International Journal of Recent Advances in Science and Technology, 2026; 12(2): 1-8

Digital Transformation in Academic Libraries: A Comparative Analysis of ICT Impact in Government and Private Medical Universities of Rajasthan

Sourav Gupta[1] , Dr. Priti Sharma[2]

[1]Research Scholar, Department of Library and Information Science, Career Point University, Kota, Rajasthan, India.

sheru2564437@gmail.com

[2]Professor, Department of Library and Information Science, Career Point University, Kota, Rajasthan, India.

pritisharma620@gmail.com

ABSTRACT

This study examines the impact of Information and Communication Technology (ICT) on academic library services in selected medical universities of Rajasthan, with a comparative focus on government and private institutions . A quantitative research design was adopted, and data were collected from 400 respondents using a structured questionnaire. Statistical analyses, including t-test, ANOVA, and correlation, were applied to evaluate differences and relationships among key variables. The findings reveal that private universities demonstrate significantly higher ICT impact than government institutions ($p < 0.001$), indicating more effective adoption and utilization of digital technologies. ICT-based resources such as e-books and online databases were found to significantly enhance accessibility and research efficiency. A strong positive correlation between ICT usage and ICT impact ($r = 0.902$) highlights that effective utilization is critical for maximizing benefits. The study concludes that while ICT has substantially improved library services, disparities in infrastructure and implementation persist, emphasizing the need for strategic development and user-focused approaches to achieve sustainable digital transformation.

Keywords: Information and Communication Technology (ICT), Academic Libraries, Digital Transformation, Medical Universities, ICT Impact, Library Services, E-resources, OPAC, User Satisfaction, Comparative Study

Introduction

In the contemporary knowledge-driven era, Information and Communication Technology (ICT) has emerged as a pivotal catalyst in reshaping the landscape of information creation, organization, dissemination, and utilization [1]. The rapid advancement of digital technologies has not only transformed the modes of accessing information but has also redefined the structural and functional paradigms of academic institutions, particularly libraries. Academic libraries, which have historically functioned as custodians of printed knowledge, are now experiencing a profound transition towards digitally integrated and user-centric information systems [2]. The shift from traditional print-based collections to hybrid and fully digital environments marks a significant milestone in the evolution of library services. ICT-enabled tools and platforms—such as e-journals, e-books, online databases, institutional repositories, and Online Public Access Catalogues (OPAC)—have substantially enhanced the speed, accessibility, and efficiency of information retrieval. Consequently, libraries are no longer confined to their physical boundaries; rather, they have evolved into dynamic knowledge hubs that facilitate seamless access to global information resources[3]. This transformation assumes even greater significance in the context of medical university libraries, where the demand for accurate, up-to-date, and evidence-based information is critical. Medical education and research are inherently dependent on timely access to current scientific literature, clinical data, and research findings. In this regard, ICT plays an indispensable role in supporting academic excellence, fostering research productivity, and enabling informed clinical decision-making [4]. The integration of ICT into medical libraries not only enhances the quality of information services but also contributes to improving healthcare outcomes through better-informed professionals. Despite these advancements, the extent and effectiveness of ICT implementation are not uniform across institutions. Variations in infrastructure, funding, administrative support, and technological readiness often result in disparities, particularly between government and private universities. Private institutions, with relatively

*Correspondence

Sourav Gupta

Research Scholar, Department of Library and Information Science, Career Point University, Kota, Rajasthan, India. Email ID: sheru2564437@gmail.com

greater financial autonomy and flexibility, tend to adopt advanced ICT solutions more rapidly, whereas government institutions may encounter structural and resource-related constraints that hinder optimal utilization [5]. Against this backdrop, the present study seeks to critically examine the impact of ICT on academic library services within selected medical universities of Rajasthan [6]. The study adopts a comparative perspective to analyze differences between government and private institutions in terms of ICT infrastructure, service delivery, and user engagement. Furthermore, it explores how ICT influences key dimensions such as information accessibility, service efficiency, and user satisfaction. By situating the analysis within the broader discourse of digital transformation in academic libraries, this study aims to contribute to the understanding of how technological interventions can enhance the effectiveness of library systems in higher education [7]. The findings are expected to provide valuable insights for policymakers, library professionals, and academic administrators in designing strategies for equitable and sustainable ICT integration.

