User Perceptions and Acceptance of Cloud-Based Public Library Services in Mumbai

Archana Verma
Research Scholar
Department of Library and Information Science
Malwanchal University
Indore (M.P.)

Ravish Verma
Prof. & Head Department of Library and Information Science
Malwanchal University
Indore (M.P.)

Abstract

This study explores user perceptions and acceptance of cloud-based public library services in Mumbai, a metropolitan city with a growing digital infrastructure. Grounded in the Technology Acceptance Model (TAM) and the Unified Theory of Acceptance and Use of Technology (UTAUT), the research identifies key factors influencing user adoption—namely, perceived usefulness, ease of use, social influence, and privacy concerns. Data were collected from 100 users across 20 public libraries using structured questionnaires and analyzed using both descriptive and inferential statistics. Findings indicate that perceived usefulness significantly predicts user acceptance, while privacy concerns negatively affect adoption. Younger users, university students, and frequent library patrons reported higher levels of acceptance. The study highlights the potential of cloud computing to enhance library access and efficiency while emphasizing the importance of user-centric design, digital literacy, and strong data privacy frameworks. Recommendations are provided for library administrators and policymakers to foster digital inclusion and improve service delivery.

Keywords:- Cloud Computing, Public Libraries, User Acceptance, Technology Acceptance Model (TAM), Digital Library Services, Privacy Concerns

1. Introduction:-

The evolution of Information and Communication Technologies (ICTs) has transformed public library services globally. Among these technologies, cloud computing stands out for its ability to enhance resource management, accessibility, and service delivery in a cost-effective manner (Kumar & Raju, 2020). Libraries benefit from cloud platforms that host services remotely, reducing the need for extensive local infrastructure and enabling seamless access to digital resources (Butler, 2016).

In Indian metropolitan areas such as Mumbai, public libraries are adopting cloud computing to serve a digitally aware and diverse user base. These libraries often face challenges such as budget constraints, inadequate infrastructure, and varying levels of digital literacy among patrons. Cloud solutions offer a way to mitigate these issues by supporting e-lending, virtual reference services, and collaborative platforms (Rahman & Islam, 2022). Similar transitions have been observed globally, as with the BIBSYS consortium in Norway, which moved to cloud-based library systems (Haugland et al., 2019).

User acceptance plays a critical role in the success of such initiatives. Perceptions of usefulness, ease of use, and trust determine continued engagement with digital platforms (Venkatesh et al., 2003). Studies such as Zhang et al. (2015) emphasize that belief systems significantly influence users' intentions to adopt cloud services. However, there is a lack of empirical research focused on Indian public library contexts, particularly in Mumbai.

This study addresses that gap by examining awareness, usage patterns, and the key determinants of acceptance among public library users in Mumbai. The findings aim to inform policymakers and librarians about strategies to enhance user engagement and service effectiveness

2. Overview of Cloud-Based Public Library Services in Mumbai:-

2.1 Current Cloud Services Offered by Mumbai Public Libraries:

Mumbai's public libraries have adopted cloud computing to more effectively service their patrons. Lots of libraries are using cloud based Integrated Library Management Systems (ILMS) like e-Granthalya, KOHA etc., that facilitate facilities like online public access catalogues (OPAC) and 24/7 online remote resources lending. A study conducted by Mehra and Deshmukh (2025) at an Indian academic library concluded that cloud-based OPACs contribute to improved user engagement through provision of real-time monitoring of resource usage and the ability to personalise and customise services depending on user's interaction patterns. These devices are multi-device enabled and use Android as their main mobile operating system. Moreover, libraries have also started adopting cloud-enabled digital preservation services to preserve rare and valuable collections thus facilitating access to the cloud-built reliable infrastructure (Chakraborty & Patel, 2025).

2.2.Infrastructure and Technology Adoption Status:

The infrastructure supporting Mumbai's cloud-based library services is progressively developing, with increased investments in broadband connectivity, cloud storage, and virtualization technologies. While many libraries have migrated to cloud platforms to reduce local IT maintenance and improve scalability, challenges remain around ensuring consistent availability and robust security. Software as a Service (SaaS) models are particularly favored due to their cost-effectiveness and ease of deployment. However, balancing operational costs with reliability and energy efficiency remains a concern, as recent research highlights the importance

of fault tolerance and energy-aware resource management in cloud computing environments (Singh & Iyer, 2025). Additionally, Mumbai's libraries are adopting cybersecurity frameworks to safeguard sensitive user data and maintain uninterrupted service amid rising cyber threats (Jain & Thomas, 2025).

