

LIBRARY SERVICE ANALYTICS FOR COLLEGE LIBRARIES IN WEST BENGAL USAGE PATTERNS DIGITAL RESOURCE PERFORMANCE AND PREDICTIVE MODELS

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Abstract

The current study analyzed library service analytics in West Bengal's college libraries, concentrating on consumption trends, digital resource performance, and predictive modeling of service utilization. A quantitative, cross-sectional research approach was utilized, and data were gathered from 100 library users using a structured questionnaire, augmented by usage analytics from library systems. Using SPSS, we used descriptive and inferential statistical methods such chi-square testing, correlation analysis, multiple regression, and predictive modeling. The results showed that people were quite interested in using digital library services. E-journals were the most popular resources, whereas institutional repositories were utilized less often. There was a strong positive link between how often people used the library and how satisfied they were with it, and user category was found to be strongly linked to how often people used digital resources. Regression analysis revealed that access to digital resources, ICT infrastructure, and user training are major drivers of overall library service consumption, with predictive models exhibiting satisfactory forecasting accuracy. The study showed how useful library service analytics can be for making decisions based on data and improving the delivery of digital services in college libraries.

Keywords: *Library service analytics; Digital resources; Usage patterns; Predictive modeling; College libraries; West Bengal*

1. INTRODUCTION

The fast growth of information and communication technology and the rise of digital information resources are changing academic libraries in a big way. College libraries, in particular, are no longer judged only by the amount of their collections or the quality of their buildings. Instead, they are judged more and more by how well they can provide services that are fast, easy to use, and based on data. In

this environment, library service analytics has become an important way to learn about how people use libraries, how well digital resources work, and how to make decisions based on facts. By rigorously examining usage patterns and service outcomes, libraries can improve resource allocation, increase user happiness, and predict future service needs. This study positions itself within the dynamic landscape by analyzing library service analytics in West Bengal college libraries, focusing on usage trends, digital resource performance, and predictive modeling of library service utilization.

1.1. Background of the Study

The growth of digital materials, online databases, and integrated library management systems has changed how college libraries in India work in a big way. In West Bengal, college libraries are using more and more ICT-based services. However, there is still not much rigorous evaluation of how these services are used and how well they work. A lot of libraries still utilize traditional ways to measure how well they are doing, and they don't use analytical evidence very much to plan services and make the most use of their resources. Libraries have had a hard time adapting their services to changing academic needs because they don't have enough empirical, data-driven information about how users behave, how they use digital resources, and how well services work. In this context, the current study was conducted to use library service analytics as a systematic method to analyze consumption trends, assess the effectiveness of digital resources, and produce predictive insights that facilitate informed decision-making in the college libraries of West Bengal.

1.2. Predictive Analytics for Library Service Utilization

Predictive analytics for library service utilization involves using statistical and data-driven models to make predictions about how people will use the library in the future based on how they have used it in the past and how they are currently using it. In college libraries, this means looking at things like how often people visit, how often they use digital resources, what kind of user they are, what kind of ICT equipment they have, and how much training they have had to find out what factors have a big effect on service demand. Predictive analytics helps libraries guess how users will behave in the future, how many resources they will need, and which services will be in high demand. It does this by using methods like regression analysis and decision-tree models. This method changes how libraries are run from making decisions based on what happens to planning ahead. This makes it possible to better allocate resources, provide better services, and make policies based on evidence that meet the changing needs of students.

1.3. Research Objectives

- To analyze the usage patterns of library services and digital resources among users of college libraries in West Bengal.
- To evaluate the performance of digital library resources in terms of accessibility, usage intensity, and user satisfaction.
- To identify key factors influencing overall library service utilization and develop predictive models for future usage.

2. LITERATURE REVIEW

Bhattacharya (2017) did an analytical study on users' access to electronic information sources at engineering college libraries in West Bengal. The study revealed trends in e-resource utilization, access impediments, and user satisfaction rates, underscoring the necessity for a methodical assessment of electronic services. The results showed that there were differences in access and use between regions, which set the stage for this study's focus on usage patterns and service performance in college libraries in West Bengal.

Deo, Mishra, and Jalaluddin (2020) looked into a library management system that uses IoT and machine learning to guess how resources would be used. Their study showed how predictive analytics may help people make decisions ahead of time, increase service quality, and make the best use of resources. This work directly influenced the predictive modeling aspect of the current study by demonstrating the viability of data-driven forecasting in library settings.

