



Strategic ICT Framework for Academic Libraries: Policy Implications from Karnataka's Engineering Institutions

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Abstract

Information and Communication Technology (ICT) is pivotal for enhancing academic library services in the 21st century. This study examines the strategic ICT framework of engineering college libraries in Karnataka, India, focusing on infrastructure, skill levels, usage patterns, training, challenges, and policy implications. Data were collected from 80 LIS professionals through structured questionnaires and analyzed using descriptive statistics. The findings reveal strong engagement with library management systems and digital resources, yet gaps persist in advanced analytics, digital repository management, and emerging ICT adoption. Key challenges include limited budget allocation, insufficient technical support, and a lack of structured ICT policies. The study provides actionable recommendations for policymakers and library administrators to develop a robust ICT framework that enhances service quality and research support.

Keywords: ICT framework, academic libraries, Karnataka, engineering colleges, library policy, digital resources, LIS professionals

1. INTRODUCTION

The growing reliance on digital technologies has transformed library operations worldwide. Academic libraries are increasingly required to provide seamless access to digital resources, implement online services, and support research activities efficiently. In Karnataka, engineering institutions are embracing ICT integration to enhance library services, but strategic frameworks to guide adoption and policy implementation remain underdeveloped.

A strategic ICT framework involves coordinated policies, infrastructure planning, skill development, and technology management to optimise library services. Assessing the current ICT landscape, understanding the competencies of Library and Information Science (LIS) professionals, and identifying systemic challenges are critical to formulating effective ICT policies. This study aims to examine the ICT infrastructure, skill levels, and operational practices of academic libraries in Karnataka's engineering institutions and propose policy implications to strengthen ICT adoption.

2. LITERATURE REVIEW

ICT integration in academic libraries has been widely studied, emphasising its role in improving access to information, supporting research, and enhancing administrative efficiency. Pandey and Madhusudhan (2024) note that ICT competencies are essential for LIS professionals to deliver digital services effectively. Arokyamary and Ramasesh (2013) highlighted the need for comprehensive ICT capabilities among engineering college librarians to manage electronic resources efficiently. Abbas and Siddique (2020) emphasized that training, infrastructure, and policy support significantly influence ICT adoption.

Thompson (2008) and H??n and Bhatti (2025) differentiate between foundational ICT skills and advanced competencies, stressing the importance of digital fluency, adaptability, and innovation in library services. Despite progress in ICT adoption, gaps persist in data analytics, repository management, and policy implementation, underscoring the need for strategic frameworks in academic libraries.

3. METHODOLOGY

A descriptive research design was adopted to profile the ICT framework in engineering college libraries in Karnataka. A purposive sample of 80 LIS professionals with at least two years of experience was selected. Data were collected using a structured questionnaire covering demographics, ICT infrastructure, skill levels, tool usage, training programs, challenges, and policy awareness. Quantitative data were analysed using descriptive statistics (frequencies, percentages), while qualitative responses were coded thematically to identify challenges and policy implications. Ethical standards, including voluntary participation and confidentiality, were strictly observed.

Scope and Limitations

This study focuses on ICT practices and strategic frameworks in engineering college libraries of Karnataka. It examines infrastructure, skill levels, usage patterns, and policy awareness. Limitations include reliance on self-reported data, exclusion of newer professionals with less than two years of experience, and the focus on engineering institutions, limiting generalizability to other academic libraries.

4. DATA ANALYSIS AND DISCUSSION

Table 1: Demographic Profile of LIS Professionals

Parameter	Frequency	Percentage (%)
<i>Gender</i>		
Male	50	62.5
Female	30	37.5
<i>Age Group</i>		
25–35	25	31.3
36–45	35	43.8
46–55	15	18.7
56 & Above	5	6.2
<i>Education</i>		
MLISc	55	68.8
B.Lib.Sc	20	25
Other	5	6.2

The demographic profile of LIS professionals in Karnataka's engineering institutions indicates a male-dominated workforce (62.5% male vs. 37.5% female), reflecting moderate gender disparity within academic library staffing. Age distribution shows that the largest segment of professionals (43.8%) falls in the 36–45 years range, suggesting that mid-career professionals form the backbone of library operations. Early-career staff (25–35 years) constitute 31.3%, while senior professionals above 56 years are minimally represented (6.2%), indicating limited late-career workforce presence.