II. LITERATURE REVIEW

The integration of Information and Communication Technology (ICT) into academic libraries has been widely acknowledged as a transformative development in Library and Information Science. Scholars have emphasized that ICT has fundamentally reshaped the processes of information creation, organization, access, and dissemination, thereby redefining the traditional role of libraries[7-9]. Early research on digital libraries highlights the transition from traditional print-based collections to electronic and networked systems. According to Borgman (2000), digital libraries extend access beyond physical boundaries and provide flexible, efficient information retrieval mechanisms. Similarly, William Y. Arms (2000) explains that digital libraries function as distributed systems, enabling seamless access to global information resources. A substantial body of literature has focused on ICT's role in enhancing user accessibility and satisfaction. Studies indicate that ICT-enabled services such as e-journals, e-books, and Online Public Access Catalogues (OPAC) significantly improve the speed and convenience of information access [9,10]. These technologies reduce time constraints and expand the range of accessible scholarly materials, thereby increasing user engagement. In the context of higher education, ICT has been identified as a key factor in enhancing teaching, learning, and research outcomes. S. P. Singh (2004) argues that ICT-based library services improve the quality of academic research by providing access to up-to-date and reliable informatio[17]. This is particularly significant in medical education, where access to current scientific knowledge is essential. Supporting this view, Asemi A. and Riyahiniya N. (2007) found that the use of online databases significantly enhances research productivity among students and faculty[1]. Despite these advantages, the literature also highlights several challenges in ICT implementation. These include inadequate infrastructure, lack of technical expertise, financial constraints, and resistance to technological change[11-14] Such challenges are particularly evident in developing countries, where institutional limitations hinder effective ICT adoption. Comparative studies between government and private academic institutions reveal significant disparities in ICT adoption and utilization. Research suggests that private universities generally demonstrate more advanced ICT infrastructure, better digital resource availability, and higher levels of user satisfaction compared to government institutions[15-17]. In contrast, government institutions often face financial and administrative constraints that limit technological advancement. Another important dimension explored in the literature is the relationship between ICT usage and its impact. Studies have shown a strong positive correlation between the extent of ICT usage and user satisfaction[18-19]. This indicates that the effectiveness of ICT depends not only on its availability but also on its utilization. Therefore, user training and digital literacy are essential for maximizing the benefits of ICT in academic libraries. Recent scholarly discourse has further emphasized the concept of digital transformation, which extends beyond technological adoption to include organizational change and user-centered service innovation. According to Andrew Cox (2016), successful digital transformation requires an integrated approach involving infrastructure, human resources, and strategic planning.

Although a substantial body of literature exists on ICT in academic libraries, several gaps remain evident. Most studies focus either on ICT infrastructure or user satisfaction, without establishing a comprehensive relationship between infrastructure, usage, and impact. Moreover, limited research has been conducted in the specific context of medical university libraries in Rajasthan, particularly from a comparative perspective between government and private institutions. Furthermore, there is a lack of empirical studies employing advanced statistical techniques—such as t-test, ANOVA, and correlation analysis—to examine the differential impact of ICT across institutional types and user categories. The present study addresses these gaps by offering a rigorous,

Table 1: Comparison of ICT Impact between Government and Private Medical Universities

University Type	N	Mean	Std. Deviation	t-value	p-value
Government	100	10.98	2.229	-7.889	0.000
Private	300	13.34	3.455		

The independent sample t-test confirms that this difference is statistically significant ($t = -7.889$, $p < 0.001$), indicating a clear distinction between the two categories. These results imply that private universities are more effective in adopting and utilizing ICT within their library services. Such variation may be associated with differences in resource availability, financial support, and the level of technological development across institutions.

data-driven, and comparative analysis of ICT impact in medical university libraries.

