

Challenges to the implementation of information and communication technologies (ICTs) in university libraries in Bangladesh

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Abstract

Purpose: The study discovers the present conditions of using ICT by the university libraries in Bangladesh. This study also finds the challenges for applying ICT in Bangladesh's public and private university libraries.

Methodology: The study is based on one structured questionnaire from ten selected university librarians.

Findings: The study demonstrates how to improve these libraries' entire condition and services by adopting modern technology. This investigation reveals the state of these libraries, including the problems they encountered in applying information technology, and puts forward necessary recommendations.

Originality/value: This study focuses on the challenges of implementing ICT in university libraries in Bangladesh. It will prompt further research on ICT-based library services in academic libraries globally.

Keywords: ICT-based library services, academic libraries, implementation of ICT, Bangladesh.

1. Introduction

Information and communication technology (ICT) advancements have given libraries more opportunities to enhance their services. Information is a crucial factor in every research and development endeavor. Over the past twenty years, ICT has been utilized by all university libraries for their daily operations. It is necessary to ascertain how ICT affects sustainability. In today's digital age, ICTs have entirely changed how people access, store, disseminate, and share information in the modern digital age. This

transformation is especially noticeable in academic settings, as university libraries are essential for granting access to various information sources (Hussaini, Haruna, and Muhammad, 2021).

University libraries in Bangladesh are not an exception, working hard to incorporate ICTs into their daily operations to fulfil the changing demands of both faculty and students. However, there are a lot of obstacles in the way of this endeavour, making it difficult for ICTs to be implemented successfully in university libraries nationwide (Islam, Agarwal, and Ikeda, 2015). ICT integration in university libraries in Bangladesh is necessary for improving access to information resources and enhancing the quality of education and research. Several formidable challenges hinder this process, requiring a multifaceted strategy involving government support and strategic planning (Ahmed, 2014). The paper aimed to examine the study on "Challenges for Implementation of ICTs in University Libraries in Bangladesh" in light of these circumstances. This work is limited to library personnel's attitudes and various services at university libraries in Bangladesh. Knowing the respondents' changing attitudes towards ICT-based information is essential in the present age. In this context, the study is very effective and fruitful for creating an ICT-based society.

2. Literature review

This section discusses the previous literature on the concept of university Libraries in Bangladesh and the influencing factors of ICT. Islam and Islam (2007) mention that although Bangladesh started implementing ICT in 1964, library automation was still in its early stages. The survey focused on nine libraries and information centers based all over Bangladesh, determining the extent of the use of ICT. They also highlighted some of the factors contributing to Bangladesh's growing ICT needs, such as the country's growing user base, rising library material demands, an increase in the volume of content published, the emergence of new electronic formats and sources, and the development of more affordable and new computers. Teaching, learning, research, and community engagement are all improving at an increasingly noticeable rate in academic libraries. In their paper, Krubu and Osawaru (2011) showed ICT resources and the use of the resources available at university libraries, such as search engines, the internet, CD-ROM, Online databases, and the World Wide Web. Information is gathered, processed, stored, retrieved, and distributed using these resources. ICT has made it possible for academic libraries to access online digital resources like Wikipedia and Amazon as well as search engines like Yahoo and Google and e-mail. Furthermore, according to Oketunji (2004), the Internet and other ICTs offer libraries a fantastic opportunity to receive value-added services. Learning is facilitated by the indexing, abstracting, publishing, and digitalization of local research.

In his PhD research, Nasiruddin (2011) observed that the public libraries of Bangladesh can play a vital role for library users. He informed that many public libraries have been established throughout the country over the years. Bangladesh's future trend of library development will undoubtedly focus on using new technologies. The application of integrated library software packages developed within or outside the country will increase substantially. The author recommended that the government allocate sufficient funds to support purchasing and maintaining automation technologies for public libraries. Ebrahim (2009) demonstrated that the growth of IT and ICT has profoundly influenced higher education. Students can use the internet to further their scientific education and research objectives. LIS can preserve and improve its identity by applying IT and ICT and can educate libraries that can prove their benefit to society by being in step with changes and advances in technology, economy, community, and culture. Technology and moral issues, affordability, technological imperialism, socialization and humanization of technology, appropriateness, and acceptability are some of the problems that Alam (2009) identified as being associated with ICT-based education. ICT-based education opportunities may only benefit some learners in countries with different socio-economic, political, and cultural environments. In this regard, Agava & Underwood (2020) try to assess the ICT proficiency of library and information science (LIS) professionals working, and according to the study's findings, the majority of librarians have outstanding ICT proficiency in fundamental ICT and some Web technologies but lack technical ICT skills. The research suggests that workshops, seminars, and conferences be held regularly to provide librarians with ICT-related training. Additionally, academic curricula in LIS institutions should include more real-world ICT-related topics. Librarians should utilize ICT training opportunities that are freely accessible online for their professional development, and library staff members should be encouraged to pursue an interest in learning ICT skills personally.