Sen and Das (2022) looked at the ICT infrastructure and how college libraries connected to West Bengal State University use electronic resources. The study found a strong link between having the right infrastructure and being able to use e-resources effectively. It also pointed out that users need more training and awareness. These results validated the incorporation of ICT infrastructure and user competence variables into the analytical framework of the current study.

Wakahia (2017) looked into how big data analytics can help academic libraries understand how people use electronic resources. The research underscored the significance of sophisticated analytical methodologies in elucidating intricate usage patterns and enhancing service planning. The conceptual insights derived from this research enhanced the analytical framework of the current study and validated the application of statistical and predictive methodologies.

Lamba and Madhusudhan (2019) utilized metadata tagging and predictive modeling to examine publication trends in a premier library and information science magazine. Their research showed that

predictive methods work well in LIS research and that modeling is useful for predicting future trends. This research offered methodological assistance for the use of predictive analytics to anticipate library service usage in the current study.

3. RESEARCH METHODOLOGY

The study employed a quantitative, analytical research approach to investigate library service consumption patterns, assess the efficacy of digital resources, and formulate predictive models for service utilization in West Bengal's college libraries. Data were gathered from library patrons and institutional library systems to facilitate both behavioral and system-level study. Statistical and machine-learning methods were used to get real-world insights and make predictions about how usage patterns may change in the future.

3.1. Research Design

A cross-sectional descriptive and analytical study design was utilized. The design was deemed suitable as it facilitated the examination of current usage habits, the evaluation of digital resource performance indicators, and the projection of future service demand within a specified timeframe.

3.2. Study Area

The research was carried out at chosen government and private college libraries throughout several districts of West Bengal. Institutions were selected to exemplify differences in geographic location, institutional scale, and levels of ICT infrastructure.

3.3. Sample Selection and Sample Size

The study selected a total sample of 100 respondents. The sample consisted of undergraduate students, postgraduate students, research scholars, and teaching faculty who were active users of library services. A stratified random sample method was used to make sure that all types of users were represented fairly. The constant sample size of 100 was deemed adequate for statistical analysis and predictive modeling at an exploratory research stage. The study had a sample of 100 respondents. The sample consisted of undergraduate students, postgraduate students, research scholars, and teaching personnel who regularly utilized library services.

3.4. Data Sources

Both primary and secondary data were utilized.

- Primary data were collected through a structured questionnaire administered to library users.
- Secondary data were obtained from library management systems, usage logs, institutional reports, and official library records related to digital resource access.

3.5. Research Instruments

A structured questionnaire was designed to collect data on:

- Frequency and purpose of library usage
- Use of digital and electronic resources
- User satisfaction with library services
- Accessibility and performance of digital platforms

In addition, usage analytics data such as login frequency, resource downloads, and session duration were extracted from library systems where available.

3.6. Variables of the Study

- **Independent Variables:** Type of user, frequency of library visits, digital literacy level, access to ICT facilities
- **Dependent Variables:** Digital resource usage intensity, service satisfaction level, overall library utilization
- **Predictor Variables:** Past usage frequency, resource access patterns, and user category

3.7. Data Collection Procedure

Data were collected over a defined study period through in-person and online questionnaire distribution. Institutional permission was obtained prior to data collection. Usage analytics data were anonymized to maintain confidentiality and ethical compliance.

3.8. Data Analysis Techniques

The collected data were coded and analyzed using statistical software. The following techniques were applied:

- Descriptive statistics (mean, percentage, standard deviation) to analyze usage patterns

- Inferential statistics (chi-square test and correlation analysis) to examine relationships between variables
- Regression analysis to assess digital resource performance factors
- Predictive modeling using linear regression and decision-tree algorithms to forecast future library service usage

4. DATA ANALYSIS AND INTERPRETATION

We used the Statistical Package for the Social Sciences (SPSS) to systematically code, enter, and analyze the data we collected. Descriptive and inferential statistical methods were utilized to analyze library usage patterns, evaluate the effectiveness of digital resources, and determine determinants of library service utilization. The findings were analyzed in accordance with the study's objectives.

To put the results in context, the researchers looked at the demographics of the people who answered the survey. This analysis helped us understand what the sample was made up of and made sure that all types of library customers were well represented in the study.

