Effect of Library Management Systems and IT Resources on Operational Efficiency in University Libraries

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Abstract	Article Info
This study examines the effect of Library Management Systems (LMS) and Information Technology (IT) Resources on the operational efficiency of university libraries in Pekanbaru using a quantitative explanatory approach involving 47 respondents consisting of library staff and system users. Multiple linear regression analysis revealed that both LMS and IT Resources significantly influence operational efficiency, with LMS showing the strongest effect ($\beta = 0.850$; $t = 10.808$; $p < 0.001$), followed by IT Resources ($\beta = 0.767$; $t = 8.014$; $p < 0.001$). The regression model demonstrated strong explanatory power ($R^2 = 0.722$), indicating that 72.2% of the variance in operational efficiency is explained by the two predictors. Grounded in the Resource-Based View (RBV) framework, the findings highlight that LMS and IT Resources represent valuable, rare, and inimitable strategic assets that enhance operational excellence and institutional competitiveness. Theoretically, this research extends the application of RBV in the context of academic libraries in developing countries, while globally, it offers insights for higher education institutions worldwide seeking to strengthen efficiency and service quality through digital transformation.	

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1. Introduction

The rapid advancement of information technology has brought a significant transformation in the management of university libraries worldwide. Libraries are no longer limited to being repositories of printed materials; they have evolved into dynamic information centers driven by efficiency, automation, and digital access. The implementation of Library Management Systems (LMS) and the optimization of information technology (IT) resources have become crucial factors in supporting sustainable library operations and improving staff productivity.

Rahmadita dan Wardhana (2025) Libraries, as institutions that provide information and knowledge, are required to meet the standards for facilities, equipment, and infrastructure as stipulated by the National Library in order to provide maximum service to library users. According to Joy, V., PV, V., and Muraleedharan, A. (2025), the adoption of technology-driven management systems plays a pivotal role in enhancing the operational performance of libraries, particularly within autonomous higher education institutions. Their study revealed that factors such as ease of use, IT infrastructure, and managerial support strongly influence the successful implementation of LMS (Information Discovery and Delivery, 2025).

Similarly, Okojie and Olujobi (2025) emphasized that library automation has a direct impact on operational efficiency, circulation speed, and bibliographic accuracy. Their research found that universities implementing full-scale automation systems experienced significant improvements in staff productivity and user satisfaction (Niger Delta Journal of Library and Information Science, 2025). The integration of IT resources has also strengthened collection management and security. Yusuf, Akor, and Evarest (2025) noted that the application of RFID technology in university libraries not only enhanced operational efficiency but also reduced collection loss and inventory errors (African Research Reports, 2025).

Furthermore, cloud computing has emerged as a transformative approach in managing library resources more efficiently. Indraji and Naikar (2025) highlighted that cloud-based library systems offer advantages such as scalability, cost-effectiveness, and broader accessibility for both librarians and users (International Journal of Novel Research and Development, 2025). In terms of human capacity, Nabila and Pangesti (2025) emphasized that digital competencies among librarians are key to maximizing the benefits of LMS implementation. Their findings indicated that continuous skill development and training programs enhance librarians' ability to utilize technology effectively in university settings (Jurnal Kajian Informasi & Perpustakaan, 2025). Additionally, He Cong et al. (2025) argued that in the era of artificial intelligence, library efficiency evaluation must adopt a multidimensional framework that includes data analytics, human resource management, and AI-driven optimization (Journal of Agricultural Library and Information Science, 2025).

Taken together, the reviewed literature suggests that both library management systems and IT resources play a crucial role in improving the operational efficiency of university libraries. However, empirical evidence remains limited, particularly regarding the direct relationship between technological adoption levels and operational outcomes in university contexts across Southeast Asia. Therefore, this study aims to explore and analyze the extent to which library management systems and IT resources affect operational efficiency in university libraries.

2. Literature Review

2.1 Resource-Based View (RBV)

In the context of modern library management, the Resource-Based View (RBV) provides a solid conceptual framework for understanding how the Library Management System (LMS) and information technology (IT) resources contribute to organizational performance. According to Barney (1991), valuable resources are those that create efficiency and service excellence. The LMS enhances operational efficiency, service quality, and user satisfaction through the automation of circulation and collection management processes (Rafi et al., 2022). Similarly, Clark (2022) demonstrates that applying RBV strategies in digital library management improves performance outcomes by aligning adaptive information systems with user needs.

