
Digital Library Infrastructure in Universities in Karnataka: An Evaluation of Facilities

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Abstract

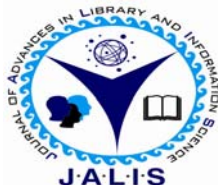
The design and development of digital library needs adequate ICT infrastructure. Since the advent of open-source digital library software, there has been an increased digital library activity in academics, especially in university libraries. So, this study explores and evaluates the digital library infrastructure facilities in university libraries across Karnataka. The study covers 50 state, central, and deemed/private universities. A questionnaire tool was used to collect and analyse the relevant data to understand the current state of digital library resources and infrastructure. This study provides valuable insights for library administrators, policymakers, and researchers in the library and information science field, enhancing educational scope for the digital transformation in the universities in Karnataka.

Keywords

Digital Libraries; Digital Library Infrastructure;
University Libraries; Karnataka

Electronic access

The journal is available at www.jalis.in
DOI: [10.5281/zenodo.14235230](https://doi.org/10.5281/zenodo.14235230)



Journal of Advances in Library and Information Science
ISSN: 2277-2219 Vol. 13. No.4. 2024. pp.171-178

1. Introduction

The rapid advancement of information and communication technologies has profoundly impacted library systems worldwide and changed the academic library scenario, particularly university libraries. There is a rapid digital transformation due to the advent of various data-capturing devices and the availability of free and open-source software for creating digital libraries. One of the key objectives of university education is to create and disseminate new knowledge through its research activity. The universities in India and Karnataka generate substantial knowledge through doctoral theses and supporting research publications. The universities have established a publications wing known as “prasara” which are given the task of converting theses into books, which was encouraged by the University

Grants Commission. But not many theses and research publications get proper documentation which involves costs and manpower. The digital conversion of these publications has provided a solution at the reduced costs. Hence many university libraries have planned for design and development of digital depositories. This requires a suitable infrastructure in terms of ICT, finances, manpower and other fringe facilities. The university libraries in India are engaged in building digital depositories in and so the university libraries in Karnataka. So it was intended to explore the digital library infrastructure of the university libraries in Karnataka and this paper has made an effort to undertake a study in this regard to assess and evaluate the digital library infrastructure in the University libraries in Karnataka.

2. The Digital Library Infrastructure:

The digital library infrastructure covers various components such as digital collections, electronic resources, and ICT facilities. Each of these elements plays a crucial role in creating an efficient, user-friendly, and comprehensive digital library ecosystem. By evaluating these components across different types of universities in Karnataka, this study aims to provide a holistic view of the region's current state of digital library infrastructure. Understanding the existing digital library landscape is crucial for several reasons. Firstly, it allows library administrators and university management to benchmark their facilities against peers and identify areas for improvement. Secondly, it provides valuable insights for policymakers and funding agencies to make informed decisions about resource allocation and development strategies. Lastly,

it contributes to the broader academic discourse on the evolution of libraries in the digital age, particularly in the context of developing countries.

This research is part of a larger thesis titled "Digital Library Infrastructure and Facilities in the University Libraries of Karnataka: An Evaluation Study." The article presents key findings from this comprehensive study, offering a detailed analysis of various aspects of digital library infrastructure across different categories of universities in Karnataka.

3. Literature Review:

Many studies on digital library infrastructure have been produced since the genesis of digital library concept in the 1990s. There have been unprecedented advances in the ICT environment, especially the "Free and Open Source Software", a boon to the ICT-based system developers. Hence few studies in this respect as of academic interest are reviewed and results are highlighted. Choudhary and Sarmah (2017) evaluated the ICT infrastructure in academic institutions and found that financial constraints and lack of skilled manpower impede problems. Kumar and Mahesh (2015) examined the digital library initiatives in academic libraries across Kerala. Their study revealed a growing adoption of digital resources but also identified infrastructure and staff training challenges. Patel and Bhatt (2019) investigated the use of open-source software in academic libraries in Gujarat, finding a preference for such solutions due to cost-effectiveness and customisation possibilities.

Ramesh and Naik (2018) studied the digital library services in select university libraries in Karnataka, state. Their research highlighted the variations in digital resource availability and usage across different types of universities. However, their study was limited to a smaller sample size and covered only part of the spectrum of digital library infrastructure. These studies provide valuable insights, but a gap remains in comprehensive evaluations of digital library infrastructure covering the latest technologies.