Table 1: Demographic Profile of Respondents (n = 100)

Category	Frequency	Percentage
Gender		
Male	56	56.0
Female	44	44.0
User Category		
Undergraduate Students	42	42.0
Postgraduate Students	28	28.0
Research Scholars	15	15.0
Faculty Members	15	15.0

The results indicated that students constituted the majority of the respondents, reflecting their dominant presence in college library usage. The inclusion of faculty members and research scholars provided a balanced perspective on advanced academic and research-oriented library service utilization.

An assessment of library usage frequency was conducted to determine the level of engagement of users with library services. Usage frequency served as a key indicator of dependency on library resources.

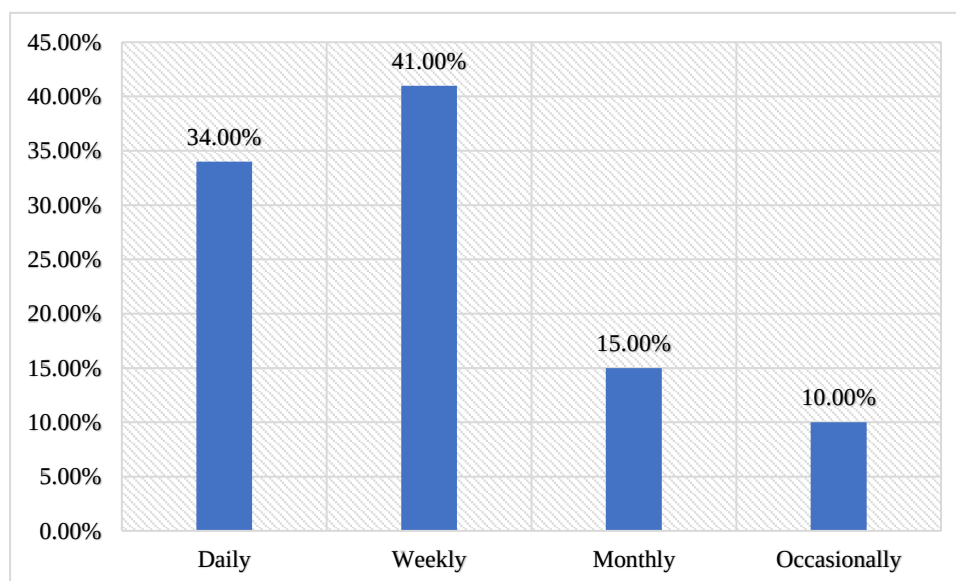


Figure 1: Frequency of Library Usage

The findings showed that a substantial proportion of users accessed library services on a daily or weekly basis, suggesting consistent engagement. This regular usage justified further analytical and predictive examination of service utilization patterns.

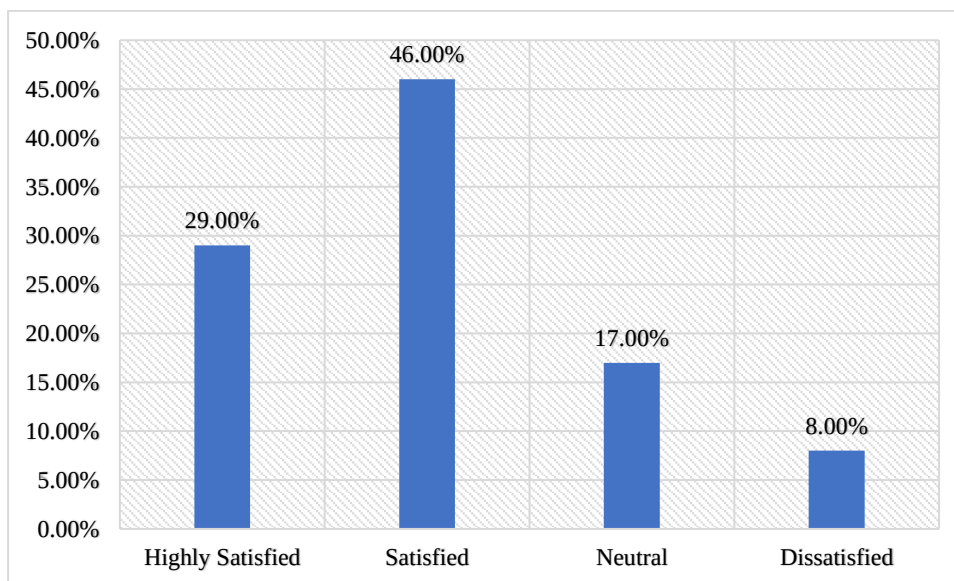
Descriptive statistical analysis was performed to examine the intensity of use of various digital resources available in college libraries. Mean scores and standard deviations were used to compare usage levels across resource types.