Kumar and Biradar (2010) investigated the use of ICT in college libraries of India by examining the ICT infrastructure, the current state of library automation, barriers to implementation of library automation, and librarians' attitudes towards the use of ICT. The research focused on the fact that the application of ICT in Indian college libraries has not progressed to a very high level. The primary barriers to automating library tasks are more funding, human resources, skilled personnel, and training. Despite the positive attitudes that librarians have demonstrated toward using ICT applications and library automation, they still require extensive and suitable training to use ICT tools. Ahmad and Sheikh (2021) primarily focus on the availability, accessibility, and usability of ICT tools as they look into how ICT affects students' learning. The study will focus on the contribution of ICT to students' pedagogical activities, particularly their learning. The results show that University of the Punjab students can access various ICT tools and applications. The availability, usability, and accessibility of ICT tools and students' academic learning are strongly positively correlated. This research demonstrates how

important technology is to students' academic success. Students can use it to look for, find, and consult various information sources. It also enables them to finish their academic assignments quickly. In his paper, Pastula (2010) demonstrated that ICT is now essential to improving library services globally. The research study looked at Massey University's, New Zealand use of technology to close the gap between traditional library services and distance learning students. Numerous software providers, formats, and implementation techniques were available regarding educational technology. The review identified a knowledge deficit in obstacles to ICT deployment in Bangladeshi university libraries. As a result, research was created to close the gap.

3. Research objective and research questions

The main objective of this study is to explore the existing ICT scenario in public university libraries in Bangladesh. The research was directed by the following research questions (RQs).

RQ#1 What types of ICT-based services and facilities are provided by academic libraries in Bangladesh?

RQ#2 What kinds of problems arise when ICT-based resources and services are provided to library users?

4. Methodology

The study was conducted using quantitative research techniques from May to August 2023 to meet the research objective and questions. The primary data was collected using two different data collection techniques. An open-ended and close-ended questionnaire was designed on issues related to the research objective and research questions. Some

Table 1: Selected university for the study

| SL. No. | Name of the University | Established |
|---------------------------|--|-------------|
| Public University | | |
| 1 | University of Dhaka (DU) | 1921 |
| 2 | Bangladesh University of Engineering and Technology (BUET) | 1962 |
| 3 | Jagannath University (JNU) | 2005 |
| 4 | Bangabandhu Sheikh Mujib Medical University (BSMMU) | 1965 |
| 5 | National University (NU) | 1992 |
| Private University | | |
| 1 | North South University (NSU) | 1992 |
| 2 | East West University (EWU) | 1996 |
| 3 | Independent University, Bangladesh (IUB) | 1993 |
| 4 | BRAC University (BRACU) | 2001 |
| 5 | Daffodil International University (DIU) | 2002 |

informal interviews or conversations with librarians have also been considered to get additional information and in-depth views on the research topic. The study was conducted through a convenient sampling method of some selected public and private university libraries. For this study, the researcher selected ten university libraries, including five public and five leading private university libraries. The researcher sent one set of questionnaires to the selected five public and five private university librarians to get information; ten questionnaires were useable. Librarian's questionnaire's response rate is 100%.

5. Data analysis and findings

The findings of the study are illustrated below:

5.1 Library staff

The distribution of library staff is noted in Table 2.

Table 2: Information about library staff

| SL No. | Name of the library | Category of library staff | | | | | Total staff |
|--------|---------------------|---|-----------------------------|----------------|------------------|--------|-------------|
| | | ICT and library software base knowledge | Computer science background | LIS background | Non professional | Others | |
| 1 | DUL | 6 | 14 | 87 | 22 | 98 | 227 |
| 2 | BUETL | 4 | 8 | 10 | 14 | 8 | 44 |
| 3 | JNUL | 2 | 2 | 5 | 4 | 6 | 19 |
| 4 | BSMMUL | 2 | 3 | 10 | 18 | 10 | 43 |
| 5 | NUL | 1 | 2 | 9 | 2 | 5 | 19 |
| 6 | NSUL | 6 | 4 | 11 | 3 | 3 | 27 |
| 7 | EWUL | 3 | 3 | 10 | 3 | 5 | 22 |
| 8 | IUBL | 1 | 1 | 5 | 4 | 4 | 15 |
| 9 | AAL | 3 | 2 | 9 | 0 | 3 | 17 |
| 10 | DIUL | 4 | 2 | 9 | 4 | 6 | 25 |