4. Study Objectives

The primary objectives of this study are:

- i) To survey the availability and types of printed and electronic resources in university libraries across Karnataka.
- ii) To examine the extent of digital library infrastructure in the study of universities

- iii) To examine, in particular, the hardware and software infrastructure supporting digital library services in these institutions.
- iv) To analyse the variations in digital library infrastructure based on the domain and nature of universities.
- v) To know ICT applications in various library activities and services like the library automation and development of digital libraries.
- vi) To assess and evaluate the digital library infrastructure based on the data compiled in this research study.

5. Methodology

This study employed a quantitative research approach, utilising survey methodology and a questionnaire tool to collect data from 50 universities across Karnataka. Data was collected through structured questionnaires, which covered various aspects of digital library infrastructure, including i) Library Resources, Both print and electronic, and ii) ICT Infrastructure and its application in library automation and digital library development. The collected data was then tabulated and analyzed using descriptive statistics.

6. The Study Area and the Sample:

Karnataka is one of the progressive states in higher education, with a host of state, central, private, and deemed universities that impart quality education. The universities also range from traditional arts and sciences to specialised medicine, agriculture, and technology subjects. As these universities strive to meet the evolving needs of their academic communities, their libraries face the challenge of integrating digital resources and infrastructure while maintaining traditional services. Considering this horizon of higher education in the state of Karnataka, the study has focused on exploring the digital library infrastructure in its select universities, which is an apt topic for research and discussion.

6.1 The Study Sample:

The study covered 50 universities established prior to 2021, with diverse types of Universities. A total of 56 questionnaires were distributed, resulting in 50 responses, with an overall response rate of 89.3%. The response rate was State universities, with 27 responses, 22 from Private/Deemed universities, yielding 22 responses, and 1 from the Central University. The universities were categorised based on two primary criteria: By types and by Domain as below.

| By Type of Universities | By Domains of |
|-------------------------|---------------|
|-------------------------|---------------|

| Universities | |
|--|---|
| i) State Universities (N=27) | i) Arts, Commerce, and Sciences (N=12) |
| ii) Private/Deemed Universities (N=22) | ii) Medical (N=3) |
| iii) Central Universities (N=1) | iii) Agriculture and Horticulture (N=2) |
| | iv) Multiple Domains (N=29) |
| | v) Others (N=4) |

7.1.1 Based on the Type of University

Table 1 presents the availability of printed information resources based on the type of University.

7. Results and Discussion

7.1 Printed Resources

Table 1: Printed Information Resources by Type of Universities

| S. No. | Resource Types | SU (N=27) | P/DU (N=22) | CU (N=1) | Total (N=50) |
|--------|--------------------------|------------|-------------|----------|--------------|
| 1 | Books | 27(100%) | 22(100%) | 1(100%) | 50(100%) |
| 2 | Journals | 25(92.59%) | 22(100%) | 1(100%) | 48(96%) |
| 3 | Back volume of Journals | 24(88.88%) | 20(90.90%) | 1(100%) | 43(86%) |
| 4 | Thesis and Dissertations | 22(81.48%) | 20(90.90%) | 1(100%) | 40(80%) |
| 5 | Conference Proceedings | 7(25.92%) | 8(36.36%) | 0(0%) | 15(30%) |
| 6 | Reports | 8(29.62%) | 10(45.45%) | 0(0%) | 17(34%) |
| 7 | Manuscripts | 1(3.7%) | 1(4.5%) | 0(0%) | 2(4%) |
| 8 | Other | 6(22.22%) | 1(4.5%) | 0(0%) | 7(14%) |

* **SU: State University. P/DU: Private/Deemed University. CU: Central University**

The data shows consistency in the availability of core resources (books, journals, back volumes) across all university types. Private/Deemed universities show slightly higher percentages in most categories compared to State universities, possibly due to more flexible funding structures. The single Central University in the sample shows 100% availability in most categories, though this is not statistically significant due to the sample size.

45.45% respectively) than in state universities (25.92% and 29.62%). This might indicate a greater focus on research outputs, and industry reports in private institutions.

7.1.2 Based on Domains of Universities

Table 2 presents the availability of printed resources across different domain universities.