Table 2: Descriptive Statistics of Digital Resource Usage

Variable	N	Mean	Std. Deviation
E-journal Usage Frequency	100	3.82	0.91
E-book Usage Frequency	100	3.45	0.88
Database Usage	100	3.21	0.95
Institutional Repository Usage	100	2.97	1.02

The analysis revealed that e-journals were the most frequently used digital resource, followed by e-books and databases. Lower mean scores for institutional repositories indicated the need for improved visibility and user awareness.

User satisfaction with digital library services was measured to evaluate perceived service quality and effectiveness. Satisfaction levels were considered crucial for assessing overall library performance.

**Figure 2:** User Satisfaction with Digital Library Services

The majority of respondents reported being satisfied or highly satisfied with digital library services, indicating acceptable service performance. However, the presence of neutral and dissatisfied responses highlighted areas requiring service enhancement.

A chi-square test was applied to examine the association between user category and digital resource usage patterns. This test helped determine whether usage behavior varied significantly among different user groups.

Table 3: Chi-Square Test Between User Category and Digital Resource Usage

Test	Value	df	Sig. (p-value)
Pearson Chi-Square	12.684	6	0.047

The results demonstrated a statistically significant association between user category and digital resource usage, indicating that different categories of users exhibited distinct patterns of engagement with digital library resources.

Correlation analysis was conducted to assess the relationship between frequency of library usage and user satisfaction. Pearson's correlation coefficient was used to measure the strength and direction of the relationship.

The analysis revealed a strong positive correlation, suggesting that increased frequency of library usage was associated with higher levels of user satisfaction. This emphasized the role of consistent engagement in shaping positive service perceptions.

Multiple regression analysis was employed to identify key predictors of overall library service utilization. The model examined the combined influence of digital access, infrastructure, and user training.

Table 4: Correlation Between Library Usage Frequency and User Satisfaction

Variables	Pearson Correlation (r)	Sig. (2-tailed)
Usage Frequency & Satisfaction	0.612	0.000

A strong positive correlation was observed between frequency of library usage and user satisfaction ($r = 0.612$, $p < 0.01$). This suggested that frequent users perceived higher service value, reinforcing the importance of engagement-driven service design.

Table 5: Regression Analysis Predicting Overall Library Service Utilization

Model Summary

R	R Square	Adjusted R Square	Std. Error
0.742	0.551	0.538	0.486

ANOVA

Model	Sum of Squares	df	Mean Square	F	Sig.
Regression	28.614	3	9.538	40.37	0.000
Residual	23.319	96	0.243		
Total	51.933	99			

Coefficients

Predictor Variable	B	Std. Error	Beta	t	Sig.
(Constant)	0.842	0.214	—	3.93	0.000
Digital Resource Access	0.461	0.072	0.521	6.40	0.000
ICT Infrastructure	0.298	0.081	0.314	3.68	0.001
User Training	0.187	0.069	0.229	2.71	0.008

The regression results confirmed that digital resource access was the most significant predictor of service utilization, followed by ICT infrastructure and user training. The model demonstrated strong explanatory power, supporting its suitability for predictive analysis.

Predictive models were evaluated to assess their effectiveness in forecasting library service usage. Model accuracy was used as a criterion to compare predictive performance.

Table 6: Predictive Usage Classification Accuracy

Model Used	Prediction Accuracy (%)
Linear Regression Model	78.0
Decision Tree Model	82.0

The decision tree model showed higher prediction accuracy than linear regression, indicating its ability to capture complex usage patterns. This finding supported the application of advanced analytics for proactive library service planning.

5. CONCLUSION

The study showed that college libraries in West Bengal were quite interested in digital library services, but the way different types of users used them was very different. E-journals and electronic databases were the most popular resources, whereas institutional repositories were not used as much as they could have been. There was a substantial link between how often people used the library and how happy they were with it. This suggests that having constant access and reliable digital services made people think the service was better. Regression and predictive analyses validated that digital resource accessibility, ICT infrastructure, and user training were significant factors influencing total library service utilization, with predictive models demonstrating satisfactory accuracy in anticipating future usage trends. The results showed that library service analytics is a useful tool for helping college libraries make decisions about how to best manage their digital resources and plan based on data.

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