022) focused on core technology competencies essential for system librarians, such as cloud computing, web publishing, basic computing, computer networking, database management systems, and information systems. These competencies were identified as crucial for adapting to the evolving technological landscape. Shahzad (2021) expanded upon this by emphasizing the importance of adapting to new emerging technologies, automation-related skills, web-based skills, innovating abilities, and skills related to providing electronic services as core competencies for modern librarianship. Devi & Bhatt (2021) delved into the evolving roles of library services, library users, and professionals in light of technological advancements. Their work underscores the necessity of ICT in contemporary librarianship, emphasizing the need for academic librarians to update their ICT skills to effectively serve as information support hubs for society. Omehia et al. (2021) uncovered a significant correlation between computer competencies and proficiencies in Web 2.0 and information retrieval among academic librarians. They stressed the importance of ongoing training in information retrieval processes, Web 2.0 technologies, and fundamental computer operations for librarians in academic settings.

Singh (2021) noted that women tend to use Web 2.0 tools more frequently than men, with participants demonstrating familiarity with platforms such as blogs, Google Drive, wikis, social networking sites, Grammarly, Gmail, and RSS. Williams (2020) highlighted the role of Web 2.0 in providing academic libraries with a virtual workspace, supplementing traditional forms of communication like email and physical mail.

Gupta & Madhusudhan (2021) investigated the utility of CCTV systems in academic libraries for security, including theft prevention, safeguarding against unethical losses and missing items, preservation of rare materials through advanced camera technology, and enhancement of service efficiency. Another study by Ajeemsha and Madhusudhan (2019) emphasized the multifaceted benefits of Web 2.0, which serves as a potent medium for information retrieval, entertainment, and learning. Reshaping librarians' skills and competencies has been crucial to the library's evolution. Bajpai and Madhusudhan (2019) stressed the importance of ICT competencies and skills for library staff to provide effective services through technology. Shehu & Singh (2022) argued that staff training is essential for improving library ICT-based services, highlighting the need for ongoing professional development. Raju (2017) advocated for integrating IT knowledge and skills into library and information science curricula, emphasizing the importance of incorporating these skills as an integral part of the educational curriculum.

Bansode & Viswe (2017) assessed the ICT literacy rate among university library staff, finding that most staff possessed basic ICT skills and highlighting the need for further improvement. This study addresses a critical gap in the literature by examining the professional development of LIS professionals in university libraries in Nepal, contributing valuable insights to the evolving landscape of library science and ICT integration to prove their ICT literacy levels. As mentioned above, the literature explains the importance of implementing ICT in libraries and LIS professionals' attire for changing trends. There was a gap in that no study has been conducted in universities in Nepal to determine the professional development of LIS

professionals. Hence, this study fills the gap in the literature in university libraries in Nepal.

3. Statement of the Problem

The transformation from traditional print resources to digital information has profoundly influenced every facet of Nepal's academic library system. This shift has particularly impacted three key dimensions: the library staff, patrons, and the array of services offered. University libraries are pivotal in delivering diverse services by utilizing information and communication technology (ICT) applications within the academic landscape. However, there is a growing imperative for university libraries to elevate their sophistication in integrating ICT-based solutions within their physical and virtual spaces. It is noteworthy that library professionals are experiencing a shift in their mindset, becoming increasingly receptive to adopting ICT applications.

To effectively serve the evolving needs of individual and collective academic communities, it is crucial to continuously enhance the proficiency of the dedicated personnel responsible for delivering information and services. To progress in this direction, librarians must acquire comprehensive knowledge concerning utilizing computers and communication technology. Nepal's university libraries have responded to the academic community's expectations by expanding their services and offering an array of e-resources. Nonetheless, it remains imperative to gauge how much library and information science (LIS) professionals leverage ICT applications and assess their competence in handling these technologies. Surprisingly, there has yet to be a comprehensive investigation in Nepal to evaluate the impact of ICT on the professional activities of LIS experts. This study aims to shed light on how LIS professionals have kept pace with the rapid advances in ICT and the degree to which their professional development endeavours have equipped them to effectively navigate the ever-evolving landscape of cutting-edge technologies within the LIS field.

4. Objectives and Methodology of the Study

(i) to identify different ICT-based tools used for information services in the university libraries studied in Nepal;

(ii) to explore the ICT skills and competencies of LIS professionals in providing ICT services to their users;

(iii) to assess the Web/Library 2.0 skills and competencies of LIS professionals in the collaborative age;

(iv) to study the problems faced by LIS professionals for effective use of ICT in universities under study and

(v) To suggest new cutting-edge emerging ICT skills and competencies for LIS professionals to enhance existing library services in smart library services.

The study is limited to a focused pilot investigation involving five (5) university libraries in Nepal, as outlined in Table 1. Employing a survey approach, the research utilized a meticulously designed questionnaire to elicit insights from participants regarding their experiences with information and communication technology (ICT) applications within the unique contexts of their respective university libraries. The questionnaire was structured into four distinct sections, encompassing (i) general information, (ii) ICT skills and competencies, (iii) ICT skills and competencies in the collaborative era, and (iv) challenges encountered in the implementation of ICT applications.

During October 2023, the questionnaire was personally administered to five librarians, all of whom completed and returned the surveys, yielding a 100% response rate. The collected responses underwent a

comprehensive analysis employing descriptive statistics and were subsequently presented in six tables to facilitate a thorough and meaningful interpretation.

Table 1: List of participating University Libraries in Nepal

Sl. No.	University Name	Library	Library's URL
1.	Tribhuvan University (TU)	Tribhuvan University Central Library (TUCL)	www.tucl.edu.np
2.	Kathmandu University (KU)	Kathmandu University Central Library	https://ku.edu.np/central-library
3.	Pokhara University (PokU)	Pokhara University Central Library	https://pu.edu.np/library/
4.	Nepal Open University (NOU)	Nepal Open University (NOU) Library	https://nou.edu.np/
5.	Patan Academy of Health Sciences (PAHS)	Patan Academy of Health Sciences (PAHS) Library	https://www.pahs.edu.np/

5 Findings of the study

5.1 Demographic Information

Demographic data, encompassing factors such as gender, qualifications, experience, and the nature of work, has been assessed to gauge the robustness of human resource management within the library, as illustrated in Table 2.

Table 2: Demographic information of respondents (N=5)

Sl. No.	Particulars	No. of respondents	Percentage (%)
Gender			
(i)	Male	03	60
(ii)	Female	02	40
Academic Degree			
(i)	MLISc	00	100
(ii)	MPhil	00	00
(iii)	PhD	00	00
(iv)	BLISc.	00	00
Professional Designation			
(i)	Library Officer	02	40
(ii)	Library Assistant	01	20
(iii)	Librarian	01	20
(iv)	Deputy Librarian	01	20
(v)	Asst. Librarian	00	00
Professional Experience			
(i)	Below 5 years	01	20
(ii)	6 to 10 Years	00	00
(iii)	11 to 15 Years	02	40
(iv)	16 to 20 Years	00	00
(v)	20 to 30 Years	02	40

(vi)	Above 31 Years	00	00
Nature of Work*			
(i)	Library Administrating	05	100
(ii)	E-resources Management	04	80
(iii)	Technical Processing	04	80
(iv)	Institutional Repository	03	60
(v)	Current Awareness Services	03	60
(vi)	System Managing (IT)	03	60
(vii)	Acquisition	02	40
(viii)	Reference service	02	40
(ix)	Data Entry	02	40
(x)	Lending Service	01	20

Note: Multiple answers are permitted.

Table 2 shows the participant demographics breakdown, revealing that male participants outnumber females by 60% to 40%. This disparity suggests a predominance of males in top-level positions within the library. Academic qualifications serve as the foundation for any employee. In this context, all library professionals, including department heads, hold post-graduate degrees in Library and Information Science (LIS) as their highest academic qualification, constituting 100% of the sample.

Within the library ecosystem, various roles entail different responsibilities. Table 2 indicates that 40% of respondents hold the designation of 'library officers,' followed by 'librarians' (20%), 'deputy librarians' (20%), and 'library assistants' (20%). Regarding professional experience, 40% of respondents have accumulated 20-30 years of experience, while another 40% have 11-15 years of experience. This data underscores the substantial professional experience held by university librarians, which greatly contributes to their adept management of library facilities and fosters innovation in their roles.

Professional experience in this context signifies practical knowledge and expertise in the specific job domain. The study further elucidates that library professionals primarily engage in library administration (100%), e-resource management (80%), and technical processing (80%) as their core responsibilities. Additionally, respondents mentioned their involvement in managing institutional repositories (60%), while similar responses were obtained for Current Awareness Services (CAS) and system management.

5.2 ICT Skills and Competencies

"Incorporating a diverse array of ICT tools, the Integrated Library Management Software (ILMS) streamlines library operations, expediting service delivery to users and ensuring prompt and efficient access" (Bajpai & Madhusudhan, 2019). As indicated in Table 3, 60% of respondents demonstrated proficiency in Koha ILS, while 40% reported non-usage of PMB software. A notable 60% of respondents expressed unfamiliarity with Mumolus software, with Libra and SoUL 2.0 registering 40% each in the same category.

"A digital library is a specialized repository housing a collection of digital artefacts encompassing textual, visual, audio, and video elements, all stored in electronic formats. These repositories meticulously manage digital assets within their collections" (Atanda et al., 2021). Table 3 illustrates that 60% of respondents possessed competencies pertaining to DSpace, while an equivalent percentage expressed a lack of utilization and the need for additional skills in Library space. Similarly, respondents exhibited comparable responses regarding Greenstone and Fedora software.

Content Management System (CMS) tools are pivotal in designing and developing websites featuring text, images, audio, and video content. As detailed in Table 3, most respondents expressed needing proficiency in CMS. Among the featured CMS platforms, Drupal and PHP Nuke topped the list with 60% each, followed by Joomla at 40%. Proficiency with WordPress was reported as average.

Table 3 underscores that all respondents (100%) possessed adept web search engine skills, while 40% demonstrated competency in subject directories. Furthermore, 80% of the surveyed librarians exhibited strong proficiency in MS Excel. On the other hand, VOSvieser, R & R Studio, and MatLab received a 60% rating in the "do not use" category.

In citation management, Table 3 revealed that 60% of respondents excelled in MS Word citation, with Mendeley and Zotero scoring 40% each. Conversely, 60% of respondents reported non-usage of EasyBib, while EndNote and RefWorks received 40% each in the same category.

Aside from providing convenience and comfort, libraries strive to create an enjoyable reading experience for patrons. However, exposing personal belongings and private information to the public poses inherent risks. AI-assisted IoT solutions can mitigate these risks (Bi et al., 2022). All respondents demonstrated proficiency in the barcode system, QR codes, biometrics, RFID, and CCTV at 60% each. In learning management systems, 40% of librarians reported skills in Google Classrooms and MS Teams/Channels. Meanwhile, most respondents expressed a need to acquire skills and awareness regarding STutor, Sakai, and Moodle.

Regarding video/audio/streaming conference tools, 80% of respondents showcased proficiency in Zoom, while Teams and Skype each registered 60%. Surprisingly, 60% of respondents reported non-usage of the Cisco application. In plagiarism detection tools, 40% of university librarians exhibited proficiency in iThentic, with equal responses (40%) in the "do not know" category for Ouriginal, Duplichecker, and Turnitin.

Within academic writing tools, 40% of respondents displayed competence in Grammarly, while 40% expressed a need to learn Quillbot software. As evidenced in Table 3, all respondents (100%) possessed proficient skills in handling memory drives and barcode printing. Except for server maintenance, most library professionals demonstrated comprehensive knowledge of hardware tools. All respondents were well-versed in Windows OS and associated applications like MS Word and MS PowerPoint. However, 40% of respondents expressed a need to acquire skills in Mac OS. Proficiency in cloud computing applications was widespread, except for MS Form, which 40% of librarians sought to learn. Sixty per cent of respondents demonstrated fair knowledge of Google Drive. At the same time, 40% expressed needing proficiency in OneDrive, part of MS 365. Knowledge of cloud computing applications except MS Form. Forty per cent of librarians needed to learn the MS Form cloud applications. Sixty per cent of respondents have a fair knowledge of Google Drive, and 2 (40%) of respondents needed to learn OneDrive, which is handled under MS 365.

Table 3: ICT Skill and Competency Tools (N=5)

Sl. No.	Particulars	Good (%)	Fair (%)	Poor (%)	Do not use (%)	Don't Know (%)
ILMS Tools						
i.	Koha	1(20)	3 (60)			1 (20)

ii.	PMB	1(20)	1(20)		2 (40)	1(20)
iii.	SoUL2.0	1(20)		1(20)	1(20)	2 (40)
iv.	Libra	1(20)		1(20)	1(20)	2(40)
v.	Mumolus	1(20)			1(20)	3 (60)
Institutional Repository Tools						
i.	DSpace	1(20)	3(60)		1(20)	
ii.	Library Space	1(20)			3 (60)	1(20)
iii.	Eprints	1(20)	1(20)		2(40)	1(20)
iv.	Greenstone			1(20)	3(60)	1(20)
v.	Fedora				3(60)	2(40)
Content Management System (CMS) Tools						
i.	WordPress	2(40)	2(40)		1(20)	
ii.	Joomla		1(20)	1(20)	1(20)	2(40)
iii.	Drupal				2(40)	3(60)
iv.	PHP Nuke				2(40)	3(60)
Navigation Tools						
i.	Web Search engine	5(100)				
ii.	Federated Search engine	1(20)	1(20)		1(20)	2(40)
iii.	Subject Gateways	1(20)		1(20)	1(20)	2(40)
iv.	Web Directories	2(40)	1(20)	1(20)		1(20)
Statistical and Visualization Tools						
i.	IBM SPSS	1(20)	1(20)	2(40)		1(20)
ii.	MS Excel	4(80)	1(20)			
iii.	R & R Studio		1(20)		3(60)	1(20)
iv.	SAS		1(20)		2(40)	2(40)
v.	VOSviewer				3(60)	2(40)
vi.	STATA	1(20)		1(20)	1(20)	2(40)
vii.	BIBExcel		1(20)	1(20)	1(20)	2(40)
viii.	MatLab				3(60)	2(40)
Citation Creation & Reference Management Tools						
i.	RefWorks	1(20)		1(20)	2(40)	1(20)
ii.	EndNote	1(20)	1(20)	1(20)	2(40)	
iii.	Easy Bib		1(20)		3(60)	1(20)
iv.	Mendeley	2(40)	1(20)		1(20)	1(20)
v.	Zotero	2(40)	1(20)		1(20)	1(20)
vi.	BibMe	1(20)	1(20)	1(20)		2(40)
vii.	MS Word Citation Tool	3(60)			1(20)	1(20)
Security and Surveillance Tools						
i.	Barcode	5(100)				
ii.	QR code	3(60)	1(20)		1(20)	
iii.	Biometric	3(60)	1(20)			1(20)
iv.	Smart Card	1(20)	1(20)		2(40)	1(20)
v.	CCTV	3(60)		1(20)	1(20)	
vi.	RFID/Electromagnetic Security	3(60)				2(40)

Learning Management System Tools						
i.	Google Classroom	2(40)	2(40)			1(20)
ii.	MS Teams/Channels	2(40)		2(40)		1(20)
iii.	ATutor	1(20)			2(40)	2(40)
iv.	Sakai	1(20)			2(40)	2(40)
v.	Moodle	1(20)			2(40)	2(40)
Video/Audio/streaming Conference Tools						
i.	Zoom	4(80)	1(20)			
ii.	Teams	3(60)		1(20)	1(20)	
iii.	Meets	2(40)		1(20)	1(20)	1(20)
iv.	Cisco Webex		1(20)		3(60)	1(20)
v.	Skype	3(60)	1(20)		1(20)	
Plagiarism Detection Tools						
i.	iThenticate	2(40)	1(20)		1(20)	1(20)
ii.	Original (Urkund)		1(20)		2(40)	2(40)
iii.	Duplichecker	1(20)	1(20)		1(20)	2(40)
iv.	Turnitin	1(20)	1(20)	1(20)		2(40)
Academic Writing Tools						
i.	Grammarly	2(40)	2(40)			1(20)
ii.	Quillbot		1(20)		2(40)	2(40)
Miscellaneous ICT Tools						
Hardware						
i.	Image scanning	4(80)	1(20)			
ii.	E-book Reader	3(60)	1(20)			1(20)
iii.	Digital camera	2(40)	3(60)			
iv.	LCD Projector	4(80)	1(20)			
v.	Laser printing	3(60)	2(40)			
vi.	CCTV	4(80)				1(20)
vii.	Webcam	4(80)	1(20)			
viii.	Memory drive	5(100)				
ix.	Wireless network	4(80)	1(20)			
x.	Barcode printing	5(100)				
xi.	Server Maintenance		2(40)	1(20)	1(20)	1(20)
Operating System						
i.	Windows	5(100)				
ii.	Mac OS			1(20)	2(40)	2(40)
iii.	Linux		2(40)		3(60)	
MS Office Applications						
i.	MS Word	5(100)				
ii.	MS Excel	4(80)	1(20)			
iii.	MS PowerPoint	5(100)				
iv.	MS Access	1(20)	1(20)		2(40)	1(20)
Cloud Computing Applications and Tools						
i.	Google Doc.	3(60)	2(40)			
ii.	Google Form	3(60)	1(20)			1(20)
iii.	Google Sheet	3(60)	2(40)			1(20)

iv.	MS PowerPoint	4(80)				1(20)
v.	MS Word	3(60)	1(20)			1(20)
vi.	MS Excel	2(40)	2(40)			1(20)
vii.	MS Form		2(40)		1(20)	2(40)
Web drive Tools						
i.	Google Drive	2(40)	3(60)			
ii.	OneDrive	1(20)	1(20)		1(20)	2(40)

Note: Multiple answers are permitted.