2.3.Stakeholders Involved in Cloud Service Implementation:

The implementation of cloud-based services in Mumbai's public libraries involves multiple stakeholders. Library management and staff are central to selecting, deploying, and maintaining cloud platforms. Government agencies and municipal authorities provide policy guidance and funding to support digital infrastructure upgrades. Cloud service providers and technology vendors supply the platforms and technical expertise necessary for deployment. Users—including students, researchers, and the general public—are key stakeholders whose feedback and acceptance influence service design and improvement. Collaboration among these groups is essential to address challenges such as data privacy, legal compliance, and digital literacy, ensuring sustainable and user-centric cloud service adoption (Roy & Banerjee, 2025). Furthermore, academic and research institutions contribute by conducting studies and developing best practices for cloud integration in library services (Chakraborty & Patel, 2025).

3. Objectives of the Study

The research objectives are as follows:

1. To assess awareness and usage levels of cloud-based public library services in Mumbai.
2. To evaluate user perceptions regarding accessibility, usability, and reliability of cloud services.
3. To identify key determinants influencing acceptance of cloud-based services.
4. To propose strategies for improving user engagement and service effectiveness.

4. Hypotheses

Based on TAM, UTAUT, and existing literature, the study proposes the following hypotheses:

- **H1**: Perceived usefulness positively influences user acceptance.
- **H2**: Perceived ease of use positively influences user acceptance.
- **H3**: Social influence positively impacts user acceptance.
- **H4**: Privacy concerns negatively affect user acceptance.
- **H5**: Demographic variables (age, education, frequency of use) significantly influence acceptance.
- **H6** (Main Hypothesis): A significant positive relationship exists between perceived usefulness and user acceptance of cloud-based public library services in Mumbai.

5. Scope and Limitations

Scope:
The study is limited to public libraries in Mumbai and focuses on user perceptions regarding cloud-based services such as OPAC, e-lending, and digital repositories.

Limitations:
The findings are context-specific and may not generalize to other regions or library types. Self-reported data may introduce bias, and rapid technological changes could affect the long-term relevance of results.

6. Literature Review

Recent literature highlights both opportunities and barriers in adopting cloud technologies in Indian public libraries. Singh and Verma (2021) note the growing awareness but also emphasize infrastructural challenges. Patil and Pawar (2022) observed operational improvements with cloud-based systems but underscored the need for staff training.

User-focused studies, such as Gupta and Sharma (2023) in Delhi and Reddy et al. (2023) in South India, found that younger, digitally literate users are more receptive to cloud services. Meanwhile, the COVID-19 pandemic accelerated digital adoption, with Chatterjee and Roy (2022) documenting successful implementations in Mumbai during lockdowns.

Other contributions (e.g., Desai et al., 2024; Joshi & Mehta, 2023) highlight concerns around data privacy and the need for sustainable funding and governance. International comparisons also show similar trends, with user-centric design and policy support emerging as critical factors (Rahman & Islam, 2022; Banerjee, 2025).

7. Research Methodology:-

7.1 Research Design:

This study adopts a mixed-methods research design, combining quantitative and qualitative approaches to comprehensively assess user perceptions and acceptance of cloud-based public library services in Mumbai. The quantitative component involves structured questionnaires for both library users and professionals,. This approach ensures a holistic understanding of statistical trends and nuanced insights.

7.2 Population and Sample:

The population for this study includes:All public libraries in Mumbai.

- Registered users of these public libraries.

The sample consists of:

- 100 users, with 5 users randomly selected from each of the 20 public libraries.

7.3 Sampling Techniques:

A purposive sampling technique is employed to select the 20 public libraries, ensuring representation across various regions and library sizes in Mumbai. Within each library, the librarian or in-charge is selected for participation. For users, a simple random sampling method is used to select 5 users per library, ensuring a fair representation of the user base.

7.4 Data Collection Methods:

- **Questionnaires:** Structured questionnaires are administered to users. The user questionnaire covers areas such as awareness, usage, perceived usefulness, ease of use, and satisfaction with cloud-based services. The librarian questionnaire focuses on implementation challenges, observed user responses, and infrastructure.
- **Observation:** Non-intrusive observation of library environments is conducted to supplement questionnaire and interview data, focusing on technology usage and user interactions.

7.5 Instrument Development and Validation:

The questionnaires and interview guides are developed based on a review of relevant literature and established models such as TAM and UTAUT. Instruments are pre-tested with a pilot group (2 libraries, 10 users) to assess clarity, reliability, and validity. Feedback from the pilot is used to refine the tools before full-scale deployment.

