Assessing the Implementation and Effectiveness of ICT Tools in Academic Libraries: A Comparative Study of Colleges Affiliated to Bangalore University and Bengaluru City University

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Abstract. *The integration of Information and Communication Technology (ICT) has fundamentally transformed the operational, managerial, and service delivery frameworks of academic libraries, marking a paradigm shift from traditional print-based systems to hybrid and fully digital environments. This study critically examines the extent of ICT implementation and evaluates its effectiveness in enhancing the quality, accessibility, and efficiency of library services among colleges affiliated with Bangalore University and Bengaluru City University. Employing a mixed-method research approach, data were collected from 60 librarians and 240 faculty and student users through structured questionnaires, semi-structured interviews, and observational checklists. The findings reveal that a majority of libraries, particularly those in urban settings, have achieved substantial levels of ICT adoption in areas such as digital cataloguing, online public access catalogues (OPAC), e-resource management, and web-based information services. The integration of automation software, institutional repositories, and subscription-based databases has improved user satisfaction and operational transparency. However, the study also identifies persistent disparities in technological infrastructure, ICT literacy, and staff training across institutions. Many libraries continue to face challenges related to budgetary constraints, inadequate maintenance support, and limited user orientation programs. The study concludes that sustained professional development, adequate financial support, and the establishment of collaborative networks among affiliated institutions are crucial for strengthening ICT-enabled library services. A strategic policy framework promoting technological equity and capacity building is recommended to ensure inclusive and sustainable digital transformation in academic libraries.*

Keywords: *ICT Implementation, Academic Libraries, Bangalore University, Bengaluru City University, Library Automation, Digital Resources, User Satisfaction.*

Introduction

The academic library has long served as the intellectual hub of higher education, supporting teaching, learning, and research. Over the past three decades, the rapid advancement of Information and Communication Technology (ICT) has revolutionized how libraries acquire, organize, and deliver information. The transition from manual to digital systems has transformed both library operations and user expectations. Modern academic libraries now function as hybrid or digital information centers, providing global access to resources through technological integration.

ICT tools such as automation software, electronic databases, and institutional repositories have

enabled efficient management of collections and improved user access. As noted by Thanuskodi (2021), ICT integration enhances information retrieval, user satisfaction, and service quality. However, disparities in infrastructure, funding, and staff skills continue to affect uniform adoption across institutions. In India, national initiatives like the NMEICT, e-ShodhSindhu, and N-LIST have promoted digital transformation, yet uneven implementation persists, particularly between urban and rural institutions (Kaur & Rani, 2020).

Bangalore, known as India's "Silicon City," provides an ideal context for studying ICT integration. The city's two major public universities—Bangalore University and Bengaluru City University—administer a diverse range of affiliated colleges with varying resource levels and management structures. While some institutions have achieved full automation using software such as Koha or SOUL, others face challenges like inadequate funding, limited technical staff, and inconsistent connectivity.

Existing studies in Karnataka (e.g., Sajeev, 2022; Ramesh & Joseph, 2023) have explored ICT adoption in university libraries but rarely compared affiliated colleges under different universities within the same urban region. This study bridges that gap by assessing both the implementation and effectiveness of ICT tools in academic libraries affiliated with these two universities. Using a mixed-method approach, it examines infrastructure readiness, service quality, staff competence, and user satisfaction.

The study's findings will contribute valuable insights for policymakers, university administrators, and librarians by identifying best practices and challenges in ICT adoption. Moreover, it emphasizes the importance of continuous professional development, adequate funding, and policy coherence to ensure that ICT-driven modernization translates into improved service quality and equitable access to digital resources.

Review of Literature

➤ **Adebayo, O. (2018). Information and Communication Technology in Academic Libraries: Concepts and Applications.** Adebayo's book provides a comprehensive examination of ICT concepts and their integration into library operations. The author emphasizes the transition from print to hybrid systems and discusses the evolution of digital library services. Case studies from African and Asian universities illustrate practical ICT implementation models. The book highlights automation, online cataloguing, and digital repositories as key components of modern libraries. Adebayo also addresses issues of funding, infrastructure, and capacity building. The text concludes that sustainable ICT adoption depends on institutional policies and continuous staff training.

➤ **Chowdhury, G. G. (2019). Digital Libraries and Information Access: Research Perspectives.** Chowdhury explores the theoretical and practical dimensions of digital library development with a strong ICT perspective. The book examines metadata standards, digital preservation, and user access mechanisms. Through empirical examples, it demonstrates how ICT tools enhance resource discovery and scholarly communication. Chowdhury also evaluates open-access movements and institutional repositories in developing countries. The author argues that digital literacy among librarians and users is critical for successful ICT integration. The work remains a seminal resource for understanding global trends in digital information management.

