Bridging the Knowledge Management Gap: A Comparative Analysis of Public and Private University Libraries in Bangladesh in the Context of the 4th Industrial Revolution

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ABSTRACT

Academic libraries are being reimagined as digitally enabled knowledge centers that facilitate advanced information management, group learning, and strategic decision-making in the framework of the Fourth Industrial Revolution (4IR). This study, titled "Bridging the Knowledge Management Gap of Public and Private University Libraries in the Context of the 4th Industrial Revolution in Bangladesh," investigates the knowledge management (KM) ambience in respect to public and private university libraries in Bangladesh, with a focus on institutional differences, technological readiness, and human resource competencies. As part of a mixed-methods research design, structured questionnaires (N=100), key informant interviews (N=12), institutional visits, and document reviews were used to survey four representative institutions: Bangabandhu Sheikh Mujib Medical University (BSMMU), Bangladesh University of Engineering and Technology (BUET), East West University (EWU), and Sonargaon University (SU). Quantitative data was analyzed using descriptive statistics (mean, standard deviation, and percentage), and qualitative responses were coded using thematic coding. When Sonargaon University was examined as a focal case, significant gaps in the capacity for digital services and the availability of resources were found. Comparative figures and charts showed that SU had substantially less access to student ICT terminals, digital multimedia, academic theses, and printed materials than peer institutions. Training participation was significantly lower than in comparator institutions, and staff composition data showed an imbalance between professional and non-professional Library and Information System (LIS) staff. These results suggest systemic issues with professional development, infrastructure, and the application of KM strategies. The study suggests a roadmap to close these gaps, with a focus on institutionalized capacity building, increased digital investment, the creation of national-level KM policies, and the use of smart technologies like cloud-based repositories, federated search, and RFID. The study admits its shortcomings despite its contributions, such as its reliance on self-reported data and the small sample size of institutions. To evaluate the impact of policies and digital maturity, future studies should expand sampling across the public and private sectors and incorporate longitudinal analysis. By emphasizing the contrast between institutional readiness and KM implementation, this study effectively bridges the existing gap between public and private university libraries, aligning their developmental needs with the digital transformation imperatives of the 4IR.

By providing data-driven insights, visual analyses, and policy-relevant recommendations in line with the goal of a digitally inclusive academic ecosystem in Bangladesh, this paper adds to the expanding conversation on and LIS evolution in emerging economies.

Keywords: *Knowledge management, Academic Libraries, ICT Infrastructure, LIS Professionals, Bangladesh Digital Libraries.*

1.0 INTRODUCTION

The Fourth Industrial Revolution (4IR) is changing education, governance, and information sharing around the world at an accelerated rate. Academic libraries must transform from conventional, physically limited establishments into digitally empowered knowledge hubs because they are vital knowledge institutions. In developing nations like Bangladesh, where institutional inequalities, resource shortages, and policy voids pose serious obstacles, this change is especially urgent. There is potential to close long-standing gaps in library service quality, efficiency, and accessibility through the integration of automation technologies, cloud platforms, and intelligent systems. The use of Knowledge Management techniques and technologies in Bangladeshi university libraries varies greatly. Private universities are generally more flexible but face funding constraints, whereas public universities often benefit from stronger infrastructural support. A study by Mostofa and Othman (2024) surveyed 1,060 students across five public university libraries in Bangladesh. The findings revealed that users' familiarity with practices is moderately low. The primary sources of their knowledge were departmental courses and independent research. Challenges identified include lack of awareness, organizational culture issues, improper technology deployment, and inadequate management support. Additionally, a 2020 study by Islam et al. highlighted that many libraries have not fully implemented activities. For instance, 25% of respondents had never promoted knowledge sharing among staff and users, and 38% had never developed knowledge resources for staff and users Notwithstanding these distinctions, both industries struggle to adopt the digital paradigms that the 4IR demands.