Table 2 shows the total library staff of ten public and private university libraries. Out of 227 staffs only 6 staffs have ICT and library software base knowledge in DUL, only 4

staffs (out of 44) in BUETL, 2 staffs (out of 19) in JNUL, 2 staffs (out of 43) in BSMMUL, 1 staff (out of 17) in NUL, 6 staffs (out of 27) in NSUL, 3 staffs (out of 22) in EWUL, 1 staff (out of 15) in IUBL, 3 staffs (out of 17) in AAL and 4 staffs (out of 25) in DIUL.

5.2 Information about library resources

The distribution of the ten university library resources is noted in Table 3. Table 3 shows the selected public and private university library resources.

Table 3: Information about library resources

| S/L | Name of the library | Books | Reference books | Monographs | Journals (Published by institution) | Journals (Published by others) | E-Books | E-Journals | CDs/ DVDs | Maps |
|-----|---------------------|--------|-----------------|------------|-------------------------------------|--------------------------------|---------|------------|-----------|------|
| 1 | DUL | 475000 | 95000 | 3200 | 34 | 2200 | 90000 | 45000 | 452 | 155 |
| 2 | BUETL | 112066 | 17847 | 1400 | 27 | 1880 | 70000 | 31000 | 300 | 25 |
| 3 | JNUL | 95000 | 1500 | 800 | 4 | 575 | 24000 | 25000 | - | 5 |
| 4 | BSMMUL | 26907 | 8500 | 1900 | 13 | 5308 | 85000 | 27000 | - | 17 |
| 5 | NUL | 38744 | 1200 | 700 | 2 | 500 | 13000 | 1200 | - | 9 |
| 6 | NSUL | 55000 | 105000 | 500 | 4 | 6474 | 98000 | 58000 | 600 | 10 |
| 7 | EWUL | 29000 | 800 | 2300 | 2 | 500 | 110000 | 45000 | 2400 | 6 |
| 8 | IUBL | 27000 | 8000 | 250 | 10 | 2200 | 6000 | 700 | - | 10 |
| 9 | AAL | 40000 | 7000 | 18318 | 6 | 8000 | 76840 | 58046 | - | 15 |
| 10 | DIUL | 22575 | 2725 | 8779 | 5 | 2000 | 15000 | 3500 | 2800 | 6 |

5.3 ICT introduced year and library automation type information

Years of introducing ICT-based services and automation types and using automated software-related information are noted in Table 4. Table 4 shows that almost all university libraries have separate library websites and are hosted by the institution except Jagannath and National University libraries. Practically all university libraries have a particular website and are hosted by the institution except Jagannath and National University libraries.

Table 4: Year of introduced ICT base services

| Name of the library | Introduced ICT base services year | Automation type | Using automated software | Separate library website | Hosted website |
|---------------------|-----------------------------------|---------------------|--------------------------|--------------------------|--------------------------|
| DUL | 1996 | Fully Automated | Open source | Yes | Owned by the institution |
| BUETL | 1968 | Fully Automated | In house developed | Yes | Owned by the institution |
| JNUL | 2005 | Partially Automated | Commercial software | No | - |
| BSMMUL | 1982 | Fully Automated | Open source | Yes | Owned by the institution |
| NUL | 1995 | Automated Soon | - | No | - |
| NSUL | 1998 | Fully Automated | In house developed | Yes | Owned by the institution |
| EWUL | 1996 | Fully Automated | Open source | Yes | Owned by the institution |
| IUBL | 1994 | Fully Automated | Open source | Yes | Owned by the institution |
| AAL | 2001 | Fully Automated | Open source | Yes | Owned by the institution |
| DIUL | 2002 | Fully Automated | Open source | Yes | Owned by the institution |

5.4 Available information/services

Available Information/Services on the library website are shown in Table 5. Table 5 shows which information/services are available on the library website. It shows that all kinds of information/services are available in the libraries except guided tour services.