7.6 Data Analysis Techniques:

Quantitative data from questionnaires are analyzed using descriptive statistics (mean, standard deviation, frequency) and inferential statistics (Chi-square tests, t-tests, ANOVA) to identify significant trends and relationships. Qualitative data from interviews are transcribed and analyzed thematically using coding techniques to extract key themes and patterns. Statistical analysis is performed using software such as SPSS or MS Excel, while qualitative analysis is managed with NVivo or similar tools.

7.7 Ethical Considerations:

- Informed consent is obtained from all participants.
- Participation is voluntary, and respondents can withdraw at any stage without repercussions.

- Anonymity and confidentiality of all participants are strictly maintained.
- Data is used solely for academic purposes and stored securely.
- The study adheres to ethical guidelines for research involving human participants, as recommended in library and information science research.

This methodology ensures robust, representative, and ethically sound research outcomes tailored to the context of Mumbai's public libraries and their users.

8. Data Analysis and Results:-

8.1 Demographic Profile of Respondents

The study surveyed 100 users from 20 public libraries in Mumbai, The demographic breakdown of the users is as follows:

Table-1

Demographic Profile of Respondents

Demographic Variable	Category	Frequency	Percentage (%)
Gender	Male	58	58
	Female	42	42
Age Group	18-25	35	35
	26-35	30	30
	36-50	25	25
	Above 50	10	10
Education Level	High School	20	20
	Undergraduate	45	45
	Postgraduate	30	30
	Others	5	5
Frequency of Library Use	Weekly	40	40
	Monthly	35	35
	Occasionally	25	25

8.2 Awareness and Usage of Cloud-Based Library Services:

Among the 100 users surveyed, 72% reported being aware of cloud-based services offered by their libraries, such as online catalogues and digital lending. Usage patterns indicate that 60% have used these services at least once, while 40% have not engaged with cloud services, citing lack of awareness or access issues.

Table 2

Awareness and Usage of Cloud-Based Library Services

Awareness of Cloud Services	**Frequency**	**Percentage (%)**
Yes	72	72
No	28	28
Usage of Cloud Services	**Frequency**	**Percentage (%)**
Regular User	30	30
Occasional User	30	30
Non-user	40	40

8.3 User Perceptions on Accessibility, Usability, and Reliability:

Users rated cloud-based services on a 5-point Likert scale (1 = Strongly Disagree to 5 = Strongly Agree) across three dimensions:

Table 3
User Perceptions on Accessibility, Usability, and Reliability

Dimension	**Mean Score**	**Standard Deviation**
Accessibility	4.1	0.7
Usability	3.8	0.9
Reliability	3.5	1.0

Most users agreed that cloud services improved accessibility (mean = 4.1), with slightly lower scores for usability and reliability, indicating room for improvement in user interface design and system stability.

8.4 Factors Influencing Acceptance of Cloud-Based Services:

Using survey responses aligned with the Technology Acceptance Model (TAM), the following factors were identified as influencing acceptance:

Table 4
Factors Influencing Acceptance of Cloud-Based Services

Factor	**Correlation with Acceptance (r)**	**Significance (p-value)**
Perceived Usefulness	0.68	<0.001
Perceived Ease of Use	0.54	<0.01
Social Influence	0.42	<0.05
Facilitating Conditions	0.49	<0.01
Privacy Concerns	-0.35	<0.05

Perceived usefulness showed the strongest positive correlation with user acceptance, while privacy concerns negatively impacted acceptance.

8.5 Statistical Analysis of User Acceptance Models:

Regression analysis was conducted to predict acceptance of cloud-based services based on TAM variables:

Table 5
Statistical Analysis of User Acceptance Models

Predictor	Beta (β)	t-value	p-value
Perceived Usefulness	0.45	5.12	<0.001
Perceived Ease of Use	0.31	3.67	0.002
Social Influence	0.18	2.10	0.038
Facilitating Conditions	0.22	2.85	0.006
Privacy Concerns	-0.20	-2.45	0.016

The model explained 62% of the variance in acceptance ($R^2 = 0.62$), confirming the significance of these factors.

8.6 Comparative Analysis by Age, Education, and Frequency of Use:

Table 6
Comparative Analysis by Age, Education, and Frequency of Use

Variable	Group	Mean Acceptance Score	ANOVA F-value	p-value
Age	18-25	4.2	4.35	0.006
	26-35	3.9		
	36-50	3.5		
	Above 50	3.1		
Education Level	High School	3.2	5.12	0.003
	Undergraduate	3.8		
	Postgraduate	4.1		
Frequency of Use	Weekly	4.3	6.45	0.001
	Monthly	3.7		
	Occasionally	3.1		

Younger users, those with higher education, and frequent library users showed significantly higher acceptance of cloud-based services.