5.3 Web 2.0/Library 2.0 Tools

The survey inquired about the respondents' Web/Library 2.0 skills and competencies, offering them nine different options (as presented in Table 4). The data from Table 4 highlights that a significant 80% of the respondents possess adept skills in managing social media and social networking platforms, closely followed by proficiency in blogs (60%), academic websites (60%), and audio/video sharing platforms (60%). Interestingly, it was observed that 60% of the respondents indicated that they do not utilize RSS feeds. Notably, Web 2.0/Library 2.0 tools are highly regarded for disseminating and promoting library resources, underscoring their crucial role in supporting the needs of contemporary library users.

Table 4: Web 2.0/Library 2.0 Tools (N=5)

Sl. No	Web 2.0/Library 2.0 Tools	Good (%)	Fair (%)	Poor (%)	Do not use (%)	Don't Know (%)
(i)	Wikis	2(40)	1(20)		1(20)	1(20)
(ii)	Blogs	3(60)	1(20)		1(20)	
(iii)	RSS feeds			1(20)	3(60)	1(20)
(iv)	Podcasts/Vodcast		1(20)		2(40)	2(40)
(v)	Social Bookmarking sites	1(20)		1(20)	2(40)	1(20)
(vi)	Social Networking sites (Facebook, Twitter/LinkedIn)	4(80)	1(20)			
(vii)	Academic Social Networking sites (ResearchGate, Academic)	3(60)	2(40)			
(viii)	Social Media (WhatsApp/Viber)	4(80)			1(20)	
(ix)	Audio/video sharing/webcasting	3(60)	1(20)	1(20)		

5.4 Opinion of the ICT applications

The survey sought respondents' opinions regarding the impact of ICT (Information and Communication Technology) applications within the operational framework of the library, as depicted in Table 5. The data from Table 5 indicates that 100% of respondents strongly agreed that ICT applications significantly enhance the library's overall status. Additionally, the majority of respondents, amounting to 80%, provided a consistent rating of "strongly agree" for the following statements: (i) "ICT applications enhance library services." (ii) "ICT applications facilitate swift access to up-to-date information." (iii) "ICT applications promote the knowledge and skills of library staff." (iv) "ICT applications reduce the

workload of library professionals." and (v) "ICT applications safeguard library data." Furthermore, the same level of agreement (80%) was recorded for the following statements: (i) "ICT applications enhance the job satisfaction of library professionals." (ii) "ICT applications elevate the standing of the library", and (iii) "ICT applications contribute to increased research visibility." These findings underscore the widespread consensus among respondents regarding the positive impact of ICT applications on various facets of library operations and professional development.

Table 5: Opinion regarding the application of ICT in working library (N=5)

Sl. No.	Attitude	Strongly disagree (%)	Disagree (%)	No opinion (%)	Agree (%)	Strongly agree (%)
(i)	ICT applications facilitate quick access to current data				2(40)	3(60)
(ii)	ICT applications improve the quality of library services				1(20)	4(80)
(iii)	ICT applications help to encourage the knowledge and skill of library staff				2(40)	3(60)
(iv)	ICT applications increased job satisfaction of Library Professional				4(80)	1(20)
(v)	ICT applications help to improve communication				4(80)	1(20)
(vi)	ICT applications improve the status of library					5 (100)
(vii)	ICT makes an integration within the library				3(60)	2(40)
(viii)	ICT applications reduce the workload of library professionals		1(20)		1(20)	3(60)
(ix)	ICT applications protect the library data				2(40)	3(60)
(x)	ICT applications help to enhance the research visibility				4 (80)	1(20)
(xi)	ICT applications make accessible library resources remotely				2 (40)	3(60)
(xii)	ICT applications improve the routine/traditional work of the library				3(60)	2(40)
(xiii)	ICT affects regular budgeting provision				3(60)	2(40)

Note: Multiple answers are permitted.

5.5 Obstacles to the use of ICT applications

A multiple-choice question was raised concerning the challenges associated with adopting ICT applications. As depicted in

Table 6, it is evident that every participant identified a deficiency in infrastructure and insufficient professional training as the primary impediments. A significant 80% of the respondents concurred that the principal barrier to using ICT applications resided in insufficient coordination among library staff and a need for more financial resources. Furthermore, an equivalent proportion of respondents (60%) shared a pressing need for greater initiative from professional associations and more self-assuredness in technical capabilities, leading to suboptimal implementation of ICT tools.

Table 6: Obstacles to the use of ICT applications (N=5)

Sl. No.	Particulars	No. of Respondents	Percentage (%)
(i)	Lack of infrastructure	05	100
(ii)	Inadequate training in ICT	05	100
(iii)	Lack of coordination among library staff	04	80
(iv)	Financial Problems	04	80
(v)	Lack of initiative role from professional associations	03	60
(vi)	Lack of technical self-confidence	03	60
(vii)	Health Problems	02	40
(viii)	Lack of support from higher authorities	02	40

Note: Multiple answers are permitted.

5.6 Suggestions for improving cutting-edge emerging ICT Skills

An open-ended question was asked for recommendations for enhancing the current ICT competencies of LIS professionals and integrating ICT tools within academic library settings. Among the responses, four librarians emphasized the importance of regular attendance at pertinent professional conferences, workshops, and ICT-focused webinars or MOOCs to stay current. Three participants suggested that organizations should organize internal training programs to keep their staff abreast of ICT advancements in the context of LIS professional development. Two respondents proposed that professional associations should take the lead in fostering professional skill development. Lastly, one participant advocated for the active involvement of library professionals in academic and research endeavours as another avenue for ICT skill refinement.

6. Discussion

Quality higher education relies heavily on a robust library and information services infrastructure, as these elements significantly contribute to the overall educational excellence within universities. As noted by Onuoha and Obialor (2015), "Information and communication technology (ICT) offers a valuable opportunity to deliver enhanced information services and access to a diverse array of digital resources to university clients". The effectiveness and efficiency of individuals holding higher academic degrees are widely recognized. However, these findings have led to the absence of advanced academic programs in the state and central universities and participants' job satisfaction. Moreover, the current minimum qualification requirements of universities have yet to serve as a sufficient motivator for individuals to pursue higher academic degrees.

It is worth noting that the study uncovered a need for more academic research experience or doctorate degrees among professionals, as depicted in Table 2. Nonetheless, employees' practical knowledge and experience are important to the organization. Surprisingly, even individuals with minimal academic qualifications, such as "library assistants," are

tasked with handling central university libraries, as indicated in Table 2.

The responsibilities of library professionals can vary from one institution to another. As institutional leaders, Librarians are primarily responsible for overseeing activities, formulating policies, planning, budgeting, managing human resources, and making critical decisions, among other functions, as outlined in Table 2.

Adopting diverse ICT applications is vital to providing intelligent services within library premises. Implementing such ICT technologies involves numerous components, including the availability of ICT-skilled and competent personnel with positive attitudes. Libraries may choose software solutions based on features, budget constraints, availability, and the expertise of their workforce. Library professionals must possess the necessary skills and competencies to manage integrated library systems (ILS) effectively, as top-level employees play a crucial role in monitoring and decision-making. Furthermore, working library professionals may have specialized expertise in the adopted system, which may exclude others, as indicated in Table 3.

Library professionals must also possess the knowledge and skills to manage digital content within institutional repositories. As stated by Dahl et al. (2006), managing locally created digital content repositories is an increasingly critical and relatively new area for libraries.

Content management systems (CMS) enable the direct publication of content on the web. The study results highlight university libraries' reliance on outsourcing web content design and development. Therefore, library professionals should develop CMS skills to manage and deliver library resources in a web-based format, as demonstrated in Table 3.

The primary objective of a discovery tool is to replace traditional Online Public Access Catalogs (OPACs) by allowing library users to search and access a wide range of resources, including institutional bibliographies, repositories, catalogue records, local databases, and other collections. ICT-capable library professionals are well-equipped to design, develop, and manage such navigation tools. While federated search technology and discovery tools share similar roles in searching and retrieving user information, these technologies may have legacy differences. Notably, subject gateways and federated search engines appear to be familiar to respondents, as indicated in Table 3.

Statistical and visualization tools are crucial in analyzing and presenting research data, both offline and online. Researchers utilize these tools for data analysis, interpretation, and visualization. Skilled and competent library professionals are essential in supporting university library users using these tools to enhance research visibility. However, the study suggests that library and information science (LIS) professionals need further training and knowledge in statistical and visualization tools to improve universities' research impact.

Citation and reference management software are valuable aids for academics in scholarly writing. Various tools, including Microsoft Word features and online citation generators, assist in creating citations and managing references. Remarkably, reference management software (RMS) is integrated into popular databases like Web of Science (WOS), Scopus, Emerald, and ProQuest, and university librarians should be knowledgeable about these tools.

Security surveillance tools are crucial for safeguarding physical and digital library premises against unethical behaviour. The study emphasizes the need for LIS professionals to improve their skills in handling smart card systems to enhance security. Learning management systems (LMS) are explicitly designed for academic purposes to support e-learning and e-teaching and are widely used in developing countries.

Streaming tools facilitate synchronous communication and collaboration among presenters and participants, making them

increasingly popular for conducting academic activities.

Regarding plagiarism, plagiarism detection software ensures the originality of documents before submission. The study underscores the importance of university librarians acquiring expertise in using plagiarism detection software and educating library users to prevent plagiarism in their research work. Advanced plagiarism checkers can also assist researchers in eliminating grammar errors and improving the structure of their documents through paragraphing.

Academic writing tools like Grammarly and Quillbot support systematic and logical construction of academic papers. These tools are popular for checking and correcting grammar, detecting plagiarism, and facilitating paraphrasing. Basic ICT skills and competencies are essential for LIS professionals to perform routine tasks, and a foundation in various ICT tools, including hardware, operating systems, MS Office applications, cloud computing applications, and web drive tools, supports the adoption of advanced and specialized applications in the library.

Table 4 highlights the need for respondents to catch up in implementing Web 2.0/Library 2.0 tools, emphasizing the urgent necessity for LIS professionals to update their collaborative skills and competencies to provide effective collaborative library services.

The role of librarians is evolving to encompass cutting-edge emerging ICT skills and competencies, enabling the transformation of traditional library services into smart library services, as suggested by Table 5. ICT skills and competency are essential factors in technology adoption. Professional development programs are instrumental in upgrading and updating personnel's skills and competencies. However, the present study identifies challenges related to infrastructure, insufficient IT training, and coordination among library staff and finance, as illustrated in Table 6. Consequently, it is recommended that university authorities and library professional associations in Nepal assume responsibility for conducting periodic training programs to enhance LIS professionals' ICT skills and competencies, boosting their technical self-confidence and enabling them to utilize various ICT tools and library services effectively. Similar challenges have been identified in recent studies by Hussain and Nayab (2021), including a lack of financial resources, limited training opportunities, the absence of professional associations, reluctance to engage with such platforms, and inadequate infrastructure, as previously reported by Enakrire & Ocholla (2017).

Learning is an ongoing process, particularly in light of the rapidly evolving landscape of cutting-edge ICT applications. Library professionals must remain current with the latest technological developments by actively participating in professional development activities, such as conferences, webinars, workshops, and training sessions. In-house training can mitigate issues related to staff constraints, such as health, time, finances, and family responsibilities. In this pursuit, staff, institutions, and associations all have vital roles to play in enhancing the professionalism and competencies of library professionals."

7 Conclusion

This study has unveiled a pressing need for enhanced ICT skills and competencies among librarians within most university libraries examined, owing to several factors. These factors include funding deficiency, inadequate staff training in handling computers and software packages, and administrative challenges. The need for more proficiency in ICT tools hampers librarians from embracing and delivering optimal services to contemporary users who rely on social networks, social media, and mobile technologies. Consequently, the study advocates for university librarians to bolster their advanced ICT skills and competencies to offer high-quality, efficient, mobile-based,

smart library services in our tech-savvy environment.

To address this imperative, it is incumbent upon university authorities to take prompt action by empowering librarians to enhance their ICT skills and competencies through continuous professional development programs and incentives or promotions. The findings of this study shed light on the barriers obstructing the adoption of ICT applications in Nepalese university libraries. Moreover, this research marks a pivotal shift toward implementing ICT applications in library services, thereby augmenting the return on investment of library resources in the studied university libraries in Nepal.

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USE AND SATISFACTION OF LIBRARY RESOURCES AND SERVICES BY TEACHERS AND STUDENTS IN THE COLLEGES OF LUNGLEI DISTRICT: AN EVALUATIVE STUDY

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Abstract

The present study has measured the use and satisfaction of library resources and services by the teachers and students of four colleges of Lunglei districts of Mizoram. The colleges are Lunglei Government College, Government J. Buana College, Government Hnahthial College, and Higher and Technical Institute Mizoram (HATIM. The study is survey based with the help of purposive sampling techniques. The total sample size is 240. The findings revealed that majority of respondents are satisfied with textbook, reference collections, circulation and reprographic service while nearly the whole respondent shows their Un-satisfaction with the collection of e-resources and journal collection. Circulation and reprography services of the library were more satisfactory to its users. Among the colleges, highest satisfaction was observed in HATIM College.

Keywords: Library resources, library services, user satisfaction, Academic library

1. Introduction

Academic libraries play an important role in the institutions they serve. The core objective of college library is to support the parent institution (i.e. college) to achieve its objectives and missions. Effah (1998) emphasized that academic support services provided by library is very important and necessary to the attainment of any academic central mission of teaching, learning and research. Kargbo (2002) stated his view that academic library is the central organ of the academic institutions and library together with good laboratories and faculties are the parameters used to judge the status of academic institutions. There are different users with different information need. User satisfaction is one method of evaluating the effectiveness of library services (Cullen, 2001).

The evaluation of user satisfaction is necessary to meet user's information requirements but no study is being done till today to know the use of library resources and user satisfaction on library resources and services in Lunglei District Colleges, Mizoram. Lunglei district is one of the eight districts of Mizoram and the largest district in the state of Mizoram in terms of geographical areas. This is the first time effort that has been made ever to measure the service quality and satisfaction of college libraries in Lunglei district.