III. METHODOLOGY

This study adopts a quantitative research approach to examine the impact of Information and Communication Technology (ICT) on academic library services in selected medical universities of Rajasthan. A comparative research design was employed to analyze differences between government and private institutions with respect to ICT infrastructure, usage, and its overall impact on library services. The study was conducted in four medical universities located in Jaipur district, comprising one government and three private institutions. A total of 400 respondents were selected using convenient sampling, ensuring representation from key user groups, including library staff, faculty members, research scholars, and students. This balanced distribution enabled a comprehensive assessment of ICT impact across different categories of library users. Primary data were collected through a structured questionnaire based on a five-point Likert scale ranging from “Strongly Disagree” to “Strongly Agree.” The instrument was designed to capture responses related to ICT infrastructure, accessibility of digital resources, usage patterns, and perceived effectiveness of ICT-based library services. Prior to the final data collection, the questionnaire was reviewed by subject experts and tested through a pilot study to ensure clarity, reliability, and content validity. For data analysis, appropriate statistical techniques were employed to address the research objectives and test the hypothesis. Descriptive statistics were used to summarize the data, while an independent sample t-test was applied to examine differences between government and private universities. Additionally, one-sample t-test, analysis of variance (ANOVA), and correlation analysis were conducted to assess user

perceptions and relationships among variables. All statistical analyses were performed to ensure accuracy and reliability of the findings. Ethical considerations were duly maintained throughout the study.

Participation was voluntary, and respondents were assured of confidentiality and anonymity. The data collected were used solely for academic and research purposes.

IV. RESULTS

The present study analyzes the impact of Information and Communication Technology (ICT) on academic library services in selected medical universities of Rajasthan. The results are presented in a structured manner, focusing on key statistical findings relevant to the research objectives. A total of 400 respondents participated in the study, representing faculty members, students, research scholars, and library staff from both government and private institutions.

Comparative Analysis of ICT Impact

To examine the difference in ICT impact between government and private universities, an independent sample t-test was conducted. The results indicate that the mean score of ICT impact in private universities (Mean = 13.34) is higher than that of government universities (Mean = 10.98). The difference between the two groups was found to be statistically significant.

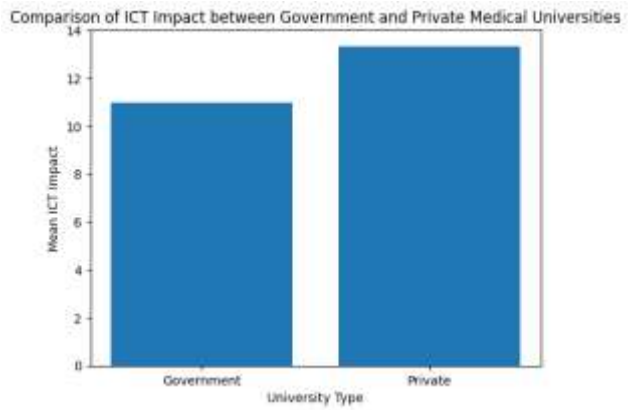

Figure 1: Comparison of Mean ICT Impact Scores between Government and Private Medical Universities

The visual difference between the two bars highlights the variation in ICT effectiveness, which is consistent with the statistical results obtained through the independent sample t-test. This representation further supports the finding that private universities demonstrate relatively stronger adoption and utilization of ICT in their library services. This finding clearly demonstrates that private medical universities exhibit a higher level of ICT effectiveness in their library services compared to government institutions.

ICT Usage and Digital Resource Utilization

The analysis of user responses reveals that ICT-based resources are widely utilized in academic libraries. A significant proportion of respondents reported that e-books are helpful for study and research purposes ($p < 0.001$). Similarly, online databases were perceived as easy and effective tools for accessing information ($p < 0.01$).

Table 2 presents the analysis of selected ICT-based resources in terms of their usage and perceived effectiveness. The findings indicate that both e-books and online databases are statistically significant contributors to academic and research activities. E-books recorded a higher mean score (Mean = 3.36) with a strong level of significance ($t = 4.702$, $p < 0.001$), suggesting their important role in supporting study and research. Similarly, online databases also show a meaningful contribution (Mean = 3.23, $t = 2.983$, $p = 0.003$), reflecting their usefulness in facilitating access to information. These results highlight the growing reliance on digital resources in academic libraries and emphasize their importance in enhancing information accessibility and research efficiency.

Table 2: User Perception of ICT-Based Resources

ICT Resource	Mean	t-value	p-value	Interpretation
E-books	3.36	4.702	0.000	Significant
Online Databases	3.23	2.983	0.003	Significant

ICT Infrastructure and Library Services

The results further highlight the role of ICT infrastructure in enhancing library services. Key components such as digital resources and Online Public Access Catalogue (OPAC) were found to be significantly associated with improved access to information ($p < 0.05$).