Table 5: Information/services available on the library website

| SL No. | Name of the library | About the library | Library rules and regulation | Library collection | Access the library OPAC | Links to institution memberships | Links to other libraries | Guided tour |
|--------|---------------------|-------------------|------------------------------|--------------------|-------------------------|----------------------------------|--------------------------|-------------|
| 1 | DUL | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| 2 | BUETL | Yes | Yes | Yes | Yes | Yes | Yes | No |
| 3 | JNUL | Yes | Yes | Yes | No | No | No | No |
| 4 | BSMMU | Yes | Yes | Yes | Yes | Yes | Yes | No |
| 5 | NUL | Yes | No | No | Yes | No | No | No |
| 6 | NSUL | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| 7 | EWUL | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| 8 | IUBL | Yes | Yes | Yes | Yes | Yes | No | No |
| 9 | AAL | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| 10 | DIUL | Yes | Yes | Yes | Yes | Yes | Yes | No |

5.5 ICT based equipment facilities

Available ICT-based equipment facilities in the university libraries are demonstrated in Table 6.

Table 6: ICT based equipment facilities in the university libraries

| SL No | Name of the library | Computer server | Computer | Net server | Scanner | Barcode scanner | Barcode printer | LCD projector | Security system | CCTV camera |
|-------|---------------------|-----------------|----------|------------|---------|-----------------|-----------------|---------------|-----------------|-------------|
| 1 | DUL | 7 | 143 | 2 | 9 | 4 | 5 | 1 | 6 | 27 |
| 2 | BUETL | 2 | 69 | 3 | 4 | 2 | 1 | 2 | 4 | 0 |
| 3 | JNUL | 0 | 17 | 1 | 1 | 0 | 0 | 0 | 0 | 0 |
| 4 | BSMMUL | 1 | 77 | 2 | 3 | 2 | 1 | 1 | 4 | 12 |
| 5 | NUL | 0 | 7 | 0 | 1 | 0 | 0 | 1 | 0 | 0 |
| 6 | NSUL | 4 | 20 | 2 | 7 | 5 | 1 | 1 | 2 | 30 |
| 7 | EWUL | 1 | 41 | 1 | 2 | 3 | 2 | 1 | 0 | 15 |
| 8 | IUBL | 1 | 11 | 1 | 2 | 4 | 0 | 1 | 0 | 8 |
| 9 | AAL | 1 | 40 | 2 | 2 | 4 | 2 | 1 | 2 | 14 |
| 10 | DIUL | 3 | 20 | 1 | 2 | 1 | 0 | 1 | 0 | 20 |

Table 6 shows the number of ICT-based hardware equipment facilities in the selected public and private university libraries.

5.6 ICT operational facilities

Available ICT operational facilities in the university libraries are demonstrated in Table 7. Table 7 shows the ICT operational facilities in the university libraries. All university libraries provide OPAC service, but JNU and NUL provide OPAC service on a test basis. Almost all universities have ICT-based facilities except JUL and NUL.

Table 7: ICT operational facilities in the university libraries

| SL No. | Name of the library | Web OPAC | Automated circulation | Online SDI service | Online reservation | Institutional repository | OJS | Plagiarism checker | RFID |
|--------|---------------------|----------------------|-----------------------|----------------------|----------------------|--------------------------|----------------------|----------------------|----------------------|
| 1 | DUL | Available | Available | Available | Not Available | Available | Available | Available | Available |
| 2 | BUETL | Available | Available | Not available | Available | Available | Not available | Available | Available |
| 3 | JNUL | Not available | Not available | Not available | Not Available | Not available | Not available | Not available | Not available |
| 4 | BSMMUL | Available | Available | Available | Available | Available | Available | Not available | Available |
| 5 | NUL | Not available | Not available | Not available | Not Available | Not available | Not available | Not available | Not available |
| 6 | NSUL | Not Available | Available | Available | Available | Available | Available | Available | Available |
| 7 | EWUL | Available | Available | Available | Available | Available | Available | Available | Available |
| 8 | IUBL | Available | Available | Available | Available | Not available | Available | Available | Available |
| 9 | AAL | Available | Available | Available | Available | Available | Available | Available | Available |
| 10 | DIUL | Available | Available | Not Available | Available | Available | Not available | Not available | Available |

5.7 Digital library services

E-resource consortium and separate digital library services provided by the university libraries are shown in Table 8 and Table 9.