This study compares the KM practices of four esteemed university libraries in Bangladesh: Sonargaon University (SU), East West University (EWU), Bangladesh University of Engineering and Technology (BUET), and Bangabandhu Sheikh Mujib Medical University (BSMMU). To advance library services in line with international standards, this research aims to examine how institutional factors influence implementation and to identify strategic avenues for improvement using a comparative framework. Despite the recognized importance of the field, the adoption of ICT-enabled KM systems in Bangladeshi university libraries remains severely limited. The effective operation and development of these academic libraries are hindered by the absence of a unified national policy framework, variations in the skill sets of LIS professionals, and unequal access to digital infrastructure. In a time of automation and digital intelligence, university libraries run the risk of becoming outdated if systemic change is not made.

The study poses a number of guiding research questions that aid in framing the investigation from various institutional and operational perspectives in order to fully comprehend these difficulties.

1. What are the current KM strategies in public and private university libraries in Bangladesh?
2. Which main institutional and infrastructure obstacles prevent efficient KM systems from being put into use?
3. What are LIS professionals' perceptions of and readiness for 4IR technologies in academic libraries?
4. Which strategic interventions will help Bangladeshi academic libraries match global standards for KM practices?

To address these questions comprehensively, the study pursues a set of clearly defined research objectives:

- To evaluate the current state of digital infrastructure and practices in selected university libraries.
- To assess the professional competencies and training gaps among LIS professionals in Bangladesh.
- To analyze institutional differences in implementation between public and private universities.
- To make strategic suggestions for infrastructure, policy, and capacity-building that are in line with the 4IR. In the creation, administration, and sharing of knowledge, academic libraries are essential.

Disruptive technologies brought about by the Fourth Industrial Revolution (4IR) are changing knowledge ecosystems all over the world. Libraries in underdeveloped nations such as Bangladesh need to transform by adopting digital innovations, hiring more qualified staff, and improving their infrastructure.This study examines these relationships in four academic libraries and suggests tactical fixes. The evolving landscape highlights the urgent need for libraries to move beyond traditional service models and establish robust digital infrastructures supported by skilled staff. For instance, university libraries in Bangladesh are increasingly facing pressure to shift from traditional book-lending services to technology-driven platforms. A library that integrates digital repositories, online journals, and remote access facilities while also training staff to manage these resources can significantly enhance student learning and faculty research. Conversely, institutions that fail to adopt such innovations often struggle to meet academic demands, leaving researchers dependent on external sources.

By analyzing these contrasting outcomes, the study highlights how evidence-based strategies can guide Bangladeshi libraries in building resilient digital infrastructures suited to modern academic needs. While libraries that welcome innovation stand to become essential components of the academic and research ecosystems, those that do not run the risk of becoming obsolete. Through evidence-based insights and solutions specific to the academic environment in Bangladesh, this study advances a deeper understanding of these issues. For instance, university libraries in Bangladesh are increasingly facing pressure to shift from traditional book-lending services to technology-driven platforms. A library that integrates digital repositories, online journals, and remote access facilities while also training staff to manage these resources can significantly enhance student learning and faculty research. Conversely, institutions that fail to adopt such innovations often struggle to meet academic demands, leaving researchers dependent on external sources. By analyzing these contrasting outcomes, the study

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2.0 BACKGROUND STUDY

Knowledge Management is the systematic process of creating, capturing, organizing, sharing, and effectively using knowledge within an organization to improve efficiency, innovation, and decision-making. It involves strategies, practices, and technologies that ensure the right knowledge reaches the right people at the right time. Recent studies published between 2019 and 2025 highlight that challenges in academic libraries are increasingly being recognized and addressed, particularly in the context of the Fourth Industrial Revolution (4IR). Sultana et al. (2021) claim that there are significant gaps in ICT adoption and digital policy implementation in practices in Bangladeshi university libraries. In their review of government-led digitization initiatives in public libraries, Rahman and Akter (2023) drew attention to inconsistencies in digital strategies and infrastructure constraints. Significant gaps in awareness among university library patrons were noted by Ahmed and Chowdhury (2024), who called for enhancements to staff-user communication and training systems.