Table 3 presents the statistical evaluation of selected ICT infrastructure components in academic libraries. The results indicate that both digital resources and OPAC availability play a significant role in supporting library services. Digital resources show a moderate mean score

(Mean = 3.15) with statistical significance (t = 2.094, p = 0.037), reflecting their contribution to improving access to academic content. In comparison, OPAC availability demonstrates a relatively higher mean value (Mean = 3.29) along with a stronger level of significance (t = 3.946, p < 0.001), indicating its effectiveness in facilitating efficient information retrieval.

These findings suggest that core ICT facilities, particularly OPAC systems and digital collections, are essential in enhancing the functionality and user accessibility of academic libraries.

Table 3: Statistical Analysis of Key ICT Infrastructure Facilities in Academic Libraries

ICT Component	Mean	t-value	p-value	Interpretation
Digital Resources	3.15	2.094	0.037	Significant
OPAC Availability	3.29	3.946	0.000	Significant

Analysis of Variance (ANOVA)

An ANOVA test was conducted to examine differences in ICT impact across different user groups. The results indicate that there is no statistically significant difference among user categories (F = 0.617, p > 0.05). This suggests that the perceived impact of ICT is relatively uniform across faculty members, students, researchers, and library staff.

Table 4 presents the results of the analysis of variance (ANOVA) conducted to examine differences in ICT impact across various user groups. The findings indicate that the variation between groups is not statistically significant (F = 0.617, p = 0.651). This suggests that the perceived impact of ICT on library services remains consistent across different categories of respondents. In other words, users—regardless of their roles—experience similar levels of effectiveness in ICT-based services.

Table 4: ANOVA Results for ICT Impact Across User Groups

Source	F-value	p-value	Interpretation
Between Groups	0.617	0.651	Not Significant

Correlation Analysis

Correlation analysis was performed to examine the relationship between ICT variables. The results reveal a strong positive correlation between ICT usage and ICT impact (r = 0.902, p < 0.001), indicating that increased use of ICT resources significantly enhances their perceived effectiveness. Additionally, a moderate positive relationship was observed between ICT infrastructure and ICT usage (r = 0.496, p < 0.001), suggesting that improved infrastructure facilitates greater utilization of digital resources[20-24]

Table 5 presents the correlation analysis among ICT infrastructure, ICT usage, and ICT impact. The results reveal a positive association among all three variables, indicating their interconnected nature. A moderate relationship is observed between ICT infrastructure and ICT usage (r = 0.496), suggesting that improved infrastructural facilities contribute to increased utilization of ICT-based services. Similarly, ICT infrastructure shows a weaker yet positive

association with ICT impact (r = 0.305), indicating that infrastructure alone has a limited direct influence on overall effectiveness. Notably, a very strong positive correlation is found between ICT usage and ICT impact (r = 0.902), highlighting that greater use of ICT resources significantly enhances their effectiveness in library services. These findings emphasize that while infrastructure forms the foundation, the actual benefits of ICT are largely determined by the extent to which these resources are actively utilized.

Table 5: Correlation between ICT Infrastructure, Usage, and Impact

Variables	ICT Infrastructure	ICT Usage	ICT Impact
ICT Infrastructure	1	0.496**	0.305**
ICT Usage	0.496**	1	0.902**

The figure illustrates a conceptual framework depicting the relationships among cognition, motivation, coping skills, age, and academic performance. In this model, cognition is positioned as the independent variable, directly influencing academic performance, which is considered the dependent variable. Motivation and coping skills are presented as mediating variables, indicating that they play an intermediary role in explaining how cognition affects academic performance. These variables suggest that higher levels of cognitive ability may enhance motivation and coping strategies, which in turn contribute to improved academic outcomes. Additionally, age is introduced as a moderating variable, influencing the strength and direction of the relationship between cognition and academic performance. This implies that the impact of cognitive ability on performance may vary across different age groups. Overall, the framework highlights both direct and indirect pathways through which cognition contributes to academic performance, emphasizing the combined role of mediating and moderating factors.