Conference proceedings and reports are more prevalent in private/deemed universities (36.36% and

Table 2: Printed Information Resources by Domains of Universities

| S.No. | Resource Types | ACS (N=12) | MU (N=3) | AHU (N=2) | MDU (N=29) | OU (N=4) | Total (N=50) |
|-------|--------------------------|------------|-----------|-----------|-------------|----------|--------------|
| 1 | Books | 12(100%) | 3(100%) | 2(100%) | 29(100%) | 4(100%) | 50(100%) |
| 2 | Journals | 11(91.66%) | 3(100%) | 2(100%) | 29(100%) | 3(75%) | 48(96%) |
| 3 | Back volume of Journals | 8(66.67%) | 2(66.67%) | 2(100%) | 27(93.103%) | 4(100%) | 43(86%) |
| 4 | Thesis and Dissertations | 8(66.67%) | 3(100%) | 2(100%) | 25(86.206%) | 2(50%) | 40(80%) |
| 5 | Conference Proceedings | 2(16.67%) | 0(0%) | 0(0%) | 13(44.827%) | 0(0%) | 15(30%) |
| 6 | Reports | 6(50%) | 0(0%) | 0(0%) | 11(37.93%) | 0(0%) | 17(34%) |
| 7 | Manuscripts | 1(8.33%) | 0(0%) | 0(0%) | 1(3.44%) | 0(0%) | 2(4%) |
| 8 | Other | 2(16.67%) | 0(0%) | 0(0%) | 4(13.79%) | 1(25%) | 7(14%) |

* ACS: Arts, Commerce, and Science MU: Medical. AHU: Agriculture and Horticulture. MDU: Multiple Domains. OU: Other Universities

The data reveals that books remain the cornerstone of university libraries across all domains, with 100% availability. Journals are also widely available (96%), with Medical and Agriculture and Horticulture universities at 100%, and the Back volumes of journals are in 86% of universities, with Agriculture and Horticulture and Other universities leading at 100%.

Theses and dissertations are available in 80% of universities, with Medical and Agriculture and Horticulture universities showing 100% availability. Conference proceedings and reports are less common, available in 30% and 34% of universities, respectively, primarily in Arts, Commerce, and

Science universities and Multiple Domains universities.

Manuscripts are the least common printed resource, found in only 4% of universities, primarily in Arts, Commerce, and Science institutions. This low percentage might be due to the specialised nature of manuscripts and the shift towards digital preservation of rare documents.

7.2 Electronic Information Resources

7.2.1 Based on the Nature of University

Table 3 presents the availability of various types of electronic resources by the type of University.

Table 3: Electronic Information Resources by Type of Universities

| S.No. | Resource Types | SU (N=27) | P/DU (N=22) | CU (N=1) | Total (N=50) |
|-------|-----------------------|------------|-------------|----------|--------------|
| 1 | E-Books | 23(85.18%) | 22(100%) | 1(100%) | 46(92%) |
| 2 | E-Journals | 22(81.48%) | 22(100%) | 1(100%) | 45(90%) |
| 3 | CD/DVD Databases | 24(88.88%) | 18(81.81%) | 1(100%) | 43(86%) |
| 4 | Online Databases | 21(77.77%) | 22(100%) | 1(100%) | 44(88%) |
| 5 | Audio/Video materials | 20(74.07%) | 21(95.45%) | 1(100%) | 42(84%) |
| 6 | Other | 1(3.70%) | 1(4.5%) | 0(0%) | 2(4%) |

The data shows a higher adoption rate of electronic resources across all university types, with Private/Deemed universities leading in most categories. E-books and e-journals show 100% availability in Private/Deemed universities, compared to 85.18% and 81.48%, respectively, in State universities. This difference could be attributed to more flexible budgeting processes or a stronger emphasis on digital resources in private institutions. Audio/Video materials show a notable difference between State (74.07%) and Private/Deemed (95.45%) universities. This could indicate a greater focus on multimedia learning resources in private institutions, possibly due to different pedagogical approaches or student expectations.

Online databases are universally available (100%) in Private/Deemed universities, compared to 77.77% in

State universities. This difference might reflect varying research intensities or funding priorities between these institution types. The Central University shows 100% availability across all categories, though this is not statistically significant due to the sample size.

7.2.2 Based on Domains of Universities

Table 4 presents the availability of electronic information resources across different university domains.