The scope of present study is limited to four colleges of Lunglei District- i.e. Lunglei Government College, Government J. Buana College, Government Hnahthial College, and Higher and Technical Institute Mizoram (HATIM). The study is further limited to teachers and students of above four colleges. There is total approximately 146 teachers and 1684 students in above four colleges. Out of which, 80 teachers (20 each college) and 160 students (40 each college) are selected to collect the primary data with details emphasis on their use and satisfaction with library resources and services.

Sl.No	Name of Colleges	Number of Teachers	Number of Students	Total
1.	Lunglei Government College	62	806	868
2.	Government J. Buana College	35	506	541
3.	Government Hnahthial College	26	107	133
4.	Higher and Technical Institute, Mizoram	23	265	288
	Total	**146**	**1684**	**1830**

Table-1.1: College wise status of students and teachers

The study has reviewed some literatures on Library user satisfaction and measurement of library service quality with a focus on Public and Academic Libraries.

Adomi et al., (2004) observed that in Delta State University Library, Abraka, Nigeria the personal characteristics of the respondents and their levels of satisfaction with reserve collection, loan policy, staff, condition of reading room, opening hours and the time it takes to serve users. Sahu (2007) found that the Jawaharlal Nehru University library is not lacking in quality of service. Pauline (2011) found that the students of Redeemers University were found most frequently used the library and the users were satisfied with the resources and services of the library. Larson (2012) found the students of Educational Development and Extension (IEDE) Library in University of Education, Winneba, Ghana. were satisfied with the current services and recommended for lengthening opening hours of the library; reprographic section and printer to enhance scholarly endeavours of users. Muhammad & Mirza (2013) found that users of Punjab Institute of Cardiology Library were satisfied but they were concerned about library space, hours, furniture and environment and suggested more availability of electronics library services, newer collections, better internet access and comfortable furniture. Bakti & Sik (2013) revealed that the service quality of university library service in Indonesia has a direct effect on customer satisfaction, which then directly influences library customer loyalty. Masrek & Gaskin (2016) found that information quality, systems quality, service quality, perceived usefulness, perceived ease of use and cognitive absorption are significant predictor of users' satisfaction with the web DL in University Teknologi MARA, Malaysia. Laltlanzova & Mawia, (2021) revealed the students and faculties of the School of Engineering and Technology, Mizoram University are satisfied by the library resources of the university.

From the above aforementioned of literature reviewed, it is proved that there is no substantial evidence of studies relating to user's satisfaction with library resources and services in Lunglei District Colleges. This has revealed the researcher to undertake research on this topic.

2. Objectives of the study

1. Identify the purpose of information seeking in the library by teachers and students under study.
2. To Assess the computer competencies and internet facilities of the libraries.
3. Find out the strength and weakness of the library collection and services.
4. Measure the satisfaction level of library users towards library resources and services.

3. Methodology

The study is aimed to assess of use and users' satisfaction with library collection and services by college teachers and students of Lunglei District colleges, thus, the survey method of research was adopted this study. For collection of primary data from respondents following data collection tools was used:

3.1. Survey of libraries

To know the library collections, services and physical infrastructure of selected college libraries, scholar personally visited to all four Lunglei District college libraries and conducts a personal interview with librarian/ library staffs and collected data.

3.2. Survey of respondents:

The respondent's survey consists of teachers and students of Lunglei District Colleges. A structured questionnaire was prepared with 25 questions and distributed to 240 respondents and total 240 filled questionnaires were received.

3.3. Sample selection:

The sample for data collection was selected on the basis of disproportionate purposive sampling techniques. There is total 146 teachers and 1684 students in four colleges of Lunglei district, out of which, 80 teachers and 160 students (from each college, 20 teachers and 40 students) were selected as sample from the four colleges. Thus, 240 becomes the total sample size for the present study.

3.4. Response rate:

A structure questionnaire was distributed among 240 respondents constituting 80 teachers and 160 students and all questionnaires were received for data analysis. Thus, response rate is 100%.

3.5. Tools for analysis:

The data collected through the survey methods was analyzed using simple percentage. The one-way analysis of variance (ANOVA) procedure was applied to examine differences in responses regarding satisfaction about library resources and services.

4. Data analysis and interpretation

4.1. Purpose of information seeking in the library

Table-3: Purpose of Information Seeking in the Library

	TEACHERS				STUDENTS				TOTAL			
	HATIM	LGC	GJBC	GHC	HATIM	LGC	GJBC	GHC	HATIM	LGC	GJBC	GHC
For Study Purpose	19 (95%)	13 (65%)	12 (60%)	14 (70%)	38 (95%)	32 (80%)	31 (77.5%)	33 (83%)	57 (95%)	45 (75%)	43 (72%)	47 (78%)
For General Purpose	7 (35%)	14 (70%)	13 (65%)	17 (85%)	19 (47%)	11 (27%)	13 (32%)	23 (57%)	26 (43%)	25 (42%)	26 (43%)	40 (67%)
For preparing competitive exam	0 (0%)	O (0%)	2 (10%)	2 (10%)	6 (15%)	10 (25%)	8 (20%)	12 (30%)	6 (10%)	10 (17%)	10 17%)	14 (23%)
For recreation	2 (10%)	3 (15%)	0 (0%)	4 (20%)	2 (5%)	3 (7%)	1 (2%)	11 (27%)	4 (7%)	6 (10%)	1 (2%)	15 (25%)
For employment Information	0 (0%)	0 (0%)	0 (0%)	0 (0%)	3 (7%)	1 (2%)	0 (0%)	0 (0%)	3 (5%)	1 (1%)	0 (0%)	0 (0%)
For Current awareness	6 (30%)	0 (0%)	10 (50%)	2 (10%)	10 (25%)	1 (1%)	1 (1%)	1 (2%)	16 (27%)	1 (2%)	11 (18%)	3 (5%)

To identify the purpose of information seeking behavior of respondents and their aim to visit the library, a six-point scale was used in questionnaire and is shown in Table 3. The analysis indicates that respondents are seeking the information for study and general purpose, very less respondents were found to seeking information for employment information, recreation and competitive exam purpose. In HATIM college, 95% teachers and students seek information for study purpose, In Lunglei Government College, 75% respondents

comprising 65% teachers and 80% students seeking information for study. In Government J. Buana College, 72% respondents comprising 60% teachers and 78% students are seeking information for study. In Government Hnahthial College, 78.33% respondents comprising 70% teachers and 82.55 students are seeking information for study purpose.

4.2.Computer knowledge and skills

Table 4: Computer Knowledge and Skills

Designation of the Respondents	College	Very Good	Good	Fairly Good	Poor	Total
TEACHERS	HATIM	3 (15%)	17(85%)	-	-	20
	LGC	1 (5%)	15 (75%)	3 (15%)	1 (5%)	20
	GJBC	-	16 (80%)	3 (15%)	1 (5%)	20
	GHC	1 (5%)	17 (85%)	2 (10%)	-	20
	Total	**5 (6%)**	**65 (81%)**	**8 (10%)**	**2 (3%)**	**80**
STUDENTS	HATIM	-	29 (73%)	11 (28%)	-	40
	LGC	11 (28%)	21 (53%)	7 (18%)	1 (3%)	40
	GJBC	4 (10%)	20 (50%)	11 (28%)	5 (13%)	40
	GHC	5 (13%)	13 (33%)	18 (45%)	4 (10%)	40
	Total	**20 (13%)**	**83 (52%)**	**47 (29%)**	**10 (6%)**	**160**
TOTAL	HATIM	3 (5%)	46 (77%)	11 (18%)	-	60
	LGC	12 (20%)	36 (60%)	10 (17%)	2 (3%)	60
	GJBC	4 (7%)	36 (60%)	14 (23%)	6 (10%)	60
	GHC	6 (10%)	30 (50%)	20 (33%)	4 (7%)	60
	Total	**25 (10%)**	**148 (62%)**	**55 (23%)**	**12 (5%)**	**240**

In present digital era, use of computers has become one of the most important education tools in academic community. Table 4 represents the computer knowledge and competency of respondents and analysis resolved that 62% respondents comprising 81% teachers and 52% students have good computer skills and 23% respondents comprising 10% teachers and 29% students have fair good computer skill while 10% respondents comprising 6% teachers and 13% students have very good computer skills. The 5% respondents comprising 3% teachers and 6% students rated their skills poor. The overall respondents have good computer knowledge and skills.

4.3.Availability of internet facilities

Table 5: Availability of Internet Facilities

Designation of the Respondent	Colleges	YES	NO	TOTAL
TEACHERS	HATIM	18 (90%)	2 (10%)	20
	LGC	12 (60%)	8 (40%)	20
	GJBC	16 (80%)	4 (20%)	20
	GHC	-	20 (100%)	20
	Total	**46 (58%)**	**34 (43%)**	**80**
STUDENTS	HATIM	31 (78%)	9 (23%)	40

	LGC	26 (65%)	14 (35%)	40
	GJBC	28 (70%)	12 (30%)	40
	GHC	-	40 (100%)	40
	Total	**85 (53%)**	**75 (47%)**	**160**
TOTAL	HATIM	49 (82%)	11 (18%)	60
	LGC	38 (63%)	22 (37%)	60
	GJBC	44 (73%)	16 (27%)	60
	GHC	-	60 (100%)	60
	Total	**131 (55%)**	**109 (45%)**	**240**

Internet has emerged as the most powerful medium of information search and retrieval. With the unprecedented growth in quantum of knowledge around the world and easy accessibility, the Internet has become a vital source of information for every institution. Table 5 shows the internet facilities provided by colleges under study and after analysis it found that Internet services are available in 3 colleges' library (i.e. HATIM, LGC and GJBC) but in Government Hnahthial College, there is no Internet facility till now. Among the respondents, 55% respondent comprising 58% teachers and 53% students reported that internet facilities are available in their library, whereas 47% respondents comprising 42% teachers and 47% students reported that their college libraries did not provide internet facilities.

4.4.Satisfaction with library resources

Table- 6: Satisfaction with Library Resources

	Sampled Respondents				**ANOVA Results**	
	HATIM	LGC	GJBC	GHC	F Value	P
Books	3.62	3.82	3.67	4.07	3.072*	0.029
Reference	3.47	3.38	2.95	3.47	4.453*	0.005
Journal	3.17	3.13	2.78	2.82	2.510	0.059
Newspaper	4.25	3.30	3.23	2.88	26.500*	0.000
E-Resources	2.55	2.93	2.18	1.62	25.900*	0.000
Back Volume binding	3.45	3.37	2.77	2.55	15.090*	0.000
*Note: * Denotes significance at 5 percent level.*						

In order to probe spatial difference in the level of satisfaction with the collection of library resources across the four sample groups belonging to HATIM, LGC, GJBC and GHC, Analysis of Variance (ANOVA) test is carried out with the F-value significant at 5 percent level in five different areas of library collection in the form of books, reference, newspaper, E- resources and back volume binding and presented in Table -6 and it inferred that there are diversity among the four groups of respondents regarding their satisfaction with the collection of library resources. HATIM ranked top in reference, journal, newspaper and back volume binding as far as the level of satisfaction of the user is concerned. Government Hnahthial College ranked top in Books and Reference and LGC ranked top in E-resources, LGC ranked top in E-resources which requires huge financial outlay, this may be due to the fact that the college is the oldest college in the state and perform well in the areas of infrastructure which requires longer gestation period. However, the level of satisfaction is not impressive. Notably, of the six areas of library

collection, the mean scores of all the colleges in E-resources is the lowest which calls for the improvement of library services in this area.

4.5. Satisfaction with library services

Table 7: Satisfaction with Library Services

Level of satisfaction with the overall services in the areas of	**Sampled Respondents**				**ANOVA Results**	
	HATIM	**LGC**	**GJBC**	**GHC**	**F Value**	**P**
Circulation	4.20	3.98	3.50	4.07	13.002*	.000
Reference	3.78	3.68	3.05	3.47	9.195*	.000
Reprographic	3.75	3.58	3.07	3.22	9.290*	.000
Note: * Signify significance at 5 percent level of confidence.						

The difference in the level of satisfaction of the users with the overall services in the areas of circulation and reprographic was probed into using Analysis of Variance (ANOVA). The efficient staff coupled with updated technology/ equipment in the library often produce quality services. The results are reported in Table 7 and it is evident that significant differences have been observed in both the areas of circulation and reprographic. In other words, there is no consensus among the users of library in their level of satisfaction in the overall services of library. A mean score of 3 and above signify that the services rendered by the library are satisfactory. It can be seen that the overall library services in the four colleges is satisfactory. However, HATIM ranked top in both the areas of overall library services.

4.6.Awareness about ugc- network resource centre

Table 8: Awareness about UGC- Network Resource Centre

Designation of the Respondent	**Colleges**	**YES**	**NO**	**Total**
TEACHERS	HATIM	2 (10%)	18 (90%)	20
	LGC	18 (90%)	2 (10%)	20
	GJBC	14 (70%)	6 (30%)	20
	GHC	2 (10%)	18 (90%)	20
	Total	**36 (45%)**	**44 (55%)**	**80**
STUDENTS	HATIM	-	40 (100%)	40
	LGC	22 (55%)	18 (45%)	40
	GJBC	22 (55%)	18 (45%)	40
	GHC	-	40 (100%)	40
	Total	**44 (27%)**	**116 (73%)**	**160**
TOTAL	HATIM	2 (3%)	58 (97%)	60
	LGC	40 (67%)	20 (33%)	60
	GJBC	36 (60%)	24 (40%)	60
	GHC	2 (3%)	58 (97%)	60
	Total	**80 (33%)**	**160 (67%)**	**240**

UGC-NRC is one of the most important E- Resources in the college relevant for teachers, students and staff. It also found that only two colleges (LGC and GJBC) under study having UGC-NRC in their college only and rest two colleges (HATIM and GHC) has not established this center in their college till now. Table 8 shows the awareness of UGC-Network Resources among respondents and after analysis it found that only 33% respondents comprising 45% teachers and 27% students are aware with this important resources and majority of respondents (67%) are not aware with this resources. The college wise analysis reveals that awareness rate is very high in Lunglei Government College (67%) and Government J. Buana College (60%), while HATIM college is very low and Government Hnahthial College respondents are almost not aware with UGC-NRC because neither these colleges have UGC-NRC centre nor Internet services till now and this service is network-based service.

4.7. Rating the quality of ugc-nrc resources

Table 9: Rating the Quality of UGC-NRC Resources (N=26)

Designation of the Respondents	Name of the Institution	Un Satisfied	Fairly Satisfied	Satisfied	Highly Satisfied	Total
TEACHERS	HATIM	-	-	-	-	-
	LGC	2 (67%)	1 (33%)	-	-	3 (100%)
	GJBC	1 (100%)	-	-	-	1 (100%)
	GHC	-	-	-	-	-
	Total	**3 (75%)**	**1 (25%)**	**-**	**-**	**4 (100%)**
STUDENTS	HATIM	-	-	-	-	-
	LGC	20 (91%)	2 (9%)	-	-	22 (100%)
	GJBC	-	-	-	-	-
	GHC	-	-	-	-	-
	Total	**20 (91%)**	**2 (9%)**	**-**	**-**	**22 (100%)**
TOTAL	HATIM	-	-	-	-	-
	LGC	22 (88%)	3 (12%)	-	-	25 (100%)
	GJBC	1 (100%)	-	-	-	1 (100%)
	GHC	-	-	-	-	-
	Total	**23 (88%)**	**3 (12%)**	**-**	**-**	**26 (100%)**

The researcher asked a question with the intention of knowing the quality of UGC-NRC resources among respondents and found that majority of all respondents (79%) in each college were not responding in these particular questions due to lack of awareness and usage of this resources. Among aware respondents (N=80), who are using these resources (N=26), are rating the quality on the basis of five parameters and shown in Table 9 After analysis its identified that majority of respondents (88%) are not satisfied with quality of resources and only 12% respondents are satisfied.