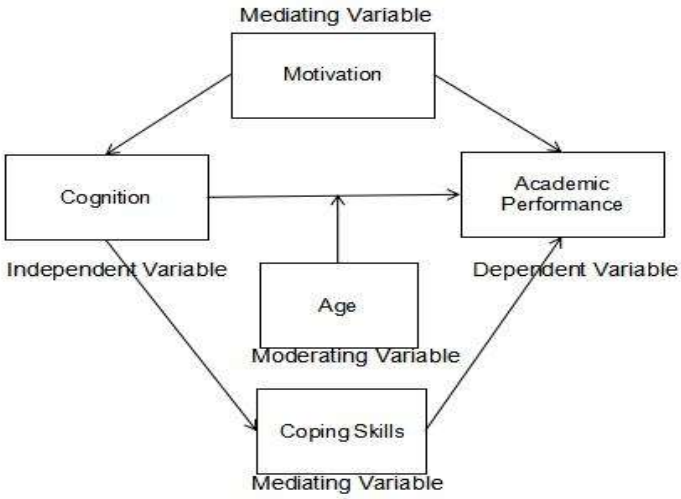

Figure 2: Relationship between ICT Infrastructure, Usage, and Impact

V. DISCUSSION

The findings of the present study provide important insights into the transformative role of Information and Communication Technology (ICT) in academic libraries. The results indicate that ICT significantly enhances accessibility, efficiency, and user experience, supporting earlier research which emphasizes the evolving role of digital technologies in library services[25,26]. The comparative analysis between government and private universities reveals a statistically significant difference, with private institutions demonstrating higher ICT impact. This finding is consistent with previous studies, which suggest that private

universities tend to adopt advanced technologies more effectively due to better funding and administrative flexibility[27]. The higher mean score observed in private institutions reflects their relatively stronger ICT infrastructure and more efficient service delivery systems. The significant role of digital resources, particularly e-books and online databases, highlights the increasing dependence of users on electronic information sources. This trend aligns with the findings of Carol Tenopir (2003), who reported a growing preference for digital resources due to their accessibility and time-saving advantages. Similarly, David Nicholas et al. (2008) observed that electronic resources have significantly altered user behavior in academic environments. The analysis of ICT infrastructure further demonstrates that components such as digital resources and OPAC systems contribute significantly to improved access to information. However, the moderate responses related to certain infrastructural aspects suggest that availability alone does not ensure effectiveness. This observation supports the argument put forward by Ziming Liu (2004), who emphasized that the success of digital libraries depends not only on technological infrastructure but also on user interaction and adaptability. The absence of significant variation across user groups, as indicated by the ANOVA results, suggests that ICT benefits are uniformly experienced across different categories of users. This finding reinforces the inclusive nature of ICT-based services in academic libraries. One of the most significant outcomes of the study is the strong positive correlation between ICT usage and ICT impact. This result clearly indicates that the effectiveness of ICT is largely driven by the extent of its utilization. This finding is consistent with the work of Md. Shariful Islam and Md. Nazmul Islam (2007), who reported that higher levels of ICT usage lead to greater user satisfaction and improved service outcomes. Overall, the discussion highlights that while ICT has substantially transformed academic libraries, disparities in implementation and utilization remain critical challenges. Addressing these issues requires a balanced approach that combines infrastructure development with user training and institutional support.[28-30]

VI. CONCLUSION

The present study establishes that Information and Communication Technology (ICT) has brought a significant transformation in academic library services, particularly in the context of medical universities. The integration of ICT has improved access to information, enhanced the efficiency of library operations, and supported teaching, learning, and research activities. The comparative analysis clearly indicates that private universities demonstrate a higher level of ICT effectiveness than government institutions. This difference reflects variations in infrastructural development, availability of digital resources, and institutional support systems. Another important outcome of the study is that the effectiveness of ICT is closely linked to its level of usage. While the availability of technological infrastructure is essential, its actual impact depends on how actively users engage with digital resources and services. The findings also reveal that ICT benefits are experienced uniformly across different user groups, indicating that digital library services have a broad and inclusive reach. However, certain gaps in infrastructure and implementation still exist, which may limit the full potential of ICT in some institutions. In conclusion, the study highlights the need for a balanced and strategic approach towards digital transformation in academic libraries. Strengthening infrastructure, promoting user awareness, and ensuring effective utilization of ICT resources are essential for enhancing the quality and effectiveness of library services in higher education.