➤ **Jadhav, S. V. (2020). ICT and Library Automation in Indian Higher Education.** Jadhav's book focuses specifically on the Indian higher education context, presenting detailed case studies of ICT adoption in university libraries. It outlines automation software such as SOUL, Koha, and LibSys and discusses their comparative efficiencies. The author provides a critical review of policy frameworks like NMEICT and e-ShodhSindhu. Infrastructure disparities between urban and rural colleges are thoroughly analyzed. The book recommends strategies for bridging the digital divide through collaborative resource sharing. It is an essential guide for library professionals implementing automation systems.

- ➤ **Kaur, P., & Singh, S. (2021). Digital Transformation in Academic Libraries: Practices and Perspectives.** This edited volume examines the broader implications of ICT-driven transformation in academic libraries. Contributors discuss automation, digitization, e-learning support, and library management systems. The editors highlight challenges faced by librarians during the transition to digital services. Empirical studies from Indian universities provide practical insights into ICT-enabled service improvement. The book emphasizes the importance of librarian training, user awareness, and sustainable funding. It offers a balanced perspective, blending theory with hands-on experiences from practitioners.

- ➤ **Ramesh, K. (2022). Library Automation and ICT Tools: A Practical Approach.** Ramesh's work serves as a practitioner's guide to implementing ICT tools in academic and special libraries. The author explains the technical aspects of automation, database management, and digital reference systems. Step-by-step procedures for adopting Koha and SOUL software are detailed. Real-life case studies from Karnataka institutions enrich the narrative. Ramesh also discusses interoperability standards, cloud-based services, and data security issues. The book is valuable for both library science students and professionals managing ICT transitions.

- ➤ **Thanuskodi, S. (2020). ICT Applications in Libraries: Challenges and Opportunities.** Thanuskodi presents a comprehensive analysis of ICT applications in academic and research libraries across India. The book covers the role of digital tools in cataloguing, circulation, and information retrieval. It highlights the role of ICT in promoting knowledge sharing and open access initiatives. The author critically examines infrastructural constraints and skill gaps among library professionals. The work emphasizes the importance of continuous professional development for effective ICT utilization. It concludes with strategies for sustaining technology-driven services in resource-limited settings.

- ➤ **Witten, I. H., & Bainbridge, D. (2021). How to Build a Digital Library (3rd ed.).** This classic text offers a deep understanding of the architecture, design, and functionality of digital libraries. Witten and Bainbridge provide both theoretical foundations and hands-on approaches to developing ICT-based library systems. The book discusses metadata management, digitization workflows, and user interface design. It emphasizes interoperability and open-source solutions suitable for academic institutions. The authors also consider the social and ethical dimensions of digital access. Widely cited, this book remains a cornerstone for researchers and practitioners in library informatics.

Objectives of the Study

- ✓ To assess the extent of ICT tools implementation in academic libraries affiliated to both universities.

- ✓ To compare the effectiveness of ICT-based services in terms of access, user satisfaction, and efficiency.

- ✓ To identify the challenges faced by library professionals in adopting and managing ICT resources.

- ✓ To suggest strategies for improving ICT-enabled library services.

Methodology

The study adopted a descriptive survey design incorporating both quantitative and qualitative approaches to obtain a comprehensive understanding of ICT implementation in academic libraries. The population consisted of 150 colleges affiliated with Bangalore University and 90 colleges under Bengaluru City University. Using stratified random sampling, 30 colleges from each university were selected to ensure representation across government, private, and autonomous institutions. Data were collected through a structured questionnaire administered to librarians, faculty members, and students to capture perceptions and usage patterns of ICT tools. In addition, semi-structured interviews with senior librarians provided qualitative insights into institutional strategies, challenges, and best practices. The observation method was used to verify the presence and condition of ICT

infrastructure, including computer systems, networking facilities, automation software, and digital resources. This triangulated approach enhanced the reliability and validity of the findings. Data from questionnaires were statistically analyzed, while interview responses were thematically interpreted. Together, these methods offered a holistic view of the current status and effectiveness of ICT integration in academic libraries across both universities.

Results and Discussion

Table 1: ICT Infrastructure Availability in Academic Libraries

ICT Infrastructure Component	Bangalore University (%)	Bengaluru City University (%)	Overall (%)
Computerized cataloguing and circulation	95	82	88
Internet and Wi-Fi connectivity	100	90	95
Library automation software (Koha, SOUL, etc.)	93	79	86
Access to digital databases (N-LIST, DELNET)	88	74	81
Institutional repository/digital archives	42	30	36

Source: Primary Data

Table 1 indicates that the majority of libraries across both universities have adopted ICT infrastructure, with Bangalore University colleges demonstrating higher readiness. Internet connectivity and automation software are widely implemented, whereas digital repositories remain limited, especially in Bengaluru City University colleges. The results suggest that infrastructural disparity remains a key determinant of ICT integration effectiveness.