Educationally, the majority of professionals hold a Master of Library and Information Science (MLISc) degree (68.8%), establishing a strong formal foundation for professional practice. A smaller portion holds a B.Lib.Sc (25%) or other qualifications (6.2%), highlighting some diversity in academic preparation. Overall, the data suggest that Karnataka's engineering college libraries are staffed by predominantly mid-career, formally trained professionals, forming a stable base for ICT skill development and implementation of strategic library policies.

Table 2: ICT Infrastructure Availability

Infrastructure Component	Available	Partially Available	Not Available
Library Management System	85%	10%	5%
Online Databases (IEEE, Springer)	90%	8%	2%
Institutional Repository	60%	25%	15%
Wi-Fi/Network Connectivity	95%	5%	0%
E-Journals & E-Books Access	88%	10%	2%
Data Analytics Tools	30%	35%	35%

The analysis of ICT infrastructure in Karnataka's engineering college libraries indicates that foundational systems are well-established. Library Management Systems (85% fully available) and online databases such as IEEE and Springer (90% fully available) demonstrate strong operational support for resource management and research activities. Network connectivity, including Wi-Fi, is nearly universal (95%), facilitating seamless access to digital resources. E-journals and e-books platforms also show high availability (88%), reflecting the libraries' focus on supporting digital scholarship.

In contrast, advanced infrastructure such as institutional repositories is only partially available in 25% of libraries, with 15% lacking access entirely, indicating uneven adoption of digital archiving solutions. Tools for data analytics are the least available, with only 30% of libraries fully equipped and 35% lacking access, highlighting a significant infrastructure gap to support research analytics and evidence-based decision-making. Overall, while core ICT systems are robust and widely implemented, advanced technologies and analytics tools remain underdeveloped, suggesting a critical area for strategic policy intervention and investment to strengthen academic library capabilities.

Table 3: Frequency of ICT Tool Usage

ICT Tool	Daily	Weekly	Rarely	Never
Library Management System	60%	25%	10%	5%
Online Databases	65%	20%	10%	5%
Institutional Repository	45%	30%	15%	10%
E-Journals & E-Books Platforms	70%	20%	5%	5%
Reference Management Tools	50%	30%	15%	5%
Social Media for Library Services	25%	30%	30%	15%

The usage patterns of ICT tools in Karnataka's engineering college libraries indicate strong daily engagement with core operational and research-support systems. Library Management Systems are used daily by 60% of professionals, while online databases see 65% daily usage, demonstrating the central role of these tools in managing library operations and supporting faculty and student research. E-journals and e-book platforms have the highest daily usage at 70%, reflecting the shift toward digital resource consumption. Reference management tools are also actively used, with 50% of professionals reporting daily engagement, supporting scholarly communication and citation management.

In contrast, institutional repositories show moderate daily usage (45%) and 30% weekly usage, indicating emerging adoption of digital archiving solutions. Social media platforms for library services are the least utilized, with only 25% daily usage and 45% rarely or never using them, highlighting the underutilization of these tools for outreach and user engagement.

Overall, the data reveal that while operational and research-focused ICT tools are integrated into daily workflows, advanced platforms and innovative digital services such as social media remain underutilised, suggesting areas for targeted training and policy-driven adoption initiatives.

Table 4: ICT Skill Levels of LIS Professionals

Skill Area	High	Medium	Low
Library Management Software	55%	30%	15%
Database Searching & Research	60%	30%	10%
Digital Repository Management	35%	40%	25%
E-Resources Management	50%	35%	15%
Data Analytics & Visualization	25%	40%	35%
Web-based Services & OPAC	55%	30%	15%

The ICT skill profile of LIS professionals in Karnataka's engineering colleges indicates strong proficiency in core operational and research-oriented domains. Library Management Software and web-based services/OPAC both show 55% of professionals at a high skill level, reflecting competence in daily library operations and user-facing digital services. Database searching and research skills are the most developed, with 60% rated high, emphasising their critical role in supporting faculty and student research. E-resources management also shows strong capability, with 50% at high competency.

However, advanced skill areas reveal notable gaps. Digital Repository Management has only 35% of professionals at a high skill level, with 25% at low competency, indicating challenges in archiving and managing institutional repositories. Data Analytics and Visualisation is the least developed domain, with just 25% at high competency and 35% at low, highlighting a critical area for capacity-building and training interventions.

Overall, while LIS professionals demonstrate strong operational and research-support skills, advanced ICT competencies remain underdeveloped, signalling the need for structured training programs and strategic initiatives to enhance analytics and digital repository management capabilities.