Table 4: Electronic Information Resources Based on Domains of Universities

| S.No. | Resource Types | ACS (N=12) | MU (N=3) | AHU (N=2) | MDU (N=29) | OU (N=4) | Total (N=50) |
|-------|-----------------------|------------|-----------|-----------|-------------|----------|--------------|
| 1 | CD/DVD Databases | 11(91.66%) | 2(66.67%) | 2(100%) | 24(82.75%) | 4(100%) | 43(86%) |
| 2 | Audio/Video materials | 9(75%) | 3(100%) | 2(100%) | 26(89.65%) | 2(50%) | 42(84%) |
| 3 | E- Books | 10(83.33%) | 3(100%) | 2(100%) | 28(96.55%) | 3(75%) | 46(92%) |
| 4 | E-Journals | 10(83.33%) | 3(100%) | 2(100%) | 27(93.103%) | 3(75%) | 45(90%) |
| 5 | Online Databases | 10(83.33%) | 3(100%) | 2(100%) | 25(86.206%) | 4(100%) | 44(88%) |
| 6 | Other | 0(0%) | 0(0%) | 0(0%) | 2(6.89%) | 0(0%) | 2(4%) |

The data reveals a high adoption rate of electronic resources across all university domains. E-books lead with 92% availability, followed by e-journals at 90%. Medical and Agriculture Horticulture universities show 100% availability across most electronic resource categories, indicating a strong emphasis on digital resources in these specialised fields. This could be attributed to the rapid pace of research and the need for up-to-date information in these domains.

CD/DVD databases are still prevalent at 86% presence, slightly lower rates than online resources. Audio/video

materials are widely available in 84% of universities, with 100% available in medical, agriculture, and horticulture universities. This highlights the importance of multimedia resources in these fields for instructional purposes or clinical demonstrations.

7.3 HARDWARE INFRASTRUCTURE

7.3.1 Based on By Type of Universities

Table 7 presents the availability of various hardware infrastructures based on by the universities.

Table 5: Hardware Based on by Type of Universities

| S.No | Description | SU (N=27) | P/DU (N=22) | CU (N=1) | Total (N=50) |
|------|------------------------------|------------|-------------|----------|--------------|
| 1 | Server | 23(85.18%) | 20(90.90%) | 1(100%) | 45(90%) |
| 2 | Clients/Computer workstation | 27(100%) | 22(100%) | 1(100%) | 50(100%) |
| 3 | Printer | 26(96.29%) | 22(100%) | 1(100%) | 49(98%) |
| 4 | Barcode printer | 23(85.18%) | 19(86.36%) | 1(100%) | 43(86%) |
| 5 | Barcode reader | 25(92.59%) | 20(90.90%) | 1(100%) | 46(92%) |
| 6 | RFID Scanner/reader | 9(33.33%) | 6(27.27%) | 1(100%) | 16(32%) |
| 7 | Book Scanner | 22(81.48%) | 13(59.09%) | 1(100%) | 36(72%) |
| 8 | KIOSK Desk | 8(29.62%) | 1(4.5%) | 1(100%) | 10(20%) |
| 9 | CD-ROM tower | 1(3.70%) | 1(4.5%) | 0(0%) | 2(4%) |
| 10 | LED projectors | 20(74.07%) | 12(54.54%) | 1(100%) | 33(66%) |
| 11 | UPS | 25(92.59%) | 16(72.72%) | 1(100%) | 42(84%) |
| 12 | CC Cameras | 22(81.48%) | 15(68.18%) | 1(100%) | 38(76%) |
| 13 | Web Cameras | 15(55.5%) | 11(50%) | 1(100%) | 27(54%) |
| 14 | Digital Camera | 3(11.11%) | 6(27.27%) | 0(0%) | 9(18%) |
| 15 | Headphones | 6(59.25%) | 9(40.90%) | 1(100%) | 26(52%) |

The data shows variations in hardware infrastructure between State and Private/Deemed universities. While core IT equipment (servers, workstations, printers) is consistently available across all university types, there are notable differences in specialized equipment. State Universities generally show higher adoption rates for

book scanners (81.48% vs. 59.09%), LED projectors (74.07% vs. 54.54%), UPS systems (92.59% vs. 72.72%), and CC Cameras

(81.48% vs. 68.18%) compared to Private/Deemed Universities. This could indicate a greater emphasis on digitization, multimedia capabilities, and security in

State Universities. KIOSK Desks are more common in State Universities (29.62%) compared to Private/Deemed Universities (4.5%), suggesting a higher focus on self-service options in state institutions.