5. Findings

1. Majority of respondents are seeking information from the library for study purpose followed by general purpose and current awareness.

2. Respondents have good computer knowledge and skills because 62% respondents have the satisfactory level of computer skills.
3. Majority of respondents are satisfied with textbook, reference collections in all the colleges while nearly the whole respondent shows their Un-satisfaction with the collection of e-resources and collection of journal. The HATIM college has the highest satisfaction level in newspaper collections.
4. Majority of respondents in all colleges are satisfied with circulation and reprography services of the library. Among the colleges, highest satisfaction was observed in HATIM College.
5. Only three colleges (HATIM, LGC and GJBC) have Internet facility in the library while Government Hnahthial College have no internet connection at present but the majority of respondents (52%) of three colleges are also not satisfied with Internet services.
6. UGC provides bundles of e-resources through UGC-Network Resource Centre but only two colleges (Lunglei Government College and Government J. Buana College) are having this facility in their college at present. The majority of respondents (76%), comprising 55% teachers and 73% students are not aware of these resources till now. Even among aware respondents, the majority of them (86%) are not using it.

6. Conclusion

The present study is conducted to evaluate the library resources and services offered by the Lunglei district college libraries and the level of user's satisfaction and service quality. User's perception and satisfaction about library resources and services have largely been ignored by researcher and practitioners of library and information science specially in Southern part of Mizoram. Thus, it can be concluded that the level of satisfaction on library resources and services by teachers and students in Lunglei district college library were satisfactory at moderate level. The findings of this study have provided useful insight for the library professionals, and the administrator of the college in Lunglei district to take appropriate strategies for the development of the library. During the study, researcher acquired many suggestions and recommendation from teachers and student's respondents, to improve their respective library resources and services. To improve in library resources in the form of Text book/ Course Book, Reference. Library should improve in its physical infrastructure by providing adequate reading space, seating capacity, furniture etc. In two colleges (HATIM and GHC) UGC-NRC center is not available, it is recommended to the library professionals and college authority to establish the center to enrich the library and its users in e- resources.

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A WEBOMETRICS STUDY OF AGRICULTURE UNIVERSITY WEBSITES OF MADHYA PRADESH

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Abstract

This paper intends to conduct a webometric analysis of the websites of the Agricultural University of Madhya Pradesh which are managed by the Indian Council of Agricultural Research (ICAR). The analysis of web link structures is the only area covered. It analyses three categories of web impact factors: simple, internal, and external, as well as the domain and page authority. A well-known search engine such as Google has been used for this study's analysis and measurement of those agricultural repositories' online presence. In this study, we get that Jawaharlal Nehru Krishi Vishwa Vidyalaya has a well-maintained website structure such as domain authority, page authority, and several web pages. Nanaji Deshmukh Veterinary Science University has a well-maintained link structure such as Self-link, Inlink, and a total number of links.

Keywords: Webometrics analysis, Web Impact Factor, Domain Authority, Page Authority.

1. Introduction

Almind and P. Ingwersen first used the word "webometrics" in 1997. The term "webometric" harmonizes the words "web" and "metric."To determine whether classical bibliometric methods applied to the Web are a viable and dependable way to compare and analyze websites, webometric techniques are still in the experimental stage of development. A web page is a collection of text documents or web pages that include images, videos, audio files, and other content that are connected by hyperlinks. Metrics means measurement, so webometrics is the measurement of the web, its application, and its structure. According to Bjornborn and Ingwersen, “Webometrics is "the study of the quantitative aspects of the constructions and use of information resources, structures, and technologies on web drawing on bibliometric and informatic approaches,”. According to Thelwell “The study of web-based content with mostly quantitative approaches for social science research purposes utilizing procedures that are not exclusive to one field of study is another definition of webometrics,”. These all of definitions introduce Webometrics as the measurement of Webpages of any website as quantitative aspects of uses of Websites and constructions of websites. In any Webometrics study encompassing the four primary domains of current webometric research:

1. Web page content analysis.
2. Web links structure analysis.
3. The web uses analysis.
4. Web technology analysis.

2. Web impact factor

It is a measurement of a site's influence on the entire Web based on the quantity of links from other sites, much like the impact factor determined in bibliometrics. In comparing any

website WIF is the most important feature for evaluating the page of a website. Websites, top-level domains, and sub-domains can be ranked, assessed, categorized, and compared using the quantitative tools offered by WIF. There are three different kinds of links exist. This category includes links that go out from web pages, links that enter a site from other sites (backlinks), and links that go within a site (from one page to another)—all of which are referred to as self-links. Additionally, there are three different kinds of WIF: self-link WIF, in-link (revised) WIF, and overall WIF.

i) The simple or overall web impact factors (SWIF) = A/D
ii) The external web impact factors (EWIF) = B/D
iii) The internal web impact factor (IWIF) = C/D

In this formula where:
A: Total number of links
B: Total number of external links
C: Total number of internal links
D: Total number of web pages published on the website.

3. Review of Related Literature

Verma & Brahma (2017) A Webometric analysis of National Libraries websites of South Asia. In this study, the author analyzed and focused on several web pages, link pages available on the website, and the Web Impact Factor. The result was National Library of India has high domain and page authority, the highest external equity passing links and total equity passing links all NLIs also have the highest Web Impact Factor, National Library of Sri Lanka got the highest internal passing Links.

Muruganandham (2019) Webometrics research methods adopted in library and information science: An Overview, Webometrics has been identified as one of the largest information science fields by bibliometric studies conducted years ago. In general, academics must recognize popular research areas and steer clear of methods required to aid in this identification process because some are unpromising. Additionally, there is heavily cited in webometrics research by fields other than information science. However, it appears that Given that the current webometric techniques have an even larger potential user base, there is a need for raising consciousness.

Ghosh & Kumar (2021) Webometric Analysis of Open Access Digital Repositories of Agricultural Sciences in Continents of Oceania.DAFWA Research Library has several Self-links and Webpages and ePrints Archive. CQ University also has lots of web pages and in-link pages.

Yadav (2023) Webometrics Study of Website of National Law Universities in India.**:** The websites of National Law Universities are indexed by Google's search engine and appear in search results. This university website does not support the use of Yahoo, Hotbot, or any other platform. The 23 1national Law Universities under consideration were ranked in order of merit. In evaluating a page, google PageRank, Alexa Traffic Rank, and rich files are considered.

5. Objectives

- To figure out the websites under investigation's domain and page authority.
- To figure out the total number of web pages the website has.
- To find out the website's total link pages, link pages, and self-link pages.
- To determine the Web Impact Factor for External Links, Web Impact Factor for Self Links, and Simple Web Impact Factor.

6. Methodology

The list of Agriculture Universities in Madhya Pradesh used in the study is obtained from the Indian Council of Agricultural Research. There are 3 Agricultural University Websites available in Madhya Pradesh. The entire study is observation-based, and we will concentrate on the website of the Agriculture University of India, specifically its structure,

design, size, graphical presentation, library services, and products.

7. Data Analysis

List of the Agricultural University of Madhya Pradesh's year of establishment, location, and website

Table 1 presents the list of Agricultural University Websites in Madhya Pradesh, there is a total of three Agricultural Universities situated in Madhya Pradesh. This table shows us the Year of establishment, location, and the present website's URL.

From the collective information, we get that the oldest AgricultureUniversity of Madhya Pradesh was Jawaharlal Nehru Krishi Vishwa Vidyalaya, established in 1964 at Jabalpur, and by analysis of website structure, org. is its domain. The next one is Rajmata Vijayaraje Schindhiya Krishi Vishwa Vidyalaya was the second Agricultural University Established in Madhya Pradesh in the Year 2008, and on another hand, Nanaji Deshmukh Veterinary Science University was established in the year of 2009.

Table 1: List of the Agricultural University of Madhya Pradesh's year of establishment, location, and website.

S. No.	Name of Library	Year of establishment	Location	Websites
1.	Jawaharlal Nehru Krishi Vishwa Vidyalaya,	1964	Jabalpur	www.jnkvv.org
2.	Nanaji Deshmukh Veterinary Science University	2009	Jabalpur	Ndvsu.org
3.	Rajmata Vijayaraje Scindia Krishi Vishwa Vidyalaya	2008	Gwalior	www.rvskvv.net

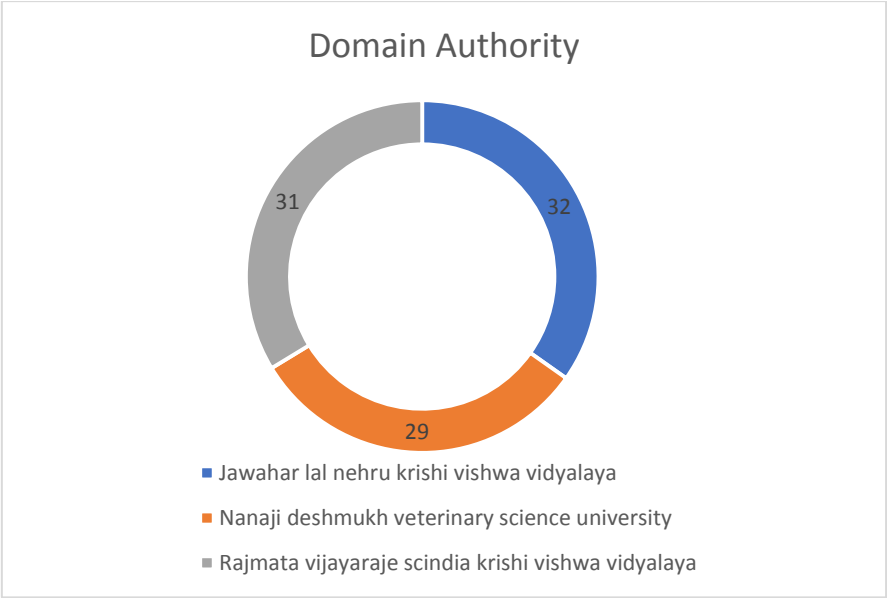
Domain and Page Authority

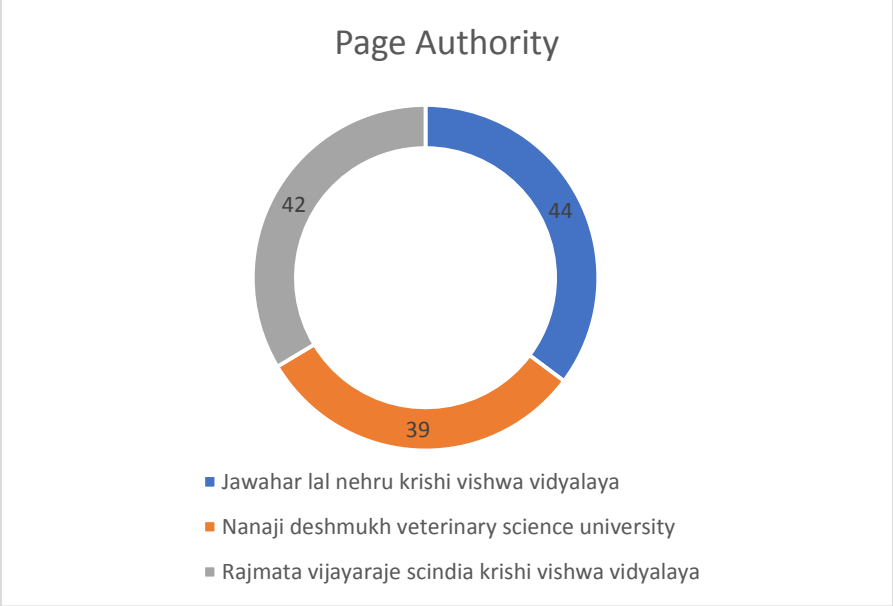
List of domain and page authority of the Agricultural University websites. Domain authority is a ranking system that indicates a website's potential position on search engine result pages (SERPs) based on a score of 100. Likewise, page authority is a metric that indicates how well On search engine result pages, a particular page will appear (SERP). To check the Domain and Page Authority of the Agricultural University Websites of Madhya Pradesh we used the MOZ tool. This tool is online available Moz is an American software as a service (SaaS) provider.

With the collection of data, we get that Jawaharlal Nehru Krishi Vishwa Vidyalaya has a domain authority of 32 ranks highest, and Nanaji Deshmukh Veterinary Science University gets 29 ranks lowest obtained by 100. In the case of Page Authority Jawaharlal Nehru Krishi Vishwa Vidyalaya has a PageAuthority of 44 out of 100 ranks highest, and Nanaji Deshmukh Veterinary Science University gets 39 out of 100 ranks lowest.

Table 2: Domain and Page Authority

S. No.	Name of Library	Domain Authority	Page Authority
1.	Jawaharlal Nehru Krishi Vishwa Vidyalaya,	**32**	**44**
2.	Nanaji Deshmukh Veterinary Science University	**29**	**39**
3.	Rajmata Vijayaraje Scindia Krishi Vishwa Vidyalaya	**31**	**42**





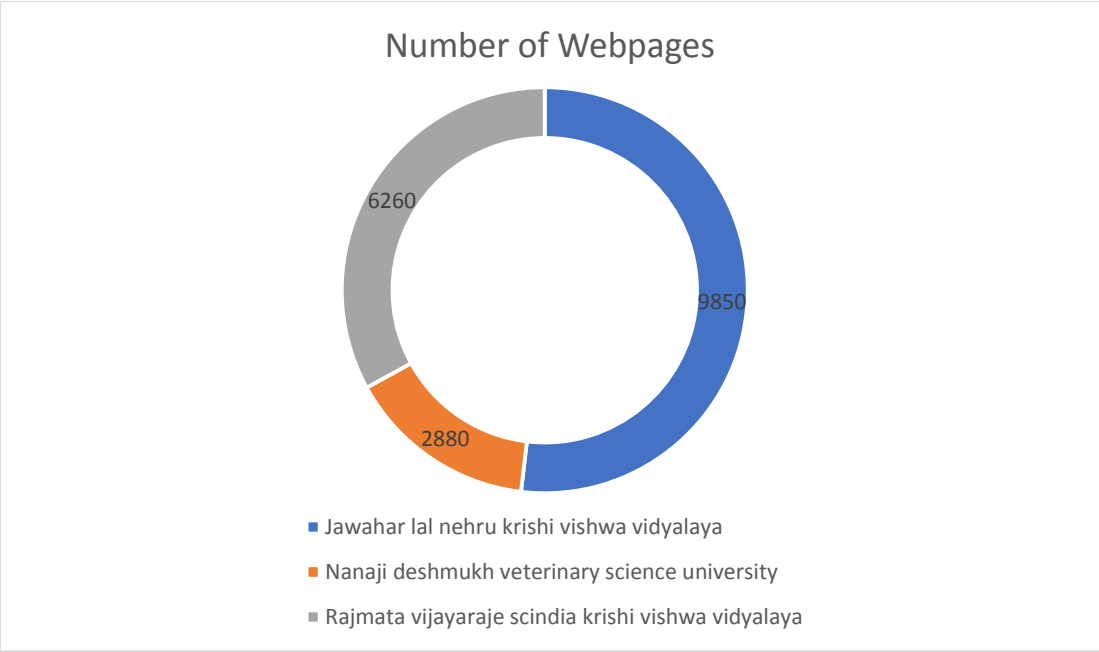
Number of Webpages of websites

Table 3 shows and tells the total number of web pages available on the Agricultural University Website of Madhya Pradesh. A website, such as our Computer Hope website, consists of several web pages. For counting of number of webpages, we used the online site.XML tool for counting webpages present in a website.

It is seen from the table that the Jawaharlal Nehru Krishi Vishwa Vidyalaya has 9,850 web pages on its Website and Nanaji Deshmukh Veterinary Science University has 2,880 web pages on its website.