Table 8: E-resource consortium and separate digital library services

| SL No. | Name of the library | E-Resource consortium | Name of E-Resource consortium | Separate digital library |
|--------|---------------------|-----------------------|-------------------------------|--------------------------|
| 1 | DUL | Yes | BIPC & UDL | Yes |
| 2 | BUETL | Yes | BIPC & UDL | Yes |
| 3 | JNUL | Yes | BIPC & UDL | No |
| 4 | BSMMUL | Yes | BIPC & UDL | Yes |
| 5 | NUL | Yes | BIPC | No |
| 6 | NSUL | Yes | BIPC & UDL | Yes |
| 7 | EWUL | Yes | BIPC & UDL | Yes |
| 8 | IUBL | Yes | BIPC & UDL | Yes |
| 9 | AAL | Yes | BIPC & UDL | Yes |
| 10 | DIUL | Yes | BIPC & UDL | Yes |

Table 8 shows that all public and private university libraries are e-resource consortium members, and all public and private university libraries have separate digital libraries except JNU and NU libraries.

Table 9: Separate digital library services provided by the university libraries

| SL No. | Name of the library | E-database | E-journals | E-books | Discussion group | Online news | Publicat. database |
|--------|---------------------|------------|------------|---------|------------------|-------------|--------------------|
| 1 | DUL | Yes | Yes | Yes | Yes | No | Yes |
| 2 | BUETL | Yes | Yes | No | No | Yes | Yes |
| 3 | JNUL | No | No | No | No | No | No |
| 4 | BSMMUL | Yes | Yes | Yes | No | Yes | No |
| 5 | NUL | No | No | No | No | No | No |
| 6 | NSUL | Yes | Yes | Yes | Yes | No | Yes |
| 7 | EWUL | Yes | Yes | Yes | Yes | Yes | Yes |
| 8 | IUBL | Yes | Yes | Yes | No | Yes | No |
| 9 | AAL | Yes | Yes | Yes | Yes | Yes | No |
| 10 | DIUL | Yes | Yes | Yes | Yes | Yes | No |

Table 9 shows which kind of digital library services are provided or not provided by the sample public and private university libraries.

5.8 Problems of librarians towards the use of ICT in the university library

In the last portion of the questionnaire for the librarian, the librarians were asked to identify the constructing strategies for identifying indicators and problems towards the use and application of ICT-based resources. Below, Table 10 the mean value, Standard Deviation and Variance, and consequence level for the thirty attributes using a five-point Likert Scale.

Table 10 is arranged to identify the library professionals' constraints towards using ICTs in university libraries. The table demonstrates that "Lack of digital library initiatives," "Lack of trained library staff for ICT activities," "Lack of proper preservation systems," and "Lack of staff skills in using the ICT" are the highest mean values these comprised jointly being 1st rank with equal a mean score of 4.90, std. deviation .316 and variance .100.

Similarly, "Lack of interest on the part of the readers" is the 2nd indicator with a mean score of 4.80, std. deviation .422 and variance .178. "Lack of concern of university management," "Lack of budget," "Lack of high-speed data network connectivity," and "Lack of online database learning and using capacity" are jointly 3rd rank with the same score of mean 4.70, std. deviation .483 and variance .233. "Lack of training to make staff efficient" and "Lack of access to other library catalogs" are jointly 4th rank indicated by the same score of mean 4.60, std. deviation .516 and variance .267.

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Table 10: Problems of librarians towards the use of ICT in the university library

(N=10)