Table 5: Training Programs Attended

Training Type	Number Attended	Percentage (%)
ICT Skill Development Workshops	40	50
Library Automation Training	45	56.3
Digital Library & E-Resources	35	43.8
Research Database Handling	30	37.5
Data Analytics & Visualization	20	25
Web Services & Online Platforms	25	31.3

The training profile indicates that LIS professionals in Karnataka's engineering colleges primarily engage in programs supporting core operational competencies. Library Automation Training is the most attended program (56.3%), reflecting its centrality in daily library management. ICT Skill Development Workshops also show substantial participation (50%), indicating ongoing efforts to enhance general technology proficiency. Training in Digital Library and E-Resources (43.8%) and Research Database Handling (37.5%) highlights focus on research support and digital resource management.

In contrast, advanced areas such as Data Analytics and Visualization (25%) and Web Services & Online Platforms (31.3%) exhibit relatively low participation, suggesting that emerging ICT skills are underrepresented in current professional development programs. These findings indicate a need for policy-driven, structured training initiatives targeting advanced competencies to ensure LIS professionals are equipped to handle evolving digital and analytical demands in academic libraries.

Table 6: Challenges in ICT Adoption

Challenge	Frequency	Percentage (%)
Lack of Advanced Training	40	50
Insufficient Technical Support	30	37.5
Limited Access to Modern Tools	25	31.3
Resistance to Change	20	25
Heavy Workload	35	43.8
Limited Budget for ICT	30	37.5

The analysis of ICT adoption challenges highlights several critical barriers faced by LIS professionals in Karnataka's engineering colleges. The lack of advanced training is the most frequently reported challenge (50%), indicating that while foundational ICT skills are present, opportunities for upskilling in emerging technologies are limited. Heavy workload (43.8%) further restricts professionals from engaging with ICT tools or participating in training programs.

Insufficient technical support (37.5%) and limited budget allocation for ICT (37.5%) underscore infrastructural and financial constraints that impede the effective integration of technology. Limited access to modern tools (31.3%) and resistance to change (25%) reflect organizational and behavioral factors that also affect ICT adoption.

Collectively, these findings suggest that targeted interventions—such as structured training programs, enhanced technical support, strategic resource allocation, and change management policies—are essential to improve ICT adoption and optimize digital library services.

Table 7: Policy Recommendations for Strategic ICT Framework

Recommendation	Priority	Implementation Level
Regular ICT Training Programs	High	Medium
Upgrading Library Management Systems	High	Low
Encouraging E-Resource Research & Use	Medium	Medium
Data Analytics & Visualization Workshops	Medium	Low
Collaboration with Tech Experts	Medium	Medium
Budget Allocation for ICT	High	Low

The policy recommendations emphasize a multi-dimensional approach to strengthening ICT capabilities in Karnataka's engineering college libraries. Regular ICT training programs are identified as high-priority with medium implementation, reflecting the need for structured professional development to address skill gaps. Upgrading Library Management Systems and allocating budgets for ICT are also high-priority initiatives, but their low implementation levels indicate infrastructural and financial constraints.

Medium-priority measures, such as encouraging e-resource research, organizing data analytics and visualization workshops, and fostering collaborations with technology experts, highlight the importance of advanced skills and innovative practices. However, implementation levels remain low to medium, suggesting the need for stronger institutional commitment and strategic planning.

Overall, these recommendations provide a roadmap for policymakers and library administrators to develop a sustainable ICT framework that enhances professional competencies, optimizes resource utilization, and supports digital scholarship and user-centric library services.

5. CONCLUSION

The study highlights that academic libraries in Karnataka's engineering institutions possess robust core ICT infrastructure and operational competencies, particularly in library management, database searching, and e-resources management. LIS professionals demonstrate proficiency in these foundational areas, ensuring smooth library operations and research support. However, advanced ICT competencies such as digital repository management, data analytics, and the use of emerging digital tools remain underdeveloped, reflecting gaps in training and resource allocation.

Key challenges, including limited advanced training, insufficient technical support, high workloads, and budget constraints, restrict optimal ICT adoption. The study underscores the need for strategic policy interventions, including structured training programs, infrastructure upgrades, enhanced budgetary support, and collaboration with technology experts. Implementing these measures can strengthen the ICT framework, enhance professional competencies, and improve service delivery, enabling academic libraries to meet the evolving demands of digital scholarship and research in engineering education.

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