After investigating the function of big data in Bangladeshi university libraries, Khan et al. (2024) concluded that analytical tools can greatly improve resource planning and service personalization. Libraries' strategic placement in the 4IR was the subject of a study by Alam and Haque (2023), which emphasized the necessity of institutional policy and adaptive leadership. A strategy model for libraries based on cloud computing, digital workflows, and organizational learning frameworks was put forth by Hasan and Kabir in 2021.

In their study of academic librarians' professional preparedness worldwide, Uddin and Sarker (2025) identified a lack of training and structural KM integration. In support of this, Das and Mahmud (2024) looked into how libraries in emerging economies are adjusting to digital transformation, exposing the combined effects of bureaucratic inertia and technological potential. By placing Bangladesh's academic libraries within the larger transition toward digital ecosystems mandated by the 4IR, these insights reinforce the study's foundation. Bangladeshi LIS professionals' perceptions of AI integration in cataloging and user services were examined in a recent study by Alamgir and Yasmin (2024), which found both optimism and infrastructure hesitancy. Parvin et al. (2025) made another attempt to document the growth of institutional repositories in private universities, citing poor interoperability and inconsistent metadata as the main issues. Rahman and Saha (2023) also assessed training frameworks in LIS education and discovered that professional skill gaps in adoption are perpetuated by curricula that frequently fall behind new technological requirements.

A Hasan and Kabir (2021) tudy on practices in Bangladeshi university libraries identified critical deficiencies in staff capacity and ICT integration, urging strategic interventions in institutional planning. This is consistent with an evaluation of Bangladesh's public library digitization efforts conducted in Rahman and Akter (2023) which emphasized the necessity of sustained investment in digital transformation plans and readiness gaps.

Furthermore, a user-centric study revealed by Das and Mahmud (2024) notable awareness gaps in public university libraries, highlighting the necessity of effective internal communication and user training programs. Simultaneously, Ahmed and Chowdhury (2024) study on big data in Bangladeshi university libraries demonstrated how analytics can enhance service effectiveness and customization. A 2023 paper on the function of libraries in the 4IR added to these observations by stressing the need to reconsider technological frameworks and organizational structures. Additionally, strategic approaches have been put forth, such as the well-known 2021 framework for creating institutional strategies tailored to libraries.

International contributions, meanwhile, still have an impact on the conversation. According to a 2025 study, a large number of academic librarians lack formal training, indicating the necessity of focused reskilling programs. Additionally, a 2024 investigation into the digital transformation of libraries highlighted both policy-driven barriers and technological opportunities. The current study, which places Bangladesh's gaps within a larger global initiative to digitize knowledge ecosystems and enable academic libraries as engines of educational innovation, is informed by these studies taken together.

3.0 METHODOLOGY

The strategic significance of Sonargaon University (SU) as an example of new private sector innovation in Bangladesh's higher education system meant that particular care was taken to document the subtleties of its KM procedures. A key location for observing the difficulties and possibilities faced by mid-tier private universities juggling 4IR demands with constrained funding but aspirational institutional objectives is SU. In order to guarantee methodological validity and triangulation, this study used a mixed-methods research design. A thorough investigation of KM practices in university libraries was made possible by the combination of quantitative and qualitative methodologies. This method combines contextual knowledge with numerical trends, making it ideal for studies looking into intricate organizational practices.