| SL No. | Problems | Minimum | Maximum | Mean | Std. deviation | Variance |
|--------|---|---------|---------|------|----------------|----------|
| 1 | Lack of digital library initiatives | 4 | 5 | 4.90 | .316 | .100 |
| 2 | Lack of trained library staff for ICT activities | 4 | 5 | 4.90 | .316 | .100 |
| 3 | Lack of proper preservation systems | 4 | 5 | 4.90 | .316 | .100 |
| 4 | Lack of staff skills in using the ICT | 4 | 5 | 4.90 | .316 | .100 |
| 5 | Lack of interest on the part of the readers | 4 | 5 | 4.80 | .422 | .178 |
| 6 | Lack of concern of university management | 4 | 5 | 4.70 | .483 | .233 |
| 7 | Lack of budget | 4 | 5 | 4.70 | .483 | .233 |
| 8 | Lack of high-speed data network connectivity | 4 | 5 | 4.70 | .483 | .233 |
| 9 | Lack of online database learning and using capacity | 4 | 5 | 3.70 | .483 | .233 |
| 10 | Lack of training to make staff efficient | 4 | 5 | 4.60 | .516 | .267 |
| 11 | Lack of access to other library catalogs | 4 | 5 | 4.60 | .516 | .267 |
| 12 | Lack of local vendor support | 3 | 5 | 4.50 | .707 | .500 |
| 13 | Lack of adequate staff to help users | 3 | 5 | 4.50 | .707 | .500 |
| 14 | Lack of appropriate linkages from an item to the full text of a document on the network | 3 | 5 | 4.50 | .707 | .500 |
| 15 | Lack of security | 4 | 5 | 4.50 | .707 | .278 |
| 16 | Lack of sufficient ICT applications | 3 | 5 | 4.50 | .707 | .500 |
| 17 | Lack of uniform software for automated function | 3 | 5 | 4.50 | .850 | .722 |
| 18 | Lack of uniform standards in database creation | 3 | 5 | 4.40 | .843 | .711 |
| 19 | Lack of proper online OPAC access to library users | 3 | 5 | 4.40 | .699 | .489 |
| 20 | Lack of proper document delivery service | 3 | 5 | 4.40 | .699 | .489 |
| 21 | Lack of funds to subscribe to digital resources | 3 | 5 | 4.30 | .823 | .678 |
| 22 | Lack of digitization of unique materials for sharing and improving access | 3 | 5 | 4.20 | .789 | .622 |
| 23 | Lack of access to database through campus network | 3 | 5 | 4.20 | .789 | .622 |
| 24 | Lack of campus networking required for connecting all the departments to the library | 3 | 5 | 4.20 | .789 | .622 |
| 25 | Lack of Training of end users in the use of ICT tools | 2 | 5 | 4.10 | .994 | .989 |
| 26 | Lack of access to learned journals in digital form | 3 | 5 | 4.10 | .568 | .322 |
| 27 | Lack of integrated library software | 2 | 5 | 4.00 | .943 | .889 |
| 28 | Lack of government concentration | 1 | 5 | 4.00 | 1.247 | 1.556 |
| 29 | Lack of participation in national and regional cooperative efforts for sharing resources& expertise | 2 | 5 | 3.80 | .919 | .844 |
| 30 | Lack of electric bulletin board service | 2 | 5 | 3.60 | .966 | .933 |

[Weight: Strongly agree =5, Agree =4, Neutral =3, Disagree =2, Strongly disagree (Here 4.90 highest & 3.60 lowest score)]

“Lack of local vendor support”; “Lack of adequate staff to help users”; “Lack of appropriate linkages from item to a full text of a document on the network”; “Lack of security”; “Lack of sufficient ICT applications” and “Lack of uniform software for automated function” with a mean value of 4.50, std. deviation .707 and .850 and variance .500, .278 and .722 belong to rank number 5th.

“Lack of uniform standards database creation,”; "Lack of proper online OPAC access to library users," and "Lack of proper document delivery service” are jointly 6th rank indicated by the same score of mean 4.40, std. deviation .843 and .699 and variance .711 and .489 respectively.

"Lack of funds to subscribe digital resources" and "Lack of digitization of unique materials for sharing and improving access”; “Lack of access database through campus network”; “Lack of campus networking required for connecting all the department to library” with mean value 4.30 and 4.20, std. deviation .823 and .789 and variance .678 and .622 belong to rank number 7th and 8th respectively.

"Lack of Training of end users in the use of ICT tools,"; "Lack of access to learned journals in digital form," and "Lack of integrated library software," "Lack of government concentration" ranked 9th and 10th respectively, with a mean score of 4.10 and 4.00, std. deviation .994, .568 and .943, 1.247 and variance .989, .322 and .889, 1.556.

The last two ranks, "Lack of participation in national and regional cooperative efforts for sharing resources& expertise" and "Lack of electric bulletin board service," with a mean value of 3.80 and 3.60 and their std. deviation .919 and .966 and variance .844 and .933 belong to rank 11th and 12th respectively.

6. Major research finding

The two research questions were explored for the current study, which produced a diverse range of findings. These findings are connected to ICT awareness, librarians' perceptions of their role in implementing ICTs in libraries, and libraries' preparedness for the limits they found.