Private/Deemed Universities show a slightly higher adoption of digital cameras (27.27% vs. 11.11% in State Universities), which might indicate a greater focus on digital content creation in these institutions.

The Central University shows 100% availability for most hardware categories, though this is not statistically significant due to the sample size.

7.3.2 Based on Domains of Universities

The Table 8 presents the availability of hardware infrastructure across different domain universities.

Table 6: Hardware Based on Domains of Universities

| S.No. | Hardware | ACS (N=12) | MU (N=3) | AHU (N=2) | MDU (N=29) | OU (N=4) | Total (N=50) |
|-------|--------------------------------|------------|-----------|-----------|------------|----------|--------------|
| 1 | Server | 11(91.66%) | 3(100%) | 2(100%) | 28(96.55%) | 3(75%) | 45(90%) |
| 2 | Clients/ Computer workstations | 12(100%) | 3(100%) | 2(100%) | 29(100%) | 4(100%) | 50(100%) |
| 3 | Printer | 12(100%) | 3(100%) | 2(100%) | 28(96.55%) | 4(100%) | 49(98%) |
| 4 | Barcode printer | 10(83.33%) | 2(66.67%) | 1(50%) | 27(93.10%) | 3(75%) | 43(86%) |
| 5 | Barcode reader | 10(83.33%) | 3(100%) | 1(50%) | 28(96.55%) | 4(100%) | 46(92%) |
| 6 | RFID Scanner/reader | 4(33.33%) | 1(33.33%) | 1(50%) | 10(34.48%) | 0(0%) | 16(32%) |
| 7 | Book Scanner | 10(83.33%) | 2(66.67%) | 1(50%) | 22(75.86%) | 1(25%) | 36(72%) |
| 8 | KIOSK Desk | 3(25%) | 0(0%) | 1(50%) | 5(17.24%) | 1(25%) | 10(20%) |
| 9 | CD-ROM tower | 1(8.33%) | 0(0%) | 0(0%) | 1(3.44%) | 0(0%) | 2(4%) |
| 10 | LED projectors | 8(66.67%) | 2(66.67%) | 0(0%) | 20(68.96%) | 3(75%) | 33(66%) |
| 11 | UPS | 12(100%) | 3(100%) | 2(100%) | 23(79.31%) | 2(50%) | 42(84%) |
| 12 | CC Cameras | 12(100%) | 3(100%) | 1(50%) | 20(68.96%) | 2(50%) | 38(76%) |
| 13 | Web Cameras | 8 (66.67%) | 1(33.33%) | 0(0%) | 17(58.62%) | 1(25%) | 27(54%) |
| 14 | Digital Camera | 2(16.66%) | 1(33.33%) | 0(0%) | 5(17.24%) | 1(25%) | 9(18%) |
| 15 | Headphones | 7(58.33%) | 2(66.67%) | 1(50%) | 15(51.72%) | 1(25%) | 26(52%) |

The data reveals a comprehensive picture of hardware infrastructure across different university domains. Essential IT equipment such as servers (90%), client/computer workstations (100%), and printers (98%) are nearly universally available. This indicates a strong foundation for digital library services across all university types. Barcode technology is widely adopted, with barcode printers (86%) and readers (92%) available in most universities. However, RFID technology, represented by RFID scanners/readers, is less common (32%), suggesting room for growth in advanced book management systems. Specialized equipment like book scanners (72%) and LED projectors (66%) show moderate adoption rates, indicating a focus on digitization efforts and multimedia capabilities in many libraries.

Security and monitoring equipment, such as CC Cameras (76%) and UPS systems (84%), are prevalent, highlighting the importance of asset protection and uninterrupted service in library operations. Multimedia equipment like web cameras

(54%), digital cameras (18%), and headphones (52%) show varying adoption rates, possibly reflecting different priorities in digital content creation and consumption across university domains.

7.4 SERVER OPERATING SYSTEM

7.4.1 Based on by Type of Universities

The Table 9 presents the availability of various Server Operating System based on by the universities.