Table 3: Number of Webpages of websites

S. No.	Name of Library	Number of Webpages
1.	Jawaharlal Nehru Krishi Vishwa Vidyalaya,	**9,850**
2.	Nanaji Deshmukh Veterinary Science University	**2,880**
3.	Rajmata Vijayaraje Scindia Krishi Vishwa Vidyalaya	**6,260**



Number of self-link, Inlink, and Total links of websites

Table 4 manifests the distribution of Self-link Pages, Inlink Pages, and total Link Pages of the Agricultural University Websites Of Madhya Pradesh To evaluate self-link pages, Inlink pages, and total link pages of our sample Agricultural website of Madhya Pradesh we used the online tool SEOMATOR (seomator.com), it is a free online page link Chaker tool for evaluate webpages and its links.

In the case of collected data and tabulated it provides information that Nanaji Deshmukh Veterinary Science University has 318 numbers Self-link and Rajmata Vijayaraje Schindiya Krishi Vishwa Vidyalaya has 141 number of Self-link which is low from others. In the case of Inlink Nanaji Deshmukh Veterinary Science University has 57 numbers of Inlink and Rajmata Vijayaraje Schindiya Krishi Vishwa Vidyalaya has 41 only number of Inlink. If we get focus on the total number of links then we get that Nanaji Deshmukh Veterinary Science University has 375 total numbers of links and Rajmata Vijayaraje Schindiya Krishi Vishwa Vidyalaya has 182 total number links.

Table 4: Number of self-link, Inlink, and Total links of websites

S. No.	Name of Library	Self-link (Internal)	Inlink (External)	Total Link
1.	Jawaharlal Nehru Krishi Vishwa Vidyalaya,	287	50	337
2.	Nanaji Deshmukh Veterinary Science University	318	57	375
3.	Rajmata Vijayaraje Scindia Krishi Vishwa Vidyalaya	141	41	182

Distribution of Self-Link PagesWeb Impact Factor (WIF) of Websites of Agricultural University of Madhya Pradesh

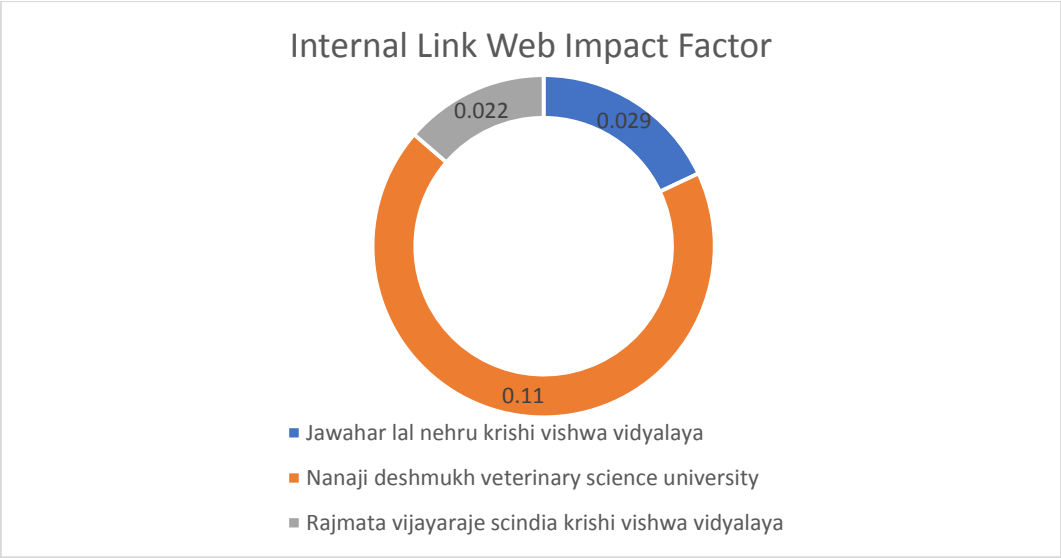
Table 5 provides Details about the Web Impact Factor (WIF) of Self-link pages available on the Website of the Agricultural University of Madhya Pradesh. WIF is found by the formula of Internal Link Web Impact Factor (IWIF). That is done by the total number of Self-link divided by the total number of Web Pages available on the sample website. This table also gives us rank according to the basis of IWIF.

This table tells us that Nanaji Deshmukh Veterinary Science University

gained first rank with 0.029 of IWIF. And Rajmata Vijayaraje Scindia Krishi Vishwa Vidyalaya gained third rank with 0.022 of IWIF.

Table 5: Distribution of Self-Link PagesWeb Impact Factor (WIF) of Websites of Agricultural University of Madhya Pradesh

S. No.	Name of Library	Self-link Pages (Internal)	Number of web pages	WIF	Rank
1.	Jawaharlal Nehru Krishi Vishwa Vidyalaya,	**287**	**9,850**	**0.029**	**2**
2.	Nanaji Deshmukh Veterinary Science University	**318**	**2,880**	**0.110**	**1**
3.	Rajmata Vijayaraje Scindia Krishi Vishwa Vidyalaya	**141**	**6,260**	**0.022**	**3**



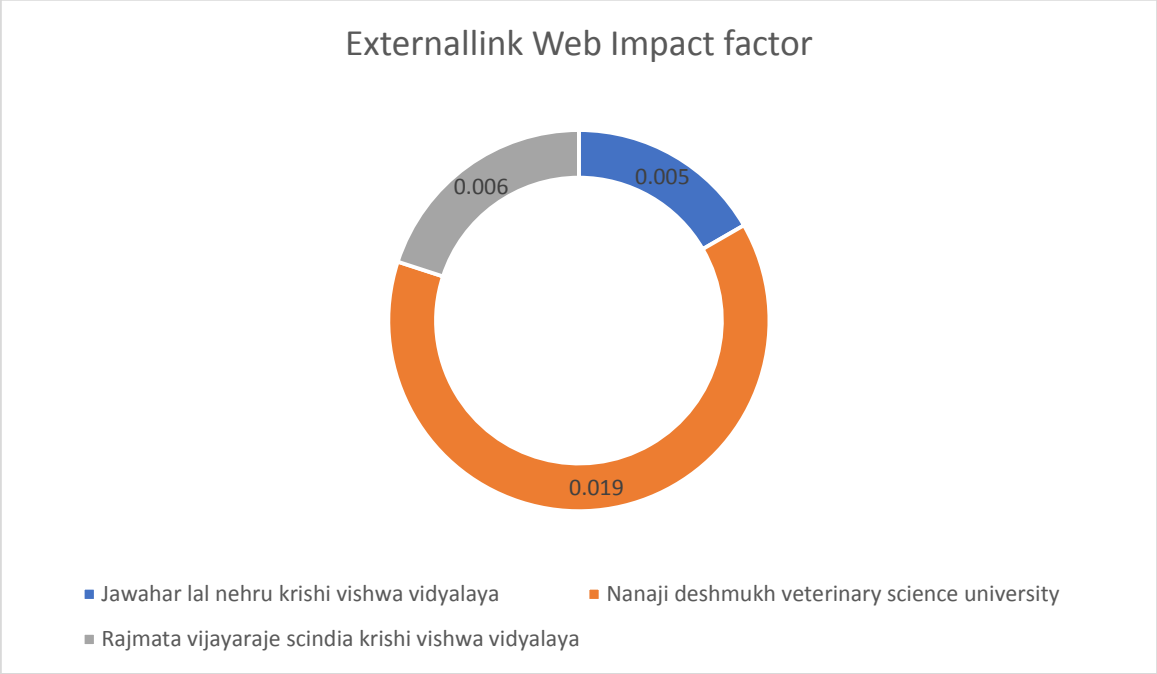
Distribution of Inlink Pages of Websites of Agricultural University of Madhya Pradesh

Table 6 provides Details about the Web Impact Factor (WIF) of Inlink pages available on the Website of the Agricultural University of Madhya Pradesh. WIF is found by the formula of External Link Web Impact Factor (EWIF). That is done by the total number of Inlinks divided by the total number of Web Pages available on the sample website. This table also gives us rank according to the basis of EWIF.

With the collected data in Table 6, we see that Nanaji Deshmukh Veterinary Science University gained first rank with 0.019 of EWIF. And Jawaharlal Nehru Krishi Vishwa Vidyalaya gained third rank with 0.005 of EWIF.

Table 6: Distribution of Inlink Pages of Websites of Agricultural University of Madhya Pradesh

S. No.	Name of Library	Inlink Pages (External)	Number of web pages	WIF	Rank
1.	Jawaharlal Nehru Krishi Vishwa Vidyalaya,	**50**	**9,850**	**0.005**	**3**
2.	Nanaji Deshmukh Veterinary Science University	**57**	**2,880**	**0.019**	**1**
3.	Rajmata Vijayaraje Scindia Krishi Vishwa Vidyalaya	**41**	**6,260**	**0.006**	**2**



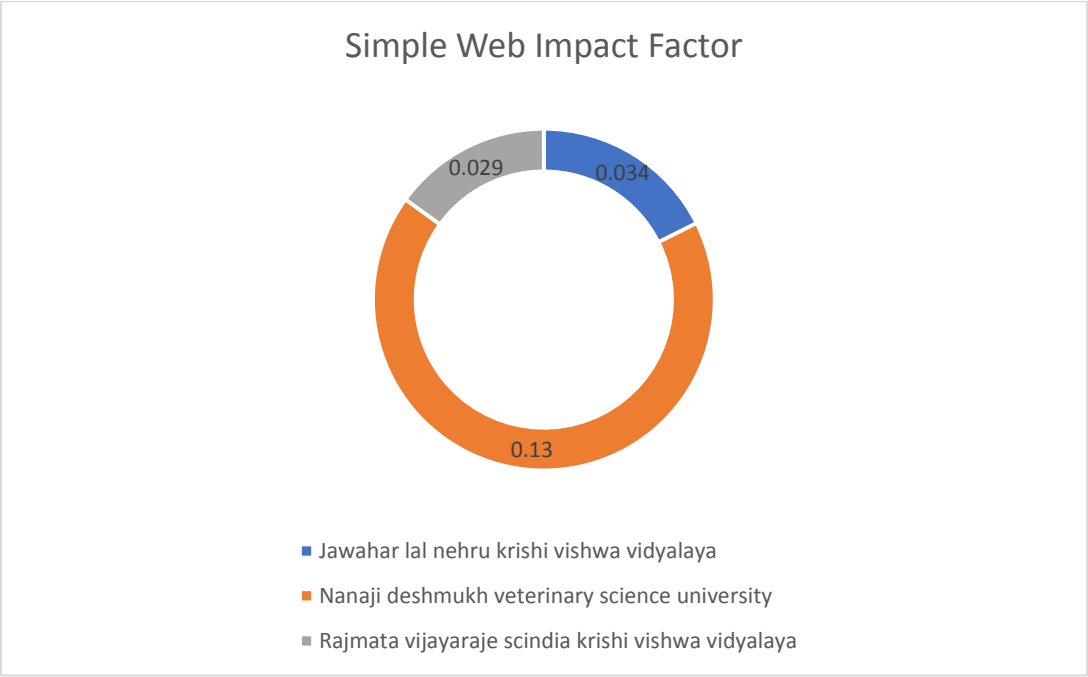
Distribution of Total link Pages of Websites of Agricultural University of Madhya Pradesh

Table 7 illustrates the Simple Web Impact Factor (SWIF) of the Total Link pages available on the Website of the Agricultural University of Madhya Pradesh. SWIF is found by the formula of Simple Link Web Impact Factor (SWIF). That is done by the total number of links divided by the total number of Web Pages available on the sample website. This table also gives us rank according to the basis of SWIF.

Table 7 provides information about the SWIF of the Agricultural University of Madhya Pradesh and shows us that Nanaji Deshmukh Veterinary Science University is the first University those have 0.130 SWIF with the first rank. And Rajmata Vijayaraje Scindia Krishi Vishwa Vidyalaya has 0.029 SWIF with the third rank.

Table 7: Distribution of Total link Pages of Websites of Agricultural University of Madhya Pradesh

S. No.	Name of Library	Total Number of links	Number of web pages	SWIFT	Rank
1.	Jawaharlal Nehru Krishi Vishwa Vidyalaya,	**337**	**9,850**	**0.034**	**2**
2.	Nanaji Deshmukh Veterinary Science University	**375**	**2,880**	**0.130**	**1**
3.	Rajmata Vijayaraje Scindia Krishi Vishwa Vidyalaya	**182**	**6,260**	**0.029**	**3**



8. Findings

- The majority of Agricultural University of Madhya Pradesh have a .org domain name for their websites. .org is specially used for organizational purposes.
- The website of Jawaharlal Nehru Krishi Vishwa Vidyalaya was established in 1964 at Jabalpur, and Nanaji Deshmukh Veterinary Science University was established in the year of 2009.
- Jawaharlal Nehru Krishi Vishwa Vidyalaya has a domain authority of 32 ranks highest, and Nanaji Deshmukh Veterinary Science University gets 29 ranks lowest obtained 100.
- Jawaharlal Nehru Krishi Vishwa Vidyalaya has a Page Authority of 44 out of 100 ranking highest, and Nanaji Deshmukh Veterinary Science University gets 39 out of 100 ranks lowest.
- Jawaharlal Nehru Krishi Vishwa Vidyalaya has 9,850 web pagesonits Website and Nanaji Deshmukh Veterinary Science University has 2,880 web pagesonits website.
- Nanaji Deshmukh Veterinary Science University has 318 numbers Self-link and Rajmata Vijayaraje Schindiya Krishi Vishwa Vidyalaya has 141 number of Self-link.
- Nanaji Deshmukh Veterinary Science University has 57 numbers of Inlink and Rajmata Vijayaraje Schindiya Krishi Vishwa Vidyalaya has 41 only number of Inlink.
- Nanaji Deshmukh Veterinary Science University has 375 total numbers of links and Rajmata Vijayaraje Schindiya Krishi Vishwa Vidyalaya has 182 total number links.
- Nanaji Deshmukh Veterinary Science University gained first rank with 0.029 of IWIF. And Rajmata Vijayaraje Scindia Krishi Vishwa Vidyalaya gained third rank with 0.022 of IWIF.
- Nanaji Deshmukh Veterinary Science University gained first rank with 0.019 of EWIF. And Jawaharlal Nehru Krishi Vishwa Vidyalaya gained third rank with 0.005 of EWIF.
- Nanaji Deshmukh Veterinary Science University is the first University those have 0.130 SWIF with the first rank. And Rajmata Vijayaraje Scindia Krishi Vishwa Vidyalaya has 0.029 SWIF with the third rank.

9. Suggestion:

- Nanaji Deshmukh Veterinary Science University needs to improve its page of authority.
- Nanaji Deshmukh Veterinary Science University should also increase the number of its web pages so that better service can be provided.
- Rajmata Vijayaraje Schindiya Krishi Vishwa Vidyalaya needs to work on its self-links, Inlink, and the total number of links.
- Rajmata Vijayaraje Schindiya Krishi Vishwa Vidyalaya should improve its IWIF.
- Jawaharlal Nehru Krishi Vishwa Vidyalaya should improve their EWIF.
- Rajmata Vijayaraje Scindia Krishi Vishwa Vidyalaya has to also work on their SWIF.

10. Conclusion

According to the study, a website presence is now much more crucial to its ability to be accessed by patrons both physically and virtually. Every user who is a member of Agricultural University or not has to visit the website first before going there. The findings of this study have contributed to the conclusion that it offers a framework for ranking Agricultural University websites of Madhya Pradesh according to various webometric indicators. We have concluded that Jawaharlal Nehru Krishi Vishwa Vidyalaya has great domain authority, page authority, and several pages. On the other hand, Nanaji Deshmukh Veterinary Science University has a great number of Self-link, Inlink, and Total numbers of links, which make it easy to move users from one page to another page. To appear on the first page of search engine results, Nanaji Deshmukh Veterinary Science University and Rajmata Vijayaraje Schindiya Krishi Vishwa Vidyalaya should focus on improving their link structure analysis. This will increase their online presence and help them achieve their goals.