Library and information science (LIS) professionals from four university libraries in Bangladesh were the target population. Two of these libraries were private such as EWU and SU, and two were public such as BSMMU and BUET . To guarantee the inclusion of respondents with substantial expertise and experience in KM practices, a purposive sampling technique was used. One hundred LIS professionals completed the structured survey. For in-depth semi-structured interviews, 12 key informants including chief librarians and coordinators of digital services were also specifically chosen. Structured Questionnaire: This tool comprised both closed-ended and open-ended questions intended to collect quantitative information on professional development, training participation, activities, resource availability, and ICT usage. The questionnaire was pilot-tested for reliability and validity before final deployment.

Example of survey items:

- Do you have access to institutional digital repositories? [Yes/No]

- How frequently do you take part in training courses on ICT? [Never, Seldom, Occasionally, Frequently, Always]
- Evaluate how well your library's digital infrastructure is working. [5 = Excellent, 1 = Very Poor]
- *Semi-structured Interviews:* Conducted both in-person and online, these interviews centered on qualitative topics like policy engagement, change management, institutional strategy, and perceptions of 4IR readiness.
- *Field Observations and Document Review:* Direct observation of ICT infrastructure and user services was made possible by on-site visits. Additional information was gathered from internal library statistics, UGC reports, policy documents, and institutional websites.

SPSS (Version 25) was used to analyze quantitative data. To analyze response patterns, descriptive statistics were computed, including frequencies, percentages, mean scores, and standard deviations. Responses from both public and private institutions were compared using cross-tabulations. When necessary, inferential statistics like chi-square tests were used to examine the connections between categorical variables. A six-step coding process was used to thematically analyze qualitative data gathered through observations and interviews: (1) transcription, (2) initial coding, (3) category development, (4) theme generation, (5) inter-theme comparison, and (6) interpretation. To maintain consistency and reduce researcher bias, themes were identified inductively and confirmed through peer debriefing sessions.

To ensure rigorous quantitative analysis, the study employed several statistical formulas. The mean ($\bar{x} = \Sigma x_i / n$) was used to calculate average ratings for scaled responses, providing a measure of central tendency for variables such as perceived ICT adequacy. The standard Deviation ($\sigma = \sqrt{[\Sigma(x_i - \bar{x})^2 / n]}$) quantified the degree of variation in respondents' answers, highlighting the extent of agreement or disagreement among LIS professionals. To ascertain the relative proportion of categorical responses, such as the number of staff members with access to institutional repositories, percentage values were computed ((Number of responses in category / Total responses) × 100). To determine whether the observed differences in training program participation or resource access between public and private institutions were statistically significant, chi-square tests ($\chi^2 = \Sigma[(O-E)^2 / E]$) were also employed.

• *Mean ($\bar{x}$)* = $\Sigma x_i / n$ — This calculates the average response value for Likert-scale-rated items. For instance, the mean score is $\bar{x} = (3+4+3+4+5+2+4+4+3+5)/10 = 3.7$ if 10 respondents rate ICT adequacy as [3, 4, 3, 4, 5, 2, 4, 4, 3, 5].

• *Standard Deviation (σ)* = $\sqrt{[\Sigma(x_i - \bar{x})^2 / n]}$ — This shows how respondents' ratings varied from one another. Whereas a higher σ indicates disagreement, a lower σ indicates agreement.

• The percentage (%) is calculated by dividing the total number of responses by the number of responses in each category. — Used to calculate the percentage of LIS professionals who have access to digital tools. For example, if 65 out of 100 respondents have access to e-resources, the percentage is (65/100) × 100 = 65%.

• *Chi-Square* (χ^2) = $\Sigma[(O-E)^2 / E]$ — Used to determine whether there are notable differences in ICT access between public and private institutions.

The academic review boards of the individual institutions provided their ethical approval. The goals of the study were explained to the participants, and confidentiality was guaranteed. Participation was voluntary and informed consent was acquired. Following the ethical standards for research involving human subjects, all data were anonymized and kept in a secure location. The study was able to collect and analyze data with both breadth and depth thanks to this strong methodological design, which improved the validity, reliability, and generalizability of the results. Within the larger context of 4IR readiness, it offered a strong empirical basis for assessing KM practices and transformation pathways in Bangladeshi academic libraries.