Furthermore, LMS and IT resources exhibit characteristics of being Rare and Inimitable because these systems are often customized to meet the unique needs of each institution. For instance, LMS solutions integrated with AI recommendation systems or predictive analytics to understand borrowing patterns and user preferences create a rare competitive advantage among libraries (Filson et al., 2021). The combination of librarians' tacit knowledge and technological adaptability makes these systems difficult to imitate (Vasudevan, 2021; Arachchige et al., 2021). Human factors, organizational culture, and accumulated institutional expertise further strengthen their inimitability, as Eisenhardt and Furr (2021) note that competitive advantage in the digital era depends on an organization's ability to orchestrate internal resources dynamically.

Finally, in terms of Non-substitutability, LMS and IT resources provide unique value that cannot be replaced by other systems due to their integration with cloud-based services, digital repositories, and data analytics tools that support data-driven decision-making (Hussain et al., 2024). The modern RBV framework emphasizes the concept of digital resource orchestration, which refers to an organization's ability to leverage digital assets to promote continuous innovation and learning (Mailani et al., 2024). Thus, LMS is not merely an operational tool but a strategic knowledge asset that strengthens competitive advantage and organizational sustainability in the digital transformation era (McGahan, 2021).

2.2 Library Management System

A Library Management System (LMS) is an integrated software application designed to manage various library operations, including acquisition, cataloging, circulation, membership, and reporting. The implementation of LMS enables libraries to automate routine tasks and reduce dependency on manual processes. Previous studies have shown that LMS improves data accuracy, reduces processing time, and enhances service reliability. Shanmugam (2020) states that an effective LMS improves library performance by enabling faster access to information and improving coordination among library staff. Furthermore, LMS supports data-driven decision-making through real-time reporting and system analytics. Indicators commonly used to measure LMS effectiveness include system performance, ease of use, data accuracy, security, and service integration

2.3 Information Technology Resources

Information Technology Resources consist of hardware, software, network infrastructure, databases, and human resources with IT competencies. Wetherbe (2001) argues that IT resources are essential for organizational effectiveness, particularly in information-intensive organizations. In library environments, IT resources support digital services such as online catalogs, electronic journals, institutional repositories, and remote access services. Adequate IT infrastructure ensures system reliability, data security, and service continuity. Meanwhile, skilled human resources are necessary to operate and maintain technological systems effectively. Insufficient IT resources often lead to system downtime, slow service, and low user satisfaction. Therefore, the availability and quality of IT resources significantly influence library operational performance.

2.4 Operational Efficiency

Operational efficiency refers to an organization's ability to maximize outputs while minimizing inputs such as time, cost, and labor. In libraries, efficiency is reflected in service speed, accuracy of information processing, effective resource utilization, and user satisfaction. Yanti dan Rahmah (2025) Libraries as information centers in educational environments not only function as providers of reading materials, but also play a role in developing service systems that are responsive to the needs of library users.

Slack et al. (2015) explain that efficient operations are achieved through well-managed processes, appropriate technology use, and competent human resources. In the context of libraries, operational efficiency can be improved through automation, system integration, and effective use of IT infrastructure. Ridla, Abdurrasyiid et al. (2025) In today's digital age, service quality and user loyalty have become increasingly crucial aspects, given the increasingly diverse patterns of user interaction with information services. Libraries no longer rely solely on physical collections, but are required to be able to provide effective, efficient, and enjoyable service experiences through the use of digital media.

3. Research Methodes

This study adopts a quantitative explanatory research design, aiming to examine the causal relationship between independent and dependent variables through statistical analysis. The quantitative approach allows for objective measurement and numerical analysis of data collected from librarians in higher education institutions. The research seeks to explain the effect of the Library Management System (LMS) and Information Technology Resources (ITR) on Library Operational Efficiency (LOE) using multiple linear regression analysis. The design was chosen to test the proposed hypotheses empirically and to determine the magnitude and direction of these relationships.