RQ#1 The study aimed to investigate the use and application of ICT resources and services in the university libraries of Bangladesh. The study shows that university libraries in Bangladesh, especially public university libraries, need to do better regarding ICT-based resources, uses, and services, , . Librarians and library authorities think they cannot provide proper modern library services without the help of ICT. Table 8 shows that most libraries do not offer individual digital library services. Some private university libraries provide separate digital library services. JNUL and NUL do not offer any digital library services with their platform. The study exposed that most respondents are experienced. The users frequently use ICT-based resources and applications in the

library, which helps them stay informed and ahead. Respondents use the Online Public Access Catalogue (OPAC), Web OPAC, institutional repository system, online journal system, web proxy server system, surfing the internet to look up information, e-mail, electronic communication, etc. Most private university libraries have almost all kinds of facilities, but some public university libraries do not have all types of facilities. DUL, JNU, and NUL do not provide online reservation services.

RQ#2 The study shows that all public and private university libraries are e-resource consortium members, and all public and private university libraries have separate digital libraries except JNU and NU libraries. However, inadequate knowledge of ICT competence, low motivation, and lack of confidence in using new technologies are barriers to providing proper ICT-based library services. A few librarians stated that sometimes ICT cannot run properly due to a lack of proper installation or original software. They indicate that university authorities prefer to refrain from spending money for installation appropriately and pursue original software. The study also identifies that users use ICT-based resources and services for many purposes. Almost all university libraries have a separate library website and are hosted by the institution except Jagannath and National University libraries. Table 5 shows that all kinds of information/services are available in the libraries except guided tour services. Table 6 shows the number of ICT-based hardware resource facilities in the selected public and private university libraries where DUL has the most significant number out of 803, N=244 ICT base resources available in the university library. In contrast, NUL has the smallest number of facilities, with only N=13. The remaining sample university BUETL has N=94, JNUL has N=22, BSMMUL has N=112, NSUL has N=80, EWUL has N=71, IUBL has N=31, AAUL has N=75 and DIUL has N=51 and the total number of ICT based hardware resources facilities to run service properly in their university libraries. Table 7 shows that all selected university libraries have their OPAC facilities. Still, some university libraries do not have an online SDI, Institutional Repository, Online Journal System, or online reference query service. Librarians were asked to identify the constructing strategies for identifying indicators and problems for using and applying ICT-based resources. The result shows that to determine the constructing methods for identifying indicators and issues towards the using and applying ICT-based resources with a mean score of 4.90 and std. deviation .316 rather than "digital library initiatives", "trained library staff for ICT activities", "proper preservation systems", and "staff skills in using the ICT". The librarians mentioned some of the common problems they encountered as inadequate modern ICT base resource facilities and resources, for example, online data and different kinds of servers, proper ICT operational facilities, library software knowledge, and computer science background and competent staff, proper e-resources consortium, lack of digital library initiatives, lack of proper preservation system and information retrieval tools, lack of budget, lack of staff's skills in using ICT, lack of proper training of users and negligence of the university authority are notable the barriers to provide ICT base resources and services to the library.

7. Problems

Some significant complexities are felt by the library staff and users when they use ICT-based resources and services in libraries, particularly university libraries in Bangladesh. The problems found in the study are mentioned below:

- Lack of digital library initiatives: Nowadays, digital media is used for all activities worldwide, and libraries are no exception. There are many digital library initiatives at an international level, but in developing countries like Bangladesh, they are still in a primary stage. Digitization programs have begun in various public and private university libraries in Bangladesh.
- Shortage of trained library staff for ICT activities: The study found that lacking ICT equipment and training skills is the main problem in providing better library services. Most of the library staff working in the libraries have yet to gain a professional degree. The personnel working in these university libraries need to gain adequate knowledge regarding the use of ICT.
- Poor knowledge of using ICT tools: User training is one of the most essential factors in providing better library services. The quality of library services depends on the users' demand and the range of user's expectations of library services. The study also established that most library users need proper knowledge about ICT tools, which is a big problem in providing better library services in Bangladesh.
- Negligence of university authority: This study established that negligence of higher authority is one of the significant problems in providing proper ICT-based services in university libraries. Lack of adequate plans to improve modern technology-based services and negative attitudes toward providing continuous logistic support are also problems for library systems and services.
- Inadequate budget: The government-run public universities provide funds, and private universities are run by their own funds. In a developing country like Bangladesh, lack of funds is the main barrier to conducting any development project. The study found that more than the library budget is needed to purchase books, ICT equipment, and others.
- Lack of high-speed data network connectivity to access: The internet connection and speed of data network connectivity are the most essential ingredients to operate ICT equipment in a library. This study exposed that many libraries have computer technologies, but the internet connection speed could be more satisfactory, and some libraries have an internet connection but need more computer technologies.