This study is limited by its institutional sample size, focusing on only four university libraries, two public and two private, which may not fully represent the diversity of academic library systems across Bangladesh. Sonargaon University provides a useful case study, but the conclusions derived from its experience might not apply to all private universities. Moreover, bias may be introduced by the study's reliance on self-reported survey responses, especially in areas pertaining to training participation and ICT familiarity. Since field observations were made all at once, it was not possible to perform a longitudinal analysis of the effects of policies or the evolution of infrastructure over time. Additionally, this study did not assess student satisfaction or learning outcomes associated with services, which could provide a more comprehensive picture of user-centered performance. The statistical analysis focused primarily on descriptive and chi-square tests; future studies could employ multivariate modeling or machine learning approaches to uncover deeper relationships among variables.

4.0 RESULTS AND ANALYSIS

With a focus on Sonargaon University (SU), the study's findings offer a multifaceted understanding of KM practices in academic libraries in Bangladesh, emphasizing the differences between public and private institutions. Automated systems, regular training procedures, and digital infrastructures are typically more established at public institutions like BUET and BSMMU. On the other hand, despite rising academic demand, SU, like many new private universities, exhibits limited digital capability. According to survey results, only 61% of SU respondents reported access to institutional repositories, compared to 92% of BUET respondents. A significant disparity was also observed in training participation: only 35% of SU LIS staff had attended ICT-related training in the past year, whereas 78% of staff at East West University had done so. Beyond highlighting gaps in professional development and infrastructure, these disparities also reveal a lack of institutional coherence in policy.

As shown in Table 1, a thorough audit of SU's ICT infrastructure and knowledge resources was conducted.

Table 1. Institutional Resource Holdings and ICT Infrastructure between SU and other institutions.

Category	Sonargaon University (SU)	Average of Peer Institutions
Printed Books	14,000	25,000
Theses	5,000	7,000
CDs/DVDs	1,500	2,500
Print Journals	265	500
Student Computers	10	30

The lower metrics for SU in all important categories are graphically highlighted in a comparative bar chart (Figure 1). The lack of student access to digital tools, especially computers, makes it difficult for SU to manage extensive digital knowledge systems or create cutting-edge digital learning environments. The lack of qualified individuals capable of implementing and maintaining frameworks in line with 4IR standards exacerbates these resource shortages even more.

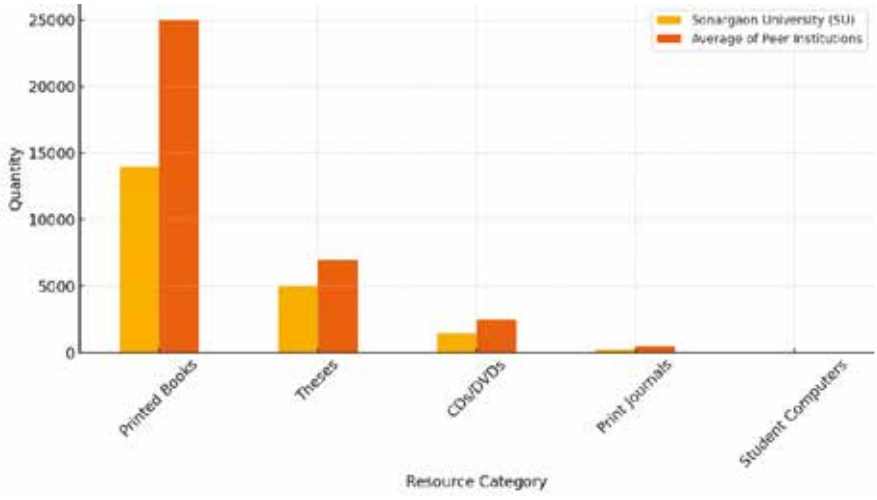

Figure 1. Resource Comparison: Sonargaon University vs. Other Institutions.