Summary:
The data indicate a generally positive perception and growing acceptance of cloud-based public library services in Mumbai, especially among younger, educated, and frequent users. Privacy concerns and usability issues remain challenges to be addressed for wider adoption.

8.7 Hypothesis Testing of the Study:

Hypothesis 1 (General TAM-based Hypotheses)

H1: Perceived usefulness positively influences user acceptance of cloud-based library services.
H2: Perceived ease of use positively influences user acceptance of cloud-based library services.
H3: Social influence positively affects user acceptance of cloud-based library services.
H4: Privacy concerns negatively affect user acceptance of cloud-based library services.
H5: There is a significant difference in acceptance levels based on age, education, and frequency of library use.

Statistical Testing and Results

- **Regression Analysis (H1–H4):**

Table 7
Regression Analysis

Predictor	Beta (β)	t-value	p-value	Result
Perceived Usefulness	0.45	5.12	<0.001	Supported (H1)
Perceived Ease of Use	0.31	3.67	0.002	Supported (H2)
Social Influence	0.18	2.10	0.038	Supported (H3)
Privacy Concerns	-0.20	-2.45	0.016	Supported (H4)

- **ANOVA (H5):**

Table 8
Anova

Variable	F-value	p-value	Interpretation
Age	4.35	0.006	Significant difference among age groups
Education	5.12	0.003	Significant difference among education levels
Frequency of Use	6.45	0.001	Significant difference by frequency of library use

Interpretation:
All hypotheses are supported. Perceived usefulness, ease of use, and social influence positively impact acceptance, while privacy concerns negatively affect it. Demographic factors significantly influence acceptance levels.

Hypothesis 6 (Specific Hypothesis on Perceived Usefulness)

H_0 (Null Hypothesis): There is no significant positive relationship between users' perceived usefulness of cloud-based public library services and their acceptance of these services in Mumbai.

H_1 (Alternative Hypothesis): There is a significant positive relationship between users' perceived usefulness of cloud-based public library services and their acceptance of these services in Mumbai.

Statistical Testing and Results

- **Pearson Correlation:**
  $r=0.68$ $r=0.68$, $p<0.001$ $p<0.001$
- **Regression Analysis:**
  $\beta=0.45$ $\beta=0.45$, $t=5.12$ $t=5.12$, $p<0.001$ $p<0.001$

Interpretation:
The null hypothesis is rejected. Perceived usefulness and acceptance of cloud-based library services a statistically significant positive relationship between perceived usefulness and acceptance of cloud-based library services exists for the users in Mumbai.

Summary:

Statistical evidence is presented in support of both the general TAM-based hypotheses and the specific focus on perceived usefulness, with respect to the Mumbai public library users. Where here we have a strong GX relevant factor perceived usefulness consistent with the findings on global technology adoption for library services.

9. Discussion

The results validate TAM and UTAUT models, confirming that perceived usefulness, ease of use, and social influence drive acceptance, while privacy concerns remain a barrier. Demographic factors also significantly shape user behavior, with younger and more educated users demonstrating higher levels of adoption.

Privacy concerns echo global studies and point to the need for transparent data governance. Libraries must invest in digital literacy, user feedback systems, and infrastructure upgrades to promote inclusive cloud service adoption.

10. Recommendations

1. **User-Centered Design**: Develop intuitive interfaces and multilingual platforms.
2. **Data Privacy**: Implement strong encryption and educate users about data protection.

3. **Digital Literacy**: Offer training for both users and staff.
4. **Infrastructure**: Collaborate with government and tech vendors to ensure service reliability.
5. **Community Engagement**: Run awareness campaigns and gather user feedback regularly.
6. **Tailored Programs**: Provide specialized outreach for older and less frequent users.

11. Conclusion

This study affirms the relevance of cloud computing in enhancing public library services in Mumbai. Perceived usefulness is the most critical determinant of acceptance, and addressing privacy concerns and demographic disparities is essential. With user-centric strategies and robust infrastructure, cloud-based services can significantly increase the accessibility and effectiveness of public libraries.

12. Suggestions for Future Research

- Explore advanced security protocols in cloud environments.
- Study ethical and socio-economic implications of cloud adoption.
- Compare rural and urban library implementations.
- Assess long-term impact on user satisfaction and learning outcomes.
- Investigate the role of emerging technologies like AI and blockchain in cloud library services.

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