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- Insufficient ICT applications: Sufficient ICT applications are essential for promoting the use of digital resources for library users. ICT application facilities like computers, printers, broadband internet connections, computer labs, projectors, digital screens, information retrieval tools, computer servers, etc., and infrastructural facilities are not available in some of the university libraries in Bangladesh.
- Software for automated function: The lack of integrated library software is one of the most essential substances for better ICT-based services in the university libraries of Bangladesh. A suitable software package is necessary for any university library, but the availability of such software could be better.
- Lack of government concentration: Administrators, policy-makers, and government bodies such as the Ministry of Education and the UGC of Bangladesh must know the importance of using ICTs at the university level.

8. Recommendations

Based on the experience gained from the problems mentioned above, the following recommendations are made for better ICT-based services in the university libraries of Bangladesh:

- Set up digital library initiatives: Digital library initiatives in Bangladesh are still in a nascent stage of development. So, librarians and library authorities should take effective initiatives to upgrade and digitize library resources using appropriate ICT. Each public and private university should establish its digital repository system to preserve its publications, scholarly resources, journals, etc.
- Appoint skilled human resources: Expert IT and professional personnel are critical to providing better library services. Experienced personnel should be employed in the university libraries of Bangladesh. Recruiting trained and skilled library professionals to opt in to handle library automation, institutional repositories, and other ICT-based resources is also essential.
- Training for end users: ICT training modules should be integrated into all university libraries and training programs for the users about the use and applications of ICT tools and techniques regularly.
- Initiative of university authority: University authorities should take initiatives to implement proper ICT-based services and to improve modern technology-based services. They must show a positive attitude toward providing ICT-based logistic support to develop library systems and services.

- Allocation of Sufficient budget: Here, government bodies like the Education Ministry and UGC have yet to intend to allot a sufficient budget for the university library. Funding must be allocated to provide the best ICT-based services in the libraries. The present study revealed that most university libraries need specific funds for IT purposes.
- High-speed data network connectivity: A high-speed internet connection with various related equipment is essential for better library services. University authorities should set up high-speed data and network connectivity and more computers and other technologies so users can access information and library resources quickly.
- Improve sufficient ICT applications: ICT infrastructural improvement is another area that must be considered in terms of increasing the number of computers and printers and improving internet connectivity. In this regard, university authorities should focus more on establishing sufficient ICT facilities and applications in the library.
- Standardized software for automated function: Uniform software for automated functions is essential for university libraries to provide better ICT-based services. Software development companies should try to develop library software packages for libraries and formulate the available ready-made software for university libraries to solve local needs.
- Government support: The government should take steps for establishing a platform for the ICT and digital library services sector under the UGC of Bangladesh. Expert faculty members, secretaries from the ICT ministry, Ministry of Education, and Cultural Affairs Ministry who have a high level of knowledge and awareness of ICT may accomplish the issues.

9. Conclusion and implication

ICTs changed the pattern and nature of library services in many ways. The society is transforming with the passing of each day, and we have found that ICT has affected almost every sector of our lives and changed people's thinking, interaction, etc. Computers and information technologies are now necessary for operating libraries and information centres. ICT departments have evolved and incorporated the information and library professions in the modern era. A well-equipped library with modern infrastructures, IT, and ICT technologies could satisfy the most significant demands of the present cognizant users. This study highlighted the current scenario of using and applying ICTs in public and private universities in Bangladesh. Based on the findings, it was concluded that the nation's public universities lacked the necessary IT infrastructure,

human resources, and electronic resource access to provide appropriate IT-based information services.

10. Future research scope

A notable research gap in the current body of work on this topic is the scant attention paid to library users' qualitative experiences and viewpoints, including students, faculty, and researchers. Understanding the end-users perspectives on the challenges and advantages of ICT implementation can provide a more holistic view of the topic. Even though ICTs are becoming increasingly crucial in Bangladeshi university libraries, there is a noticeable gap in research that addresses the intricacies of these issues and their potential solutions. Additionally, research should also focus on exploring the impact of ICT implementation on educational and research outcomes, which can help guide future initiatives in this crucial area. Further research should be conducted on –

- User Perceptions of ICT-Based Library Services in the Universities of Bangladesh
- User Satisfaction of ICT-Based Library Services in Bangladeshi Universities
- Usages and Applications of ICT in University Libraries of Bangladesh
- Impact of ICTs on University Libraries of Bangladesh.

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