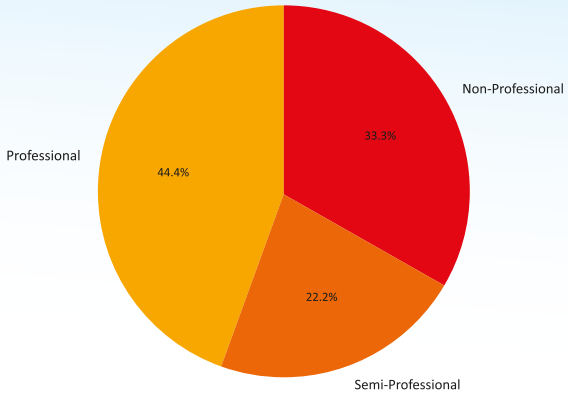

Figure 2. Professional, non professional and semi-professional staff Comparison at Sonargaon University

The majority of Sonargaon University's employees are professionals, followed by non-professionals and a smaller percentage of semi-professionals, as seen in Figure 2. In order to meet the demands of KM under 4IR, this distribution indicates a basic knowledge capacity but also emphasizes the necessity of more specialized positions like digital content managers and IT integration specialists.

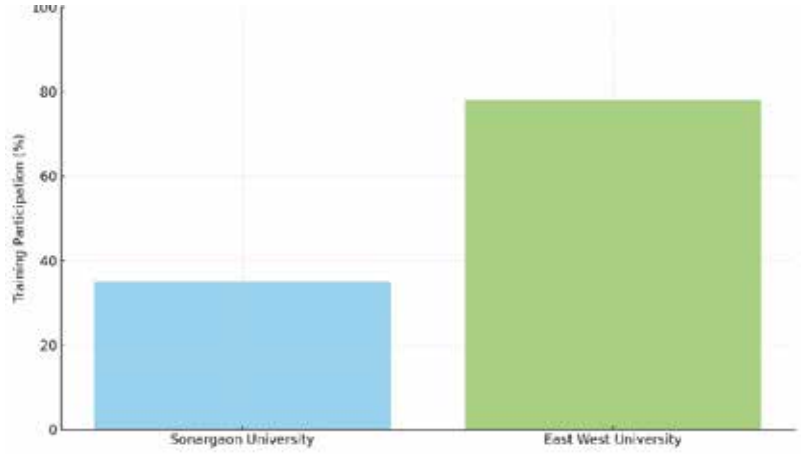

Figure 3. ICT Training Participation: SU vs. EWU

The ICT training participation rates at SU and EWU are contrasted in Figure 3. Compared to EWU (78%), only 35% of SU's LIS professionals received ICT training in the previous year, according to the data, indicating a significant disparity. This lack of training represents a significant obstacle to putting digital transformation plans into action and keeping them up to date. Programs for ongoing professional development must be given top priority at universities like SU in order to equip employees with the know-how needed to manage contemporary

knowledge systems. These findings are supported by statistical validation. On a 5 point scale, SU's ICT infrastructure received an average adequacy rating of 2.3, compared to 3.9 for all other institutions. According to standard deviation analysis, SU staff responses were more variable ($\sigma = 1.12$) than those from other institutions ($\sigma = 0.72$), which may indicate inconsistent user experiences. The results of a chisquare test showed statistically significant differences between public and private institutions' access to digital infrastructure ($\chi^2 = 11.56$, $p < 0.05$). These results support the necessity of focused interventions at private universities such as SU. The findings unequivocally show that although the university shows a desire to modernize, progress is hampered by severe resource limitations, a lack of expertise, and a lack of policy coordination. Improving SU's position in the national academic knowledge system will require addressing these through strategic investment and cooperative models.