Table 2: Utilization of ICT-based Services by Users

ICT-Based Service	Faculty (%)	Students (%)	Overall Mean Satisfaction (1–5)
Online Public Access Catalogue (OPAC)	90	84	4.1
E-journals and Databases Access	88	82	4.2
Digital Reference Services	75	68	3.9
Institutional Repository Access	48	36	3.7
Online Renewal/Reservation	80	86	4.3

Source: Primary Data

Table 2 reveals that faculty members and students actively use ICT-enabled services, with the highest satisfaction recorded for online renewal and e-resource access. However, digital reference and institutional repository services show relatively lower engagement, indicating scope for improvement in awareness and usability. The mean satisfaction score of 4.1 reflects overall positive user experiences with ICT-based services.

Table 3: Challenges in ICT Implementation

Challenges Identified	Bangalore University (%)	Bengaluru City University (%)	Overall (%)
Inadequate funding	60	78	69
Lack of trained technical staff	55	72	64
Irregular power supply	40	65	53

and connectivity			
Limited ICT skills among librarians	42	58	50
Infrequent training/workshops	30	52	41

Source: Primary Data

Table 3 highlights the institutional barriers affecting ICT implementation. Bengaluru City University colleges face greater difficulties in funding, staffing, and technical maintenance compared to Bangalore University colleges. Only 41% of institutions conduct regular ICT training, revealing a significant gap in capacity-building efforts that could hinder long-term technological sustainability.

Table 4: Staff Training and ICT Competency Development

Training Parameter	Bangalore University (%)	Bengaluru City University (%)	Overall (%)
Regular ICT skill workshops conducted	70	46	58
Participation in national-level ICT programs	54	38	46
Availability of ICT manuals/guidelines	67	49	58
Peer mentoring and in-house sessions	61	40	51
Management support for ICT training	73	52	63

Source: Primary Data

Table 4 shows that Bangalore University libraries have stronger institutional support for ICT training and competency development. More than two-thirds of these libraries conduct regular workshops and maintain structured ICT manuals. The relatively lower figures in Bengaluru City University colleges suggest a need for more consistent professional development and administrative encouragement for technical upskilling.

Table 5: Comparative Analysis of ICT Effectiveness

Component	Bangalore University	Bengaluru City University
ICT Infrastructure Level	High	Moderate
Use of Automation Software	93%	79%
Access to E-resources	88%	74%
Staff ICT Training	70%	46%
Mean User Satisfaction (1–5)	4.3	3.9

Source: Primary Data

Table 5 provides a summary comparison of ICT implementation between the two university systems. Bangalore University-affiliated colleges exhibit a higher degree of ICT maturity across all dimensions—automation, e-resource accessibility, staff training, and user satisfaction. Conversely, Bengaluru City University colleges, though progressing, remain in the intermediate stage of ICT adoption. The overall trend emphasizes the influence of institutional policy and resource allocation on ICT effectiveness.

Findings

The study revealed several significant insights regarding the implementation and effectiveness of Information and Communication Technology (ICT) in academic libraries affiliated with Bangalore University and Bengaluru City University.

1. **High ICT Adoption with Institutional Variation:** Most libraries across both universities have adopted automation software and digital cataloguing systems. However, colleges affiliated with Bangalore University demonstrated more comprehensive ICT infrastructure and higher operational efficiency compared to those under Bengaluru City University.

2. **Prominent Use of Automation Software:** The study found that Koha was the most widely used library automation software, followed by SOUL and LibSys. The implementation of these systems has improved cataloguing accuracy, circulation management, and record maintenance.

3. **Enhanced Access to E-Resources:** About 72% of libraries provided access to databases such as N-LIST, DELNET, and J-Gate, facilitating seamless information retrieval for faculty and students. Despite this, issues related to bandwidth limitations and subscription renewals were observed.

4. **User Satisfaction and Service Effectiveness:** Faculty and students expressed a high level of satisfaction with ICT-enabled services, particularly online renewal, remote access, and e-journal availability. The mean satisfaction level was higher among Bangalore University users (4.3/5) compared to Bengaluru City University (3.9/5).

5. **Infrastructural and Human Resource Challenges:** The study identified inadequate funding, shortage of technical staff, and limited ICT proficiency among librarians as major constraints. Power instability and poor maintenance also affected ICT usage in several institutions.

6. **Training and Professional Development Gaps:** Only 45% of the surveyed institutions conducted regular ICT workshops. Colleges under Bangalore University reported more frequent staff training and administrative support, indicating a stronger institutional culture for professional growth.

7. **Comparative Institutional Performance:** The comparative analysis highlighted that Bangalore University colleges have reached a higher level of ICT maturity with better infrastructure, trained personnel, and stronger management commitment. In contrast, Bengaluru City University colleges are in a developing phase of ICT integration.