Table 7: Availability of Server Operating System

| S. No | Server Operating System | SU (N=27) | P/DU (N=22) | CU (N=1) | Total (N=50) |
|-------|-------------------------|------------|-------------|----------|--------------|
| 1 | Window Server | 16(59.26%) | 15(68.18%) | 1(100%) | 32(64%) |
| 2 | Ubuntu Server | 14(51.85%) | 11(50%) | 1(100%) | 24(48%) |
| 3 | CentOS Server | 1(3.70%) | 3(13.64%) | 0(0%) | 4(8%) |

| | | | | | |
|---|--------------|-----------|-----------|---------|---------|
| 4 | Unix Server | 1(3.70%) | 1(4.55%) | 0(0%) | 2(4%) |
| 5 | Linux Server | 9(33.33%) | 9(40.91%) | 1(100%) | 19(38%) |
| 6 | Fedora | 0(0%) | 3(13.64%) | 0(0%) | 3(6%) |

The Table 9 presents the server operating system by the type of universities under study. The data shows the types of server operating systems in use across different university types. Windows Server is the most used in 59.26% of State universities, 68.18% of Private/Deemed universities, and 100% of the Central university, which overall totals 64%. Ubuntu Server is second in this regard, deployed by 51.85% of the State universities, 50% of Private/Deemed universities, and 100% of the Central universities, making up 48% of the total account. Equally it is also used by 33.33% of State universities, 40.91% of Private/Deemed universities, and the Central university 100%. It accounts for 38% of the total. The least observed versions are CentOS Server, which is observed in 8% of universities, and Unix was reported in 4% of the universities. The least used operating system is Fedora, found in just 6% of universities.

7.4.2 Based on Domains of Universities

The Table 8 presents the availability of Server Operating System across different domains of universities.

Table 8: Server Operating System Based on Domains of Universities

| S. No | Server Operating System | ACS (N=12) | MU (N=3) | AHU (N=2) | MDU (N=29) | OU (N=4) | Total (N=50) |
|-------|-------------------------|------------|-----------|-----------|------------|----------|--------------|
| 1 | Window Server | 9(75%) | 3(100%) | 1(50%) | 8(62.07%) | 2(25%) | 32(64%) |
| 2 | Ubuntu Server | 4(33.33%) | 3(100%) | 2(100%) | 7(58.62%) | 2(50%) | 24(48%) |
| 3 | CentOS Server | 0(0%) | 3(33.33%) | 0(0%) | 3(10.34%) | 0(0%) | 4(8%) |
| 4 | Unix Server | 0(0%) | 0(0%) | 0(0%) | 2(6.90%) | 0(0%) | 2(4%) |
| 5 | Linux Server | 3(25%) | 3(33.33%) | 1(50%) | 2(41.38%) | 2(50%) | 9(38%) |
| 6 | Fedora | 0(0%) | 0(0%) | 0(0%) | 3(10.34%) | 0(0%) | 3(6%) |

In Table 8 the server operating systems used by universities by domains. The Windows Server occupies the largest number in 64% of all universities, having the highest in medical universities and amounting to 100%, and the lowest in other universities with a share of 25%. Ubuntu Server is quite widespread, being used in 48% of universities. It is also highly used in universities of Multiple Domains-58.62% and Agriculture and Horticulture-100%. CentOS Server

appears in 8% of universities, some of them being medical universities (33.33%). The rarest is Unix, at 4% in general, though it appeared in Multiple Domains institutions. 38% of the Universities were using a Linux Server other than Ubuntu, which also dominated in Multiple Domains 41.38%. Fedora is the rarest, with only 6%, and exclusively in the Multiple Domains universities. So, this distribution shows a great preference for Windows and Ubuntu servers throughout the types of universities, using other server operating systems less frequently.

7.5 INTERNET BROWSER

7.5.1 Based on the type of Universities:

The Table 9 presents the availability of various Internet Browsers by the type of universities.