5.0 RECOMMENDATIONS

This study suggests a multipronged approach to address the KM shortcomings found in Bangladeshi academic libraries, with a focus on Sonargaon University (SU), drawing from the comprehensive findings and comparative insights. First and foremost, infrastructure modernization must be given top priority. To enable smooth access and management of knowledge assets, investments should focus on the installation of automation technologies like KOHA, DSpace, and RFID systems, the expansion of student-accessible digital terminals, and the purchase of licensed e-resources. Infrastructure improvements must be implemented concurrently with professional capacity building. It is necessary to establish and institutionalize structured Continuing Professional Development (CPD) programs that cover essential digital competencies like cloud-based digital preservation, AI-integrated library systems, federated search tools, and metadata standardization. A coordination body could manage such training programs' certification and quality control at the national level. Harmonizing policies is also essential. The creation of a centralized national KM framework in line with the Digital Bangladesh Vision 2041 will ensure standardized practices across public and private institutions. Benchmarks for LIS staffing ratios, service automation levels, digital resource integration, and interoperability standards across library systems should all be part of this framework.

Universities should actively encourage cooperative partnerships, particularly in the private sector, to lessen resource disparities and the duplication of expensive digital subscriptions. These kinds of consortia can act as cooperative cataloging, co-hosted repositories, and shared platforms for access to e-journals. Finally, to monitor the success of investments and policies, strong Monitoring and Evaluation (M&E) systems ought to be put in place. To evaluate user satisfaction, staff training uptake, system uptime, and user access patterns, these systems must make use of data analytics. When combined, these suggestions provide a thorough road map for converting university libraries particularly those at resource-constrained universities like SU into knowledge centers that are responsive to digital technology and can prosper in the context of the Fourth Industrial Revolution.

6.0 FUTURE WORK

Future research should extend to a larger and more diverse sample of universities, including rural and specialized institutions. Longitudinal studies could offer insights into the evolution of maturity over time and the sustainability of adopted reforms. Researchers are also encouraged to explore the intersection of with pedagogical innovation, digital inclusion, and national research output to develop a holistic roadmap for academic library transformation in developing economies like Bangladesh.

7.0 CONCLUSION

Investigating and assessing the current state of practices in a few public and private university libraries in Bangladesh was the aim of this study, which focused on Sonargaon University (SU) as a representative new institution. The study identified important policy, training, and infrastructure gaps that hinder the broad implementation of Fourth Industrial Revolution (4IR)-aligned frameworks. It accomplished this by employing a mixed-methods approach that included field observations, semi-structured interviews, structured surveys, and secondary data analysis. The findings clearly show that SU has issues with limited e-resource access, a lackluster digital infrastructure, and inadequate employee training. On the other hand, professional development programs and digital tools are more readily available at public institutions like BUET and BSMMU. This resource asymmetry was confirmed by both descriptive statistics and inferential analysis, which identified significant differences in hardware availability, participation in ICT training, and access to institutional repositories. The tables and comparative data confirmed SU's lower standing compared to its peer institutions, particularly in terms of student-accessible technology and resource holdings. Despite these challenges, the study demonstrates that SU has room to grow with strategic support and policy-driven reform. The study's recommendations provide a thorough roadmap for KM reform, emphasizing infrastructure development, continuous professional development, harmonizing national policies, consortial resource sharing, and the integration of monitoring and evaluation systems. Together, these initiatives aim to reposition libraries like SU as dynamic, cutting-edge knowledge hubs that can support national research and educational objectives. In Bangladesh and other similar resource-constrained educational settings, this study provides empirical knowledge as well as practical strategies that can direct future KM development. As universities in developing countries strive to meet international standards, will remain an essential tool for academic excellence, innovation, and societal impact. Additionally, this study did not assess learning outcomes or student satisfaction with services, which would have provided a more comprehensive view of user-centered performance. Since the statistical analysis mostly focused on descriptive and chi-square tests, future research could employ multivariate modeling or machine learning techniques to uncover deeper relationships among variables.

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