REFERENCES

1. Asemi, A., & Riyahiniya, N. Awareness and use of digital resources in the libraries of Isfahan University of Medical Sciences, Iran. The Electronic Library, 2007;25(3): 316–327.
2. Arms, W. Y. (2000). Digital Libraries. Cambridge, MA: MIT Press.

3. Borgman, C. L. (2000). From Gutenberg to the Global Information Infrastructure: Access to Information in the Networked World. Cambridge, MA: MIT Press.
4. Cox, A. M. How has digital transformation affected the role of the academic library? Library Management, 2016;37(8/9): 405–417.
5. Cullen, R. Addressing the digital divide. Online Information Review, 2001;25(5): 311–320.
6. Davis, F. D. Perceived usefulness, perceived ease of use, and user acceptance of information technology. MIS Quarterly, 1989;13(3):319–340.
7. Islam, M. S., & Islam, M. N. Use of ICT in libraries: An empirical study. Library Philosophy and Practice, 2007;1–8.
8. Jain, P. Application of information technology in academic libraries. International Journal of Library and Information Science, 2013;5(9):281–288.
9. Kumar, B. T. S., & Biradar, B. S. Use of ICT in college libraries in Karnataka. DESIDOC Journal of Library & Information Technology, 2010;30(3):37–46.
10. Liu, Z. Perceptions of digital libraries: A survey of users in academic settings. Journal of Academic Librarianship, 2004;30(5):372–377.
11. Mahapatra, R. K., & Ramesh, D. B. ICT use in university libraries: A comparative study. International Journal of Information Dissemination and Technology, 2014;4(1): 32–36.
12. Mishra, C. S. ICT and its impact on academic libraries. Library Philosophy and Practice, 2009;1–9.
13. Nicholas, D., Huntington, P., Rowlands, I., & Jamali, H. R. The impact of e-journals on academic behavior. Journal of Academic Librarianship, 2008;34(6): 481–489.
14. Ranganathan, S. R. (1931). The Five Laws of Library Science. Madras: Madras Library Association.
15. Rogers, E. M. (2003). Diffusion of Innovations (5th ed.). New York: Free Press.
16. Rowley, J. The electronic library. Library Review, 1998;47(7): 362–368.
17. Singh, S. P. Information technology applications in academic libraries in India. Annals of Library and Information Studies, 2004;51(2): 45–52.
18. Tenopir, C. Use and users of electronic library resources. Library Trends, 2003;51(4): 566–589.
19. Thanuskodi, S. Use of e-resources by students and researchers. Library Philosophy and Practice, 2012:1–9.
20. Tripathi, M., & Jeevan, V. K. J. Evaluation of digital libraries. Annals of Library and Information Studies, 2010;57(3): 207–214.
21. Tyagi, S. Use of information technology in academic libraries. International Journal of Digital Library Services,2011; 1(2): 1–9.
22. Venkatesh, V., Morris, M. G., Davis, G. B., & Davis, F. D. User acceptance of information technology: Toward a unified view. MIS Quarterly, 2003;27(3): 425–478.
23. Wang, M., & Wang, X. Digital library development in academic institutions. The Electronic Library, 2010;28(2): 250–260.
24. Weiner, S. A. Information literacy and digital transformation. Journal of Academic Librarianship, 2011;37(5): 401–407.
25. Yamane, T. (1967). Statistics: An Introductory Analysis (2nd ed.). New York: Harper & Row.
26. Zhang, Y. Developing digital libraries: A theoretical approach. Journal of Documentation, 2010;66(1): 1–21.
27. Ziming, L.The digital library environment. Journal of Academic Librarianship, 2004;30(5): 372–377.
28. Kaur, A., & Singh, K. ICT applications in academic libraries. International Journal of Information Studies, 2015;7(2): 45–52.
29. Sharma, R., & Singh, S. Digital transformation in higher education libraries. International Journal of Library Science, 2016;8(1): 12–20.
30. Gupta, D. K., & Jambhekar, A. What is digital library? DESIDOC Bulletin of Information Technology, 2002;22(3): 3–9.