Table 9: Availability of various Internet Browsers

| S. No | Browsers | SU (N=27) | P/DU (N=22) | CU (N=1) | Total (N=50) |
|-------|-------------------|-------------|-------------|----------|--------------|
| 1 | Internet Explorer | 14 (51.85%) | 19 (86.36%) | 0 (0%) | 33(66%) |
| 2 | Google Chrome | 25 (92.59%) | 22(100%) | 1(100%) | 48(96%) |
| 3 | Firefox | 18 (66.67%) | 16(72.72%) | 1(100%) | 35(70%) |
| 4 | UC Browser | 1 (3.70%) | 0 (0%) | 0 (0%) | 1(2%) |
| 5 | Other | 1 (3.70%) | 0 (0%) | 0 (0%) | 1(2%) |

The Table 9 shows the data on use of internet browsers adopted by the universities by their types. The data shows that Google Chrome is the most widely used browser among all types of universities, with 96% overall usage, including 92.59% of State Universities, 100% of Private/Deemed Universities, and 100% by the Central University. Firefox usage is equally good, as it is used by 70% of universities in total, out of which 66.67% by State Universities, 72.72% Private/Deemed Universities, and the Central University. Internet Explorer is still in use by the Private/Deemed Universities with 86.36%, compared to the State Universities, which accounts for only 51.85%, while in Central University, this browser is not used at all. UC Browser and others are very minimally used, where UC appears in only 1 State University and other browsers in 1 State University. This indicates that Google Chrome and Firefox are in large scale usage of Internet Explorer remains in private universities/deemed universities.

7.5.2 Based on Domains of Universities

The Table 10 presents the availability of Internet Browser across different domain universities.

Table 10: Internet Browser used by Domain Universities

| S. No | Browsers | ACS (N=12) | MU (N=3) | AHU (N=2) | MDU (N=29) | OU (N=4) | Total (N=50) |
|-------|-------------------|------------|----------|-----------|-------------|----------|--------------|
| 1 | Internet Explorer | 5 (41.67%) | 3 (100%) | 1(50%) | 22 (75.86%) | 2 (50%) | 33(66%) |
| 2 | Google Chrome | 12(100%) | 3 (100%) | 2(100%) | 27(93.10%) | 4(100%) | 48(96%) |
| 3 | Firefox | 8(66.67%) | 3 (100%) | 2(100%) | 21(72.41%) | 1(25%) | 35(70%) |
| 4 | UC Browser | 0 (0%) | 0 (0%) | 0 (0%) | 0 (0%) | 1(25%) | 1(2%) |
| 5 | Other | 1(8.33%) | 0 (0%) | 0 (0%) | 0 (0%) | 0 (0%) | 1(2%) |

Table 12 presents the type of internet browsers used by domain universities. The above data shows that the majority of Universities prefer Google Chrome, and is almost identical among all types: Arts, Commerce, and Science Universities (100%), Medical Universities (100%), Agriculture and Horticulture Universities (100%), and Multiple Domains Universities (93.10%). Thus, it is obvious that it is the most widely used browser overall, at 96%. Firefox also enjoys significant usage, especially in Medical and Agriculture and Horticulture Universities, and has a 70% overall usage amongst universities. Notably, Internet Explorer performs well in Medical with 100% and Multi-Domain Universities with 75.86%, though still less when compared to Chrome and Firefox. The rest of the browsers are little used to show their limited adoption and support. The above clearly depicts the dominance of Google Chrome and Firefox in university environments when Internet Explorer has managed persistence, although at a declining rate.

8. Conclusion

A near-comprehensive study on the digital library infrastructure of Karnataka's universities reveals a complex and evolving scenario. The strong adoption of core digital resources, such as e-books and e-journals, across all university types indicates a successful transition towards digital content delivery. However, there are notable variations in the availability of specialized resources like conference proceedings, reports, and manuscripts, particularly in specialized universities, suggesting a need for targeted digitization efforts.

There are disparities in hardware and software infrastructure, such as in the adoption of technologies like RFID systems and multimedia equipment, present challenges to the range and quality of digital services offered by different universities. Domain-specific variations are also evident, with medical and agriculture universities showing higher adoption rates

for certain resources and hardware, which is likely driven by the specific needs of these disciplines.

Advanced technologies like RFID systems could enhance library operations and improve user experiences. Moreover, collaboration between public and private institutions could help address disparities in digital infrastructure and resource availability. Future research should explore how variations in digital infrastructure affect student and faculty satisfaction, research output, and overall academic performance. Overall, while Karnataka's university libraries have made significant strides in digital transformation, there is still room for improvement and standardisation across institutions. Addressing the identified gaps and building on existing strengths will allow these libraries to continue their development as essential hubs of digital knowledge in the 21st-century academic landscape.

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