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DIGITAL REPOSITORIES: MANAGING, STORING AND DISSEMINATING DIGITAL CONTENT

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Abstract

Digital repositories have become indispensable platforms for managing, storing, and disseminating digital content in our increasingly digitized world. These repositories serve as virtual archives, ensuring long-term access to a wide range of digital materials, including scholarly articles, research data, audiovisual media, and more. This article provides an overview of digital repositories, their definition, purpose, and various types. It explores the historical background of their development, driven by the need to preserve digital information and ensure its availability. The article also highlights the key features and components of modern digital repositories, including storage systems, metadata frameworks, user interfaces, and search functionalities. Preservation strategies are discussed, emphasizing the importance of safeguarding digital content from degradation and technological changes. Challenges related to preservation, such as file formats, data integrity, metadata consistency, and long-term storage costs, are examined, along with strategies to address them. Access and discovery in digital repositories are explored, focusing on user-friendly interfaces, advanced search functionalities, and metadata cataloging. Legal and ethical considerations, including intellectual property rights, privacy, and security, are discussed to ensure compliance and build trust among users. The article concludes by highlighting future trends and innovations in digital repositories, such as the integration of artificial intelligence, improved semantic search capabilities, and the adoption of blockchain technology. Digital repositories play a vital role in the development, preservation, and accessibility of digital content, and overcoming the challenges they face will ensure their continued value as invaluable resources for generations to come.

Keywords: Digital Repositories, Preservation, OAI-PMH, Metadata, Blockchain

1. Introduction

Digital repositories have emerged as essential platforms for managing, storing, and disseminating digital content. They serve as virtual archives, ensuring long-term access to digital materials such as scholarly articles, research data, audiovisual media, and more. With the increasing digitization of information, these repositories have become vital in our digital age. Digital repositories have revolutionized the information which is stored, managed, and shared in the digital age. As the world becomes increasingly digitized, organizations and individuals are faced with the challenge of effectively preserving and providing access to vast amounts of digital content.

Digital repositories, also known as digital archives or digital libraries, are specialized systems designed to store,

organize, and disseminate digital assets. These assets can encompass a wide range of digital content, including research papers, datasets, images, audio files, videos, and more. The primary goal of digital repositories is to ensure the long-term preservation and accessibility of digital materials, enabling users to discover, retrieve, and utilize them efficiently.

In the past, physical libraries and archives were the primary means of storing and accessing knowledge and information. However, with the advent of digital technologies, the need for digital repositories emerged. Digital repositories provide several advantages over traditional methods of information storage. They enable organizations to overcome the limitations of physical space and geographical boundaries, allowing for the efficient preservation and dissemination of digital content on a global scale.

One of the key advantages of digital repositories is their ability to enhance the discoverability and visibility of digital assets. Through the use of metadata and robust search functionalities, users can easily locate and access relevant resources within the repository. This promotes collaboration, knowledge sharing, and interdisciplinary research.

Moreover, digital repositories play a vital role in promoting open access to scholarly publications and research findings. By providing free and unrestricted access to academic materials, they contribute to the democratization of knowledge and foster innovation and progress. Researchers, students, and professionals worldwide can benefit from the wealth of information available within digital repositories, regardless of their geographical location or institutional affiliations.

In addition to preserving and providing access to digital content, digital repositories often incorporate features such as version control mechanisms, access controls, and authentication protocols to ensure the security and integrity of the stored materials. They also facilitate the management of intellectual property rights, licensing agreements, and copyright compliance, safeguarding the rights of content creators and owners.

As technology continues to advance, digital repositories are evolving to meet the changing needs of users and organizations. New trends and innovations, such as the integration of artificial intelligence and machine learning, are shaping the future of digital repositories, enabling more sophisticated search capabilities, content recommendation systems, and data analytics.

Digital repositories have become indispensable tools in the digital landscape, providing efficient and secure means of storing, managing, and disseminating digital content. They empower individuals and organizations to preserve their knowledge, share their research, and contribute to the collective growth of society. With their continued development and adoption, digital repositories will play a crucial role in shaping the future of information management and access.

2. Definition and Purpose

Digital repositories are online platforms designed to store and organize digital content. They serve as centralized locations for collecting, preserving, and providing access to digital resources. The primary purpose of digital repositories is to ensure the long-term availability and accessibility of digital content. A digital repository, also known as a digital archive or digital library, is a specialized system designed to store, organize, preserve, and provide access to digital assets. These assets can include various types of digital content, such as research papers, datasets, images, audio files, videos, and more. Digital repositories serve as trusted sources of information, ensuring long-term preservation and accessibility. Digital repositories have become essential components of the modern information landscape. They provide organizations and individuals with a centralized platform for

storing, managing, and disseminating digital content.

3. Literature Review

Aminu Umar, Musa & Aliyu (2014) acknowledge the transformative potential of digitization projects in Nigerian universities, positioning them as a step forward. Collaboration with related projects and donor agencies is deemed essential for success. While academic libraries are recognized as primary beneficiaries, the review emphasizes the need for libraries to stay technologically updated to address challenges.

Loan (2014) highlights the increasing prominence of the open-access movement in Asian countries. It acknowledges their active contribution through the establishment of various repositories. While Asia has begun preserving digital content, the paper advocates for concrete steps to accelerate the open-access movement. It emphasizes the need for countries, particularly developing ones, to contribute to narrowing the information gap. The review suggests the adoption of web portals, such as Japan's JAIRO, and proposes the creation of a common National Digital Repository, citing India's Information and Library Network (INFLIBNET) as a potential facilitator.

Jantz, & Giarlo (2005) define the challenges, urging institutions to carefully balance risks against the maturity of the preservation process. While aspiring to preserve cultural heritage in perpetuity, the unpredictable digital landscape advises caution. Despite uncertainties, it stresses the imperative for libraries to start integrating policies, standards, and technologies for digital preservation. The text highlights the ongoing research needed, particularly in discerning equivalence between digital objects and managing issues like data migration. Acknowledging risks, it advocates for libraries to establish their reputation in the evolving role of digital preservation. Trust is deemed essential, paralleling the confidence we place in our financial statements. Ultimately, the review emphasizes the need for users to trust institutions undertaking the role of a "trusted digital repository," highlighting the vital role libraries play in this evolving landscape.

Yakel et. al. (2013) delves into the nuanced relationship between trust in digital repositories and data repositories. It emphasizes that trust is distinct from trust in the data itself, influencing how reusers engage with repositories. The paper highlights trust as integral to the designated community-repository relationship, impacting overall repository quality. The work suggests that establishing metrics around understanding the designated community, as per ISO TRAC's goal, is complex. Understanding stakeholders' trust construction is crucial for reinforcing repository initiatives and achieving trusted repository status.

Zuccala, Oppenheim & Dhiensa (2008) addresses the novel management challenges faced by repository managers, emphasizing the infancy of available techniques like LexiURL for long-term evaluations. The study advocates for a comprehensive evaluation process, considering both the perspectives of repository management teams and users. It highlights the importance of objective measures to gauge factors contributing to a repository's success. The review acknowledges the predominant concern for institutional repositories in existing literature and calls for further research on diverse repository types, such as learning object repositories, in higher education. The paper concludes by advocating for the development of programs or specialized modules in library and information science schools to train repository managers, emphasizing the need for ongoing research in this rapidly evolving field.

4. Objectives

Objectives of this article are following:

- To understand digital repositories, defining their purpose, scope, and the

types of digital content they are designed to manage, store, and disseminate.

- To know how well-organized digital repositories contribute to the preservation, accessibility, and effective use of diverse digital assets.
- To identify and address the challenges associated with managing, storing, and disseminating digital content.
- To know ethical consideration of digital repositories.

5. Methodology

This study applies case study to explore the pivotal role of digital repositories in the development, preservation, and accessibility of digital content, as well as the challenges they face. The research investigates the impact of technological advancements, legal considerations, and preservation concerns on these repositories. By understanding these dynamics, the study seeks to provide insights into how digital repositories can continue to evolve as essential tools in information management.

6. Types of Digital Repositories

There are several types of digital repositories, each catering to specific content and user needs. Institutional repositories focus on preserving and sharing scholarly outputs from a specific institution or organization. Discipline-specific repositories concentrate on a particular academic discipline, providing a curated collection of resources. Additionally, subject repositories, data repositories, and multimedia repositories serve specific purposes within their respective domains.

- **Institutional Repositories:** Institutional repositories are created by academic institutions, such as universities, colleges, or research centers. They serve as a central hub for storing and sharing scholarly output produced by faculty members, researchers, and students. Institutional repositories typically include research papers, theses, dissertations, conference papers, and other academic materials. These repositories aim to promote open access to scholarly work, increase visibility and discoverability of research, and provide long-term preservation of institutional knowledge. Example: CORE, Digital Commons Network, Open DOAR (Directory of Open Access Repositories), Registry of Open Access Repositories (ROAR) etc.
- **Subject-based Repositories:** Subject-based repositories focus on specific subject areas or disciplines. They cater to researchers and professionals working in specialized fields who require access to relevant resources. These repositories collect and curate digital content specific to a particular discipline, such as biology, chemistry, physics, or humanities. Subject-based repositories provide researchers with a targeted platform to find and access scholarly publications, datasets, and other resources relevant to their areas of interest. Example: Social Sciences Research Network (SSRN), Open Science Director, CogPrints, PubMed Central etc.
- **Data Repositories:** Data repositories specialize in storing and sharing research datasets. They are designed to ensure the long-term preservation and accessibility of valuable research data. Data repositories typically include datasets from various disciplines, including scientific research, social sciences, and environmental studies. These repositories often provide tools and metadata standards for effective data management, making it easier for researchers to discover, access, and reuse datasets for their own studies. Example: Data warehouse, Data cubes, Data marts etc.
- **Government Repositories:** Government repositories are established by governmental bodies and agencies to preserve and share important documents, records, and information. These

repositories serve as archives for historical records, legislative documents, public reports, and cultural artifacts. Government repositories play a crucial role in preserving the nation's heritage and ensuring transparency in governance. They provide public access to government publications and facilitate research and analysis in various fields. Example: NDR (National Data Repository), Indian Academic Research Data Repository (IARDR), India Code etc.

- **Digital Libraries:** Digital libraries are comprehensive repositories that encompass a wide range of digital content. They may include digitized books, journals, manuscripts, photographs, maps, audiovisual materials, and more. Digital libraries often collaborate with libraries, museums, and cultural institutions to digitize and preserve their collections. These repositories aim to provide universal access to knowledge and cultural heritage, allowing users to explore and access resources from diverse disciplines and genres. Example: National Digital Library of India, Google Books, Open Library, Universal Digital Library etc.
- **Commercial Repositories:** Commercial repositories are managed by private organizations or companies that offer services for storing and distributing digital content. These repositories cater to industries such as publishing, entertainment, and media. Commercial repositories focus on protecting and monetizing digital assets, ensuring copyright compliance, and providing secure distribution channels. They may include platforms for e-books, music, videos, and other digital media. Cornerstone, kindle, LibriVox etc.

These are just a few examples of the different types of digital repositories available. Each type serves unique purposes and addresses specific requirements, contributing to the preservation, accessibility, and dissemination of digital content in various domains.

7. Development of Digital Repositories

The development of digital repositories has been a dynamic and evolving process, driven by advancements in technology, changing needs of users, and the growing importance of preserving and sharing digital content. Over the years, several key factors have contributed to the development and improvement of digital repositories:

- **Technological Advancements:** The rapid progress of digital technologies has played a fundamental role in the development of digital repositories. Increased storage capacities, improved data compression techniques, and enhanced network infrastructures have made it possible to handle and store large volumes of digital content. Advancements in metadata standards, digital preservation techniques, and search algorithms have also significantly improved the functionality and effectiveness of digital repositories.
- **Open Access Movement:** The open access movement, which advocates for free and unrestricted access to scholarly publications and research outputs, has influenced the development of digital repositories. The movement has fostered the creation of institutional repositories and subject-based repositories, providing platforms for researchers to share their work openly. Digital repositories have become key components in enabling open access to academic materials, facilitating the dissemination of knowledge on a global scale.
- **Collaboration and Interoperability:** Digital repositories have become more interconnected and interoperable, allowing for seamless integration and sharing of content between different repositories and systems. Initiatives such as the OAI-PMH (Open Archives Initiative Protocol for Metadata Harvesting) have enabled repositories to exchange metadata, promoting collaboration and enabling

users to discover resources across multiple repositories. The development of standardized metadata schemas and protocols has facilitated the interoperability of digital repositories, making it easier for users to access and utilize content from various sources.

- **Preservation and Long-Term Access:** Digital preservation has been a significant focus in the development of repositories. The need to ensure the long-term accessibility and usability of digital content has led to the adoption of preservation strategies and best practices. Repositories incorporate mechanisms such as data backup, migration, and emulation to mitigate the risks of technological obsolescence and data loss. Preservation metadata and formats have been developed to support the long-term sustainability of digital materials, ensuring their integrity and authenticity over time.
- **User Experience and Engagement:** User-centric design and user experience have become key considerations in the development of digital repositories. Repositories are designed to provide intuitive interfaces, powerful search capabilities, and personalized features that enhance the user experience. Integration with social media, citation management tools, and collaborative platforms has further increased user engagement and facilitated the sharing and discovery of digital content.
- **Community Engagement and Best Practices:** The development of digital repositories has been shaped by the collaborative efforts of various communities and organizations. Professional associations, research consortia, and international initiatives have played a crucial role in establishing best practices, guidelines, and standards for the management and operation of repositories. Communities of practice have emerged, fostering knowledge exchange and sharing of experiences to improve the effectiveness and sustainability of repositories.

Looking ahead, the development of digital repositories is expected to continue, driven by emerging technologies and evolving user needs. Artificial intelligence and machine learning are poised to play a more significant role in enhancing search capabilities, content recommendation systems, and metadata enrichment. Integration with research data management workflows and emerging technologies such as blockchain may further expand the functionalities and applications of digital repositories.

The development of digital repositories has been a dynamic and ongoing process, guided by technological advancements, the open access movement, collaboration, preservation concerns, user experience, and community engagement. As repositories continue to evolve, they will continue to play a crucial role in preserving, sharing, and promoting access to digital content, fostering collaboration, and advancing knowledge across various disciplines.

8. Key Features and Components

Digital repositories play a crucial role in managing, storing, and disseminating digital content effectively. They serve as organized and centralized platforms that provide access to a wide range of digital materials, including research articles, datasets, multimedia content, and other digital assets. Let's explore the key features and components that make digital repositories essential tools for knowledge management and information sharing:

- **Content Management**: Digital repositories offer robust content management systems that enable the organization and categorization of digital assets. They provide metadata standards and descriptive fields to ensure proper indexing and search ability of content. Through content management features, repositories facilitate easy discovery and

access to digital materials, enhancing their usability and visibility.