8. **Need for Sustainable Policy and Collaboration:** The findings underscore the importance of a sustained ICT development policy, enhanced financial allocation, and inter-library collaboration to bridge the digital divide between urban and semi-urban institutions.

9. **Positive Impact on Library Service Delivery**: ICT implementation has significantly improved information access, retrieval speed, and service quality, transforming the traditional library setup into a more user-cantered and technology-driven environment.

10. **Scope for Continuous Improvement:** While the progress in ICT adoption is commendable, the study concludes that strategic investment in infrastructure, training, and digital literacy programs is essential for achieving uniform growth and maximizing the benefits of ICT in academic libraries.

Discussion and Implications

The findings of this study reaffirm the transformative potential of Information and Communication Technology (ICT) in strengthening academic library services and facilitating seamless access to information. The results demonstrate that both Bangalore University and Bengaluru City University have made notable progress in implementing ICT-based systems, though the pace and depths of integration vary across institutions.

The higher ICT maturity observed in Bangalore University colleges can be attributed to better financial support, proactive management, and a well-established culture of professional training. These libraries have successfully adopted automation software such as Koha and SOUL, enabling efficient cataloguing, circulation, and resource management. This aligns with the observations of Kaur and Rani (2020), who highlighted that library automation, enhances operational transparency and reduces manual workload.

Conversely, colleges affiliated with Bengaluru City University face persistent challenges such as limited infrastructure, irregular funding, and insufficient technical manpower. These gaps mirror the findings of Rao and Bhat (2021), emphasizing that institutional disparities often hinder full-scale ICT adoption. The study further identified that while access to digital databases like N-LIST, DELNET, and J-Gate is widespread, issues such as low bandwidth, delayed subscription renewals, and minimal user training restrict optimal utilization.

A key discussion point emerging from this research is the role of staff competency and continuous training. Institutions that conduct regular ICT workshops and skill enhancement programs exhibit higher efficiency and user satisfaction. This finding reinforces the idea that technological infrastructure alone is insufficient—human resource development remains a critical factor for sustainable ICT integration.

The user perspective provides an encouraging outlook. Both faculty and students rated ICT-based services highly, particularly for their convenience, accessibility, and speed. This satisfaction reflects the growing digital literacy among academic users and the increasing relevance of e-resources in teaching, learning, and research. However, limited awareness of institutional repositories and digital reference services suggests a need for greater promotion and user orientation programs.

From a broader institutional standpoint, the comparative analysis highlights the importance of strategic planning and policy-level coordination. Collaborative initiatives between the two universities could help share best practices, pool resources, and standardize digital service models. Joint training programs, inter-library networks, and shared e-resource platforms could bridge existing gaps and ensure equitable ICT access across affiliated colleges.

In terms of policy implications, the study calls for increased funding for ICT infrastructure, particularly for smaller and semi-urban colleges. University administrations and government agencies should prioritize capacity building, technical support, and regular monitoring mechanisms to ensure that ICT adoption translates into tangible improvements in library performance and user experience.

Overall, the discussion underscores that ICT is not merely a tool for modernization but a strategic enabler of academic excellence. Sustained investment, policy coherence, and professional development will be essential to achieve a digitally empowered academic library ecosystem in Karnataka's higher education landscape.

Recommendations

1. **Create a Joint ICT Consortium:** Form a collaborative consortium between Bangalore University and Bengaluru City University to facilitate the sharing of e-resources, automation software, and technical expertise, thereby reducing costs and ensuring equitable access to digital content.

2. **Enhance Professional Development:** Organize periodic ICT skill enhancement programs and hands-on workshops for librarians and technical staff to strengthen their competence in managing and innovating digital library services.

3. **Increase Financial Investment:** Allocate a dedicated budget for continuous upgradation of ICT infrastructure, including procurement of modern hardware, software updates, and routine maintenance, to sustain long-term digital operations.

4. **Strengthen Digital Literacy Initiatives:** Introduce awareness and training programs for faculty and students to improve their ability to locate, evaluate, and effectively utilize electronic information resources.

5. **Formulate Institutional ICT Policies:** Encourage university-level policy frameworks that establish uniform standards for ICT implementation, monitoring, and evaluation across affiliated colleges to ensure consistency and quality in digital library services.

Conclusion

The study underscores that ICT implementation in academic libraries has enhanced operational

efficiency, access to information, and user engagement. However, disparities persist between the two university systems due to differences in financial support, staff competence, and policy prioritization. For sustainable ICT-based services, institutions must emphasize continuous professional development, collaborative resource sharing, and investment in up-to-date technologies. Periodic evaluation and user feedback mechanisms should be institutionalized to ensure quality improvement.

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