- **Storage and Preservation:** Digital repositories provide secure and reliable storage infrastructure to house digital content. They employ preservation strategies, including backup systems, redundant storage, and data replication, to ensure the long-term integrity and accessibility of digital assets. Repositories often adhere to digital preservation standards and best practices to safeguard content from data loss, corruption, or obsolescence.
- **Access Control and Security:** Digital repositories incorporate access control mechanisms to protect intellectual property rights, sensitive data, and confidential materials. They offer various access levels, allowing content owners to define permissions and restrictions for different user groups. Repositories also implement security measures, such as authentication, encryption, and digital rights management, to ensure authorized access and prevent unauthorized use or distribution of digital content.
- **Search and Discovery:** Digital repositories feature powerful search and discovery functionalities, making it easy for users to locate and retrieve specific digital assets. They employ indexing techniques, metadata harvesting, and full-text search capabilities to enable efficient and precise searching across large repositories. Advanced search filters, faceted navigation, and relevance ranking algorithms enhance the discoverability of digital content.
- **Metadata and Descriptive Information:** Digital repositories rely on comprehensive metadata standards and descriptive information to facilitate content organization and discovery. Metadata enriches the digital assets with contextual information, such as title, author, subject, keywords, and licensing terms. Repositories often follow established metadata schemas, such as Dublin Core, MODS, or METS, to ensure interoperability and consistency in describing digital content.
- **Interoperability and Integration:** Digital repositories promote interoperability by supporting standard protocols and formats for content ingestion, retrieval, and dissemination. They often integrate with external systems, such as institutional repositories, library catalogs, learning management systems, and research databases, to enable seamless content exchange and integration. Interoperability allows for the efficient sharing and reuse of digital materials across different platforms and systems.
- **Metadata Harvesting and Aggregation:** Digital repositories may participate in metadata harvesting and aggregation initiatives to increase the visibility and accessibility of digital content. They contribute metadata records to larger aggregators, such as OAI-PMH-based services or digital library networks, enabling wider exposure and discovery of digital assets. Metadata harvesting and aggregation enhance the reach and impact of digital repositories within the scholarly and research communities.
- **Usage Statistics and Analytics:** Digital repositories provide usage statistics and analytics features to track and analyze user interactions with digital content. They generate reports on downloads, views, citations, and other usage metrics, providing valuable insights into the impact and usage patterns of the deposited materials. Usage statistics help repository managers and content owners understand the reach and relevance of their digital assets.
- **Collaboration and Social Features:** Some digital repositories offer collaboration and social features that foster engagement and interaction among

users. These features may include commenting, annotation, sharing, and social bookmarking functionalities, allowing users to engage in scholarly discussions, provide feedback, and collaborate on research projects. Such features promote community building and knowledge sharing within the repository ecosystem.

- **Licensing and Rights Management:** Digital repositories support licensing and rights management for digital content. They enable content owners to specify licensing terms, access restrictions, and usage permissions for their materials. Repositories may also integrate with licensing registries or Creative Commons platforms to streamline the licensing process and ensure compliance with copyright regulations.

Digital repositories provide a comprehensive set of features and components that facilitate the management, storage, and dissemination of digital content. With robust content management, secure storage, powerful search capabilities, and interoperability, repositories serve as vital tools for knowledge sharing, research collaboration, and preserving digital heritage.

9. Importance of Preservation

Preservation plays a critical role in digital repositories, ensuring the long-term accessibility, integrity, and usability of digital content. As digital materials become increasingly vital for research, education, and cultural heritage, it is essential to recognize the significance of preservation within the context of managing, storing, and disseminating digital content. Let's explore the importance of preservation in digital repositories:

- **Long-Term Access:** Preservation safeguards digital content, ensuring its availability and accessibility for future generations. Digital repositories employ strategies like data backups, replication, and migration to protect against data loss, hardware failures, and technological obsolescence. By preserving digital content, repositories mitigate the risks of content becoming inaccessible or unusable over time.
- **Content Integrity:** Preservation measures maintain the integrity of digital materials, safeguarding them from corruption, unauthorized alterations, or data loss. Digital repositories implement checksums, file validation techniques, and redundancy mechanisms to detect and prevent data corruption. Preservation practices ensure that digital assets remain trustworthy, reliable, and unchanged over time.
- **Legal and Regulatory Compliance:** Digital repositories often house materials that are subject to legal and regulatory requirements, such as copyright restrictions or data protection laws. Preservation strategies help repositories fulfill their legal obligations by ensuring compliance with copyright regulations, privacy standards, and intellectual property rights. By preserving content according to legal requirements, repositories protect themselves and their users from legal disputes and infringements.
- **Research Reproducibility:** Preservation contributes to research reproducibility by ensuring that digital materials used in scholarly investigations remain accessible and unchanged. By preserving datasets, research articles, and other research outputs, repositories enable future researchers to verify and reproduce previous studies. This fosters transparency, accountability, and the advancement of scientific knowledge.
- **Cultural and Heritage Preservation:** Digital repositories often host materials of cultural, historical, or societal significance, such as archival documents, artworks, or audiovisual recordings. Preservation ensures that these valuable

assets are safeguarded for future generations, preventing loss, degradation, or irretrievability. By preserving cultural and heritage materials, repositories contribute to the preservation of collective memory and cultural diversity.

- **Data Management and Curation:** Preservation is an integral part of effective data management and curation in digital repositories. Repositories employ metadata standards, documentation practices, and version control mechanisms to ensure that data remains discoverable, well-documented, and usable over time. Preservation complements data management efforts, enabling the efficient reuse, sharing, and analysis of valuable research data.
- **Continuous Technological Adaptation:** Preservation in digital repositories involves continuous adaptation to evolving technologies and formats. As technology advances and file formats change, repositories must actively monitor and address format obsolescence. Preservation strategies include format migration, emulation, or normalization to ensure that content remains accessible and usable despite technological advancements or changes.
- **Knowledge Continuity and Innovation:** Preservation ensures the continuity of knowledge and fosters innovation by providing access to past research, scholarly outputs, and historical records. By preserving digital content, repositories contribute to the collective memory of human accomplishments, enabling researchers, scholars, and the public to build upon previous work, spark new ideas, and drive innovation in various fields.

Preservation plays a crucial role in digital repositories, ensuring the long-term accessibility, integrity, and usability of digital content. By implementing effective preservation strategies, repositories contribute to research reproducibility, legal compliance, cultural preservation, data management, and knowledge continuity. Preservation safeguards digital materials, allowing them to remain accessible, usable, and valuable for current and future generations.

10. Challenges and Strategies

Preserving digital content poses several challenges. These include issues related to file formats, data integrity, metadata consistency, and long-term storage costs. Digital repositories employ strategies such as format migration, emulation, and checksums to address these challenges. Collaboration between repositories and adherence to preservation standards further enhance the preservation efforts.

10.1 Access and Discovery in Digital Repositories

- **User Interface and Search Ability:** A user-friendly interface is crucial for effective access to digital repositories. Intuitive navigation, advanced search functionalities, and filtering options enhance user experience. Well-designed interfaces ensure that users can easily discover relevant resources and explore the repository's content.
- **Metadata and Cataloging:** Metadata plays a vital role in the discovery and organization of digital resources. Repositories use standardized metadata schemas to describe the content, enabling effective searching and browsing. Cataloging practices ensure that resources are appropriately classified, tagged, and linked, enabling seamless exploration within the repository.

10.2 Legal and Ethical Considerations

- **Intellectual Property Rights:** Digital repositories must navigate the complex landscape of intellectual property rights. Balancing the rights of content creators and users is crucial to ensure legal

compliance. Repositories often rely on licensing agreements, copyright policies, and fair use provisions to manage intellectual property concerns.

- **Privacy and Security:** Protecting user privacy and maintaining data security are paramount for digital repositories. Safeguarding sensitive information and implementing secure authentication protocols are essential to build trust among users. Compliance with privacy regulations and continuous monitoring of security threats help maintain the integrity and confidentiality of the repository's content.
- **Future Trends and Innovations:** Digital repositories continue to evolve to meet the changing needs of users and technological advancements. Some emerging trends include the integration of artificial intelligence for automated metadata generation, improved semantic search capabilities, and the adoption of blockchain technology for enhanced security and transparency. These innovations promise to reshape the landscape of digital repositories in the coming years.

11. Conclusion

Digital repositories play a vital role in the development, preservation, and accessibility of digital content. By providing a centralized platform for storing and organizing diverse resources, they contribute to the advancement of knowledge. However, repositories face challenges related to preservation, access, legal considerations, and technological advancements. Overcoming these challenges will ensure that digital repositories continue to serve as invaluable resources for generations to come. digital repositories have become indispensable platforms for managing, storing, and disseminating digital content in our increasingly digitized world. These repositories serve as virtual archives, ensuring long-term access to a wide range of digital materials, including scholarly articles, research data, audiovisual media, and more. They play a vital role in the development, preservation, and accessibility of digital content, and overcoming the challenges they face will ensure their continued value as invaluable resources for generations to come.

Digital repositories have revolutionized the way information is stored, managed, and shared in the digital age. They provide numerous advantages over traditional methods of information storage, including enhanced discoverability, increased accessibility, and the promotion of open access to scholarly publications and research findings. By providing free and unrestricted access to academic materials, digital repositories contribute to the democratization of knowledge and foster innovation and progress.

The development of digital repositories has been driven by technological advancements, the open access movement, collaboration, preservation concerns, user experience, and community engagement. They have evolved to incorporate features such as content management, storage and preservation, access control and security, search and discovery, metadata and descriptive information, interoperability and integration, metadata harvesting and aggregation, usage statistics and analytics, and collaboration and social features. These features and components ensure the effective management, preservation, and dissemination of digital content while enhancing user experience and engagement.

Looking ahead, digital repositories will continue to evolve and adapt to meet the changing needs of users and organizations. Emerging technologies, such as artificial intelligence and machine learning, will play a significant role in enhancing search capabilities, content recommendation systems, and metadata enrichment. Integration with research data management workflows and the adoption of blockchain technology may further

expand the functionalities and applications of digital repositories.

Digital repositories have become essential tools in the digital landscape, providing efficient and secure means of storing, managing, and disseminating digital content. They empower individuals and organizations to preserve their knowledge, share their research, and contribute to the collective growth of society. With their continued development and adoption, digital repositories will play a crucial role in shaping the future of information management and access.

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DIGITAL LEARNING REVOLUTION: A COMPARATIVE ANALYSIS OF NPTEL, NDL, SWAYAM, AND E-PG PATHSHALA IN INDIA'S EDUCATIONAL LANDSCAPE

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Abstract

The digital era has brought about a revolutionary transformation in the field of education, particularly in India, where various online platforms have emerged to supplement traditional learning methods. This paper presents a comprehensive comparative analysis of four prominent digital learning platforms in India: NPTEL (National Programme on Technology Enhanced Learning), NDL (National Digital Library), SWAYAM (Study Webs of Active-Learning for Young Aspiring Minds), and e-PG Pathshala. The study aims to evaluate their impact, effectiveness, and contribution to India's educational landscape.

This study compares four major digital learning platforms in India – NPTEL, NDL, SWAYAM, and e-PG Pathshala – to assess their impact on education. Examining aspects like content diversity, accessibility, and user satisfaction, we find NPTEL excels in tech education, NDL is a comprehensive digital library, SWAYAM promotes interactive learning, and e-PG Pathshala focuses on postgraduate education. Challenges like internet connectivity and digital literacy are noted. Recommendations include increased collaboration and enhanced user support. This analysis informs policymakers and educators navigating the evolving landscape of digital education in India.

This comparative study will provide valuable insights for educators, policymakers, and e-learning platform developers in India. It will help them understand the strengths and weaknesses of these platforms, allowing for informed decisions on how to enhance the learning experiences of students across the country. Additionally, the study may contribute to the broader discourse on the role of e-learning in shaping the future of education in India.

Keywords: Digital Learning Revolution, Online Education, Distance Learning, Learning Platforms, Skill Development, Virtual Classroom, Artificial Intelligence

1. Introduction:

In recent years, India has witnessed a transformative shift in its educational landscape with the advent of digital learning platforms. This revolution has been propelled by the increasing accessibility of the internet and a growing demand for flexible, inclusive, and technology-driven education. Among the platforms contributing significantly to this transformation are the National Programme on Technology Enhanced Learning (NPTEL), the National Digital Library (NDL), SWAYAM, and e-PG Pathshala. This paper aims to provide a comparative analysis of these digital learning initiatives, shedding light on their structures, content offerings, impact, and challenges within the Indian educational context.

- **NPTEL (National Programme on Technology Enhanced Learning):** NPTEL, initiated by the Indian Institutes of Technology (IITs) and the Indian Institute of Science (IISc), focuses on providing high-quality technical education through online courses. It offers a diverse range of video lectures, assignments, and assessments in engineering, technology, and sciences. The platform has gained popularity for its

rigorous content and association with prestigious institutions. [1]

- **NDL (National Digital Library):** The NDL is a digital repository that aims to facilitate learning and research by providing access to a vast collection of digital resources. Developed by the Ministry of Human Resource Development (MHRD), NDL offers e-books, articles, theses, videos, and other educational materials. It serves as a comprehensive resource hub for students, researchers, and educators across various disciplines.
- **SWAYAM (Study Webs of Active Learning for Young Aspiring Minds):** Launched by the Government of India, SWAYAM is a massive open online course (MOOC) platform that offers a wide range of courses, including school education, undergraduate, postgraduate, and vocational training. It collaborates with universities and institutions to deliver interactive and self-paced courses, making education accessible to learners nationwide.
- **e-PG Pathshala:** Developed by the University Grants Commission (UGC), e-PG Pathshala is an e-content platform offering postgraduate-level courses in various disciplines. It aims to enhance the quality of postgraduate education by providing high-quality, interactive, and multimedia-rich content. The platform caters to diverse subjects, making it a valuable resource for postgraduate students and educators.

As these digital learning platforms continue to gain traction, several challenges and opportunities emerge. Challenges include ensuring internet connectivity in remote areas, addressing the digital divide, maintaining content quality, and fostering learner engagement. However, the opportunities lie in the potential to democratize education, reach a wider audience, and adapt to evolving pedagogical practices.

2. Brief overview of the digital learning revolution in India

The Digital Learning Revolution in India has witnessed significant transformations in the country's educational landscape, with various initiatives aiming to make quality education accessible to a larger audience. India, with its large and diverse population, has long recognized the need for accessible and quality education to empower its citizens. Online education platforms have emerged as a crucial means to address this challenge. The historical development of digital learning in India has been shaped by a complex interplay of technological advancements, educational policies, and societal changes. These narrative highlights key milestones and trends in the evolution of digital education in the country.

(i) **Early Initiatives (1990s-2000s):** The introduction of computers in Indian education began in the 1990s, focusing primarily on computer literacy. However, the limited availability of technology restricted its implementation to a few urban schools and institutions. The National Policy on Education (NPE) in 1986 emphasized the use of technology in education, but progress was slow. [2]

(ii) **Emergence of E-Learning (2000s):** The 2000s witnessed the growth of e-learning platforms and initiatives. Organizations like the National Programme on Technology Enhanced Learning (NPTEL) and the Indira Gandhi National Open University (IGNOU) began offering online courses. [3]Nevertheless, internet penetration remained low, limiting access to a broader audience.

(iii) **National Mission on Education through ICT (2009):** In 2009, the Indian government launched the National Mission on Education through Information and Communication Technology (NME-ICT) to leverage technology for expanding the reach of quality education. [4]This initiative led to the development of the Sakshat portal,

offering access to educational resources.

(iv) **Digital India Campaign (2015):** The Digital India campaign, initiated in 2015, aimed to transform India into a digitally empowered society. In the education sector, there was a push towards digital content creation, online assessments, and the integration of technology in classrooms. [5]

(v) **Online Learning Platforms Boom (2010s-2020s):** Over the past decade, there has been a significant rise in online learning platforms such as BYJU's, Coursera, Udacity, and Khan Academy. [6] These platforms provided diverse courses and study materials, and the increasing availability of affordable data and mobile penetration played a crucial role in making digital education more accessible. [7] [8]

(vi) **COVID-19 Pandemic (2020):** The COVID-19 pandemic accelerated the adoption of digital learning in India. Temporary closures of schools and colleges necessitated a rapid transition to online teaching, highlighting the importance of digital infrastructure and teacher training in online pedagogy. [9]

(vii) **Government Initiatives (2020s):** Government initiatives like the National Digital Education Architecture (NDEAR) and the PM e-Vidya program [10] continued to promote digital learning. Efforts were made to address challenges such as the digital divide and ensure inclusive access to online education. [11]

3. Historical context of NPTEL, NDL, SWAYAM, and e-PG Pathshala

In the evolving landscape of education in India, several initiatives have been introduced to enhance the quality and accessibility of learning resources, especially in higher education. NPTEL, NDL, SWAYAM and e-PG Pathshala stand as pivotal contributors to this transformative journey. These initiatives, launched in the early 21st century, signify a paradigm shift in how education is imparted and accessed, leveraging technology to break down geographical and financial barriers. Here is a brief description of One by One.

(i) NPTEL (National Programme on Technology Enhanced Learning): NPTEL is a project initiated by the Indian Institutes of Technology (IITs) and the Indian Institute of Science (IISc) to provide high-quality education in engineering and science through online courses. It was launched in 2003 and is funded by the Ministry of Education (formerly the Ministry of Human Resource Development) in India. NPTEL aims to enhance the quality of engineering education by making course materials available online for free. The courses include video lectures, lecture notes, assignments, and exams. NPTEL is an initiative by the Indian Institutes of Technology (IITs) and the Indian Institute of Science (IISc) to provide online courses and certification in engineering and science disciplines [12]and his aimed to enhance the quality of engineering education by making course materials available online. Over the years, it expanded its course offerings and introduced certification for learners. [13]

(ii) NDL (National Digital Library of India): The National Digital Library of India (NDL NDL was initiated in 2015 as a project under the Ministry of Human Resource Development. It aims to facilitate learning and research by offering a diverse collection of e-books, articles, videos, and other educational resources. NDL provide access to a vast repository of academic content in various formats, including books, articles, theses, and multimedia. [14] It was launched in 2016 with the goal of facilitating learning and research by making educational resources easily accessible to students, teachers, and researchers across the country. NDL is a

digital repository of academic resources with a focus on educational materials. It provides a platform for students, researchers, and teachers to access a wide range of content. [15]

(iii) SWAYAM (Study Webs of Active Learning for Young Aspiring Minds): SWAYAM is an online platform launched by the Government of India in 2014 to provide free online courses, covering a wide range of subjects from school-level to postgraduate education. SWAYAM aims to bridge the digital divide and ensure that quality education is accessible to all, regardless of geographical location. It offers courses developed by faculty from various institutions, including IITs, IIMs, and central universities. It integrates with conventional education and allows students to earn academic credits. [16] Launched in 2014, SWAYAM is part of the Government of India's efforts to promote Massive Open Online Courses (MOOCs) and make quality education accessible to a larger audience. It collaborates with institutions and professors across the country. [17]

SWAYAM Prabha: To cater to learners who have limited internet access, SWAYAM Prabha was launched, providing access to educational content via 32 satellite channels. This initiative ensures that even those in remote areas can benefit from SWAYAM's offerings. [16]

(iv) e-PG Pathshala: e-PG Pathshala is an initiative by the University Grants Commission (UGC) in India to develop high-quality, curriculum-based e-content at postgraduate levels. Launched in 2014, it offers a wide range of online courses and e-resources for postgraduate students across disciplines. The content includes video lectures, e-books, and other learning materials. The goal is to enhance the learning experience for postgraduate students and promote the use of technology in higher education. The project was launched to address the need for comprehensive and accessible postgraduate education resources. It offers e-content in the form of e-books, video lectures, and other multimedia formats. [18]

4. Importance of comparing NPTEL, NDL, SWAYAM, and e-PG Pathshala

Comparing NPTEL, NDL, SWAYAM, and e-PG Pathshala is essential for students, educators, and policymakers to understand the strengths and weaknesses of each platform. These platforms play a crucial role in providing educational resources in India, and assessing their merits can help individuals make informed decisions about which one to use or support. Here are some key aspects to consider when comparing these platforms:

S. N.	Platforms	Focus Area	Content Type	Coverage	Collaboration	Certification
1	**NPTEL**	Primarily focuses on engineering and science courses	Offers video lectures, course materials, and assignments.	Provides a wide range of courses from basic to advanced levels.	Collaborates with premier institutes and professors.	Provides certification for completed courses.
2	**NDL**	A digital repository that hosts a variety of educational content including books, articles,	Not a course provider, but offers access to a vast collection of educational resources.	Provides resources across multiple disciplines.	Collaborates with various institutions to collect and host digital content.	Does not provide certification for courses.

		theses, and multimedia.				
3	**SWAYAM**	Offers a wide range of courses across various disciplines, including arts, science, commerce, and more.	Provides video lectures, reading materials, quizzes, and discussion forums.	Collaborates with universities and professors to offer courses.	Collaborates with institutions and professors across India.	Provides certification for completed courses.
4	**e-PG Pathshala**	Targets postgraduate education and provides high-quality e-content in different subjects.	Offers e-textbooks, audio/video lectures, and supplementary materials.	Covers a range of postgraduate level subjects.	Developed by UGC (University Grants Commission) in collaboration with INFLIBNET (Information and Library Network).	The focus is on learning resources, and it may not provide certification for courses.

Each platform serves a specific purpose, and the choice depends on the learner's preferences, academic needs, and the type of content they are seeking. Where the NPTEL is renowned for its technical and engineering courses, while NDL boasts a vast repository of academic content spanning various disciplines. SWAYAM caters to a broad spectrum of learners, from school-level students to postgraduates, and e-PG Pathshala focuses on higher education.

4.1 Here's are the analyze summary for each platform in a table

S. N.	Platforms	Details	Summary
1	**NPTEL**	• Developed by IITs (Indian Institutes of Technology) and IISc (Indian Institute of Science). • Primarily focuses on engineering and science disciplines. Offers video lectures, course materials, and assignments. • Collaborates with premier institutes and renowned professors. • Provides certification for completed courses.	• NPTEL is a high-quality online learning platform developed by prestigious institutions. • Its primary focus is on engineering and science courses. • The platform provides comprehensive video lectures, course materials, and assignments. • Collaboration with top-tier institutes and renowned professors ensures the quality of content. • Certification is offered for successful completion of courses, adding value to the learner's credentials.
		• A digital repository offering a diverse collection of educational resources. • Hosts books, articles, theses, and multimedia content. • Not a course provider but a	• NDL serves as a comprehensive digital library, offering a vast collection of educational resources. • It is not a course provider but rather a repository for books, articles, theses, and multimedia content.

2	**NDL**	resource hub. • Collaborates with various institutions to collect and host digital content. • Does not provide certification for courses.	• Collaboration with various institutions contributes to the richness of the content available. • NDL does not offer certification, as its primary focus is on providing access to a wide range of educational materials.
3	**SWAYAM**	• A government initiative offering courses across diverse disciplines. • Provides video lectures, reading materials, quizzes, and discussion forums. • Collaborates with universities and professors across India. • Offers certification for completed courses.	• SWAYAM is a government-supported initiative that provides a broad spectrum of courses across various disciplines. • The platform offers interactive features such as video lectures, reading materials, quizzes, and discussion forums. • Collaboration with universities and professors ensures a diverse and high-quality course catalog. • SWAYAM provides certification upon successful completion of courses, enhancing the learner's academic achievements.
4	**e-PG Pathshala**	• Developed by UGC (University Grants Commission) in collaboration with INFLIBNET. • Tailored for postgraduate education. • Offers e-textbooks, audio/video lectures, and supplementary materials. • Covers a variety of postgraduate level subjects. • Focuses on learning resources rather than certification.	• e-PG Pathshala is specifically designed for postgraduate education, providing tailored content for advanced studies. • The platform offers e-textbooks, audio/video lectures, and supplementary materials to support postgraduate level subjects. • Developed in collaboration with UGC and INFLIBNET, ensuring credibility and academic relevance. • While it emphasizes learning resources, e-PG Pathshala may not provide certification, focusing more on the educational content for postgraduate students

5. Evaluation of the impact on India's educational landscape

The impact of platforms like NPTEL, NDL, SWAYAM, and e-PG Pathshala on India's educational landscape has been significant and multifaceted. Here's an evaluation of their impact:

(i) **Increased Access to Quality Education:** These platforms have significantly increased access to quality educational resources, especially in remote and underserved areas of India. Students can access lectures, study materials, and courses from prestigious institutions like IITs and IISc through NPTEL and SWAYAM, thus democratizing education.

(ii) **Diversification of Subjects:** These platforms offer a wide range of subjects, including technical, non-technical, and interdisciplinary fields. This diversification allows students to explore various disciplines and pursue their interests, contributing to a more holistic education landscape.

(iii) **Certification and Recognition:** NPTEL and SWAYAM offer certifications that are recognized by

industries and institutions. These certificates have helped students enhance their employability and academic credentials. They also promote lifelong learning and upskilling.

Promotion of Open Access: NDL promotes open access to educational resources, contributing to a culture of sharing knowledge. It has made research papers, books, and other educational materials accessible to a wider audience, including researchers and the general public.

(iv) **Enabling Lifelong Learning:** These platforms have made it easier for individuals of all ages to engage in lifelong learning. Professionals can update their skills, and adults can pursue further education without the need to enroll in traditional courses.

(v) **Complementary to Traditional Education:** These platforms complement traditional education, providing additional resources and support to students. They can serve as supplementary study materials for classroom learning. In Negative impact While these platforms have expanded access to education, challenges related to internet connectivity and device availability in rural and remote areas still persist. Not all students have equal access to these resources.

(vi) **Quality Assurance:** Ensuring the quality of courses and materials across these platforms can be challenging. While prestigious institutions are involved, quality assurance mechanisms need to be continuously strengthened.

(vii) **Impact on Conventional Institutions:** These platforms have the potential to disrupt traditional educational institutions. While they offer access to quality education, they also pose competition to conventional colleges and universities.

(viii) **Government Support and Policy Impact:** The Indian government's support for these initiatives has been instrumental in their growth. Policy initiatives have helped in standardizing and promoting the use of these platforms in the education sector.

6. Government support and policies

Government support and policies have played a pivotal role in shaping the landscape of online education in India. Here are some key aspects of government support and policies in the context of educational platforms like NPTEL, NDL, SWAYAM, and e-PG Pathshala.

(i) **Financial Support and Funding:** The Indian government has allocated significant financial resources to support the development and maintenance of these educational platforms. This funding has enabled the creation of high-quality course content, technology infrastructure, and outreach efforts. [19]

(ii) **Regulatory Framework:** The government has established a regulatory framework to govern the functioning of online education platforms. This framework includes guidelines for certification, accreditation, and quality assurance

(iii) **Digital India Initiative:** Educational platforms align with the government's Digital India initiative, which aims to promote digital literacy and access to digital resources for all [20] These platforms contribute to this goal by providing free and open access to educational content.

(iv) **SWAYAM Prabha:** As part of SWAYAM, the government launched the SWAYAM Prabha initiative, which provides 32 high-quality educational DTH (Direct-To-Home) television channels. [20]This initiative enhances access to educational content, especially in remote areas with limited internet connectivity.

(v) **National Education Policy (NEP) 2020:** The NEP 2020 emphasizes the importance of online and digital education. It envisions the integration of technology in education and supports the development of online resources and platforms. [21]

(vi) **Promotion of Open Educational Resources (OER):** [22] the government encourages the creation and sharing of open educational resources, which align with the principles of platforms like NDL. This promotes transparency, affordability, and accessibility in education. [23]

(vii) **Support for Skill Development:** Government initiatives like Skill India align with the goals of platforms like NPTEL and SWAYAM, which offer courses to enhance skills and employability.

7. Future Prospects and Trends in India's Educational Platforms

(i) **AI and Personalized Learning:** Educational platforms are likely to increasingly incorporate artificial intelligence (AI) to personalize learning experiences. AI algorithms will analyze learner data to recommend courses, adapt content, and provide real-time feedback tailored to individual needs. [24]

(ii) **Online Skill Development for Employment**: Platforms like NPTEL and SWAYAM will continue to offer skill development courses to enhance employability. In response to evolving job market demands, more courses on emerging technologies and soft skills will be introduced. [25]

(iii) **Blended Learning Models:** A hybrid of online and offline learning, known as blended learning, is expected to gain prominence. Institutions may integrate platforms like SWAYAM and e-PG Pathshala into their curriculum, combining traditional teaching with online resources. [26]

(iv) **Digital Credentials and Micro learning:** Micro learning modules will become more popular, allowing learners to acquire specific skills or knowledge in bite-sized formats. Digital badges and micro-certifications will gain recognition as credible credentials for employment and advancement.

(v) **Multilingual Content:** Platforms will diversify their content offerings by providing courses and resources in multiple Indian languages, making education more accessible to non-English-speaking learners.

(vi) **Augmented and Virtual Reality (AR/VR):** AR and VR technologies will be integrated into educational platforms to create immersive learning experiences. This trend will enhance the understanding of complex concepts in science, engineering, and other fields.

(vii) **Data Privacy and Security:** As the use of educational platforms grows, ensuring the privacy and security of user data will be a critical concern. Stricter data protection measures and compliance with data privacy laws will be necessary.

(viii) **Collaborative Learning and Social Integration:** Platforms will facilitate collaborative learning through features like discussion forums, group projects, and peer assessments. Social integration will be encouraged to create a sense of community among online learners.

(ix) **Government Initiatives:** The Indian government will continue to support and fund educational platforms, expanding their reach and impact. Policies related to online education will evolve to address emerging challenges and opportunities.

(x) **Global Outreach:** Educational platforms will extend their reach beyond India, attracting international learners. Collaboration with foreign institutions and the recognition of

Indian certifications globally will increase. [27]

8. The role of NPTEL, NDL, SWAYAM, and e-PG Pathshala in shaping India's educational landscape

- NPTEL, NDL, SWAYAM, and e-PG Pathshala are initiatives that have significantly contributed to shaping India's educational landscape. Each of these programs plays a unique role in providing quality education, promoting digital learning, and enhancing access to educational resources. Here's a brief overview of their roles:
- NPTEL has democratized access to quality education, especially in technical fields, by making courses from top institutions available online for free. It has benefited students, professionals, and educators across the country.
- NDL has played a crucial role in providing a centralized repository of digital educational content, making resources easily accessible to students and researchers. It promotes self-paced learning and helps bridge the gap in resource availability.
- SWAYAM has expanded access to education, reaching learners in remote areas and those who might not have access to traditional educational institutions. It offers a variety of courses, enabling learners to choose based on their interests and career goals.
- e-PG Pathshala contributes to the digitalization of postgraduate education, providing resources for students pursuing higher studies. It enhances the quality of education by offering standardized content and supporting self-directed learning.
- Together, these initiatives have transformed the educational landscape in India by leveraging technology to increase accessibility, affordability, and the overall quality of education across various levels and disciplines. They have played a crucial role in addressing the challenges of traditional education and promoting a culture of continuous learning.

9. Conclusion

The Digital Learning Revolution in India, exemplified by NPTEL, NDL, SWAYAM, and e-PG Pathshala, has transformed the educational landscape. These initiatives prioritize democratization, making quality education accessible across diverse demographics. Leveraging technology for flexibility, these programs offer self-paced learning and a wealth of resources. Collaboration among institutions ensures high-quality content, while technology serves as a key enabler, driving a shift towards tech-driven education. With a specific focus on postgraduate education, these initiatives align with governmental policies, signaling a strategic commitment to the integration of digital learning in India's educational framework. Overall, they signify a transformative and inclusive future for education in the digital age.

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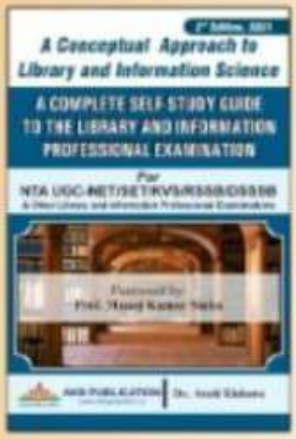

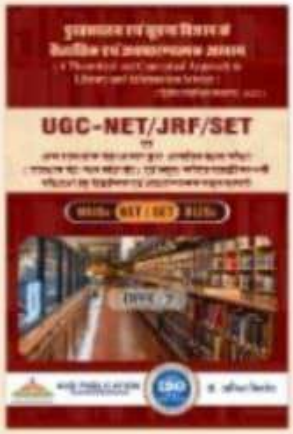

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