The research was conducted in four accredited private university libraries in Pekanbaru, Indonesia namely, Universitas Islam Riau (UIR), Universitas Lancang Kuning (UNILAK), Universitas Muhammadiyah Riau (UMRI), and Universitas Sains dan Teknologi Indonesia (USTI)

The object of this study is the operational performance of academic libraries, focusing on how the utilization of library management systems and information technology resources influence their operational efficiency. These institutions were selected because they have implemented technology-based library management systems and employ professional librarians, making them suitable for the research objectives.

The population includes all librarians working at the four universities listed above who are directly involved in library operations and information system management. The study used a saturated sampling technique (census method), in which all 47 librarians were included as research respondents. This approach was chosen because the population size was relatively small, allowing the inclusion of the entire group to ensure comprehensive data representation.

This study consists of two independent variables and one dependent variable, as presented in Table 1.

Table 1. Research Variables and Indicators

Variable	Code	Indicators
Library Management System	X1	System performance, ease of use, data accuracy, security, service integration
Information Technology Resources	X2	Hardware availability, software support, network reliability, IT staff competence
Operational Efficiency	Y	Service speed, work effectiveness, resource utilization, service accuracy

Source: Data (2025)

Data were collected using a structured questionnaire designed on a 5-point Likert scale (ranging from 1 = strongly disagree to 5 = strongly agree). The questionnaire was distributed directly to respondents and validated by academic experts in library and information science prior to deployment. Supporting documents, institutional reports, and relevant secondary data were also analyzed to provide context. The data were analyzed using SPSS software to perform both descriptive and inferential statistical analyses, including tests for validity, reliability, and regression assumptions. The stages of analysis are as follows, content validity was verified through expert judgment, where subject-matter experts reviewed each item to ensure that it accurately represented the theoretical constructs. Items were revised or removed based on feedback. Construct validity was tested using Confirmatory Factor Analysis (CFA). An item is considered valid if:

- Factor Loading ≥ 0.50
- Kaiser-Meyer-Olkin (KMO) ≥ 0.50
- Bartlett's Test of Sphericity significance < 0.05

The results showed that all items met the statistical criteria, confirming that the questionnaire measured the intended constructs accurately. Reliability was tested using Cronbach's Alpha coefficient to assess internal consistency. A Cronbach's Alpha value ≥ 0.70 indicates acceptable reliability.

Table 2. Reliability test

Variable	No. of Items	Cronbach's Alpha	Interpretation
Library Management System (X_1)	7	0.942	Reliable
Information Technology Resources (X_2)	6	0.951	Reliable
Library Operational Efficiency (Y)	7	0.939	Reliable
Overall Instrument	**20**	**0.962**	**Highly Reliable**

Source: Data (2025)

The high Cronbach's Alpha values indicate that the measurement instrument is consistent and dependable for assessing the study variables.

Before conducting regression analysis, the classical assumptions were tested to ensure the model's validity: Normality was tested using the Kolmogorov–Smirnov test and visualized through Histogram and P–P Plot graphs. The results showed a significance value (Sig.) > 0.05, and the residual distribution followed a normal curve, confirming that the data were normally distributed.

Multicollinearity was checked by examining Variance Inflation Factor (VIF) and tolerance values. Criteria:

- VIF < 10
- Tolerance > 0.10

Both independent variables met these criteria, indicating no multicollinearity problem.

The Glejser Test and Scatterplot were used to detect heteroscedasticity. Results showed no discernible pattern and p-values > 0.05, indicating that the model was free from heteroscedasticity, fulfilling the assumption of constant variance (homoscedasticity). After verifying that all assumptions were met, the study applied Multiple Linear Regression Analysis to test the effect of Library Management System (X_1) and Information Technology Resources (X_2) on Library Operational Efficiency (Y). Hypothesis testing included;

- Partial test (t-test): to examine the individual impact of each independent variable on Y.
- Simultaneous test (F-test): to test the combined effect of X_1 and X_2 on Y.
- Coefficient of Determination (R^2): to determine the proportion of variance in Y explained by X_1 and X_2.

All diagnostic results including validity, reliability, and classical regression assumptions demonstrated that the data met the necessary statistical requirements. Therefore, the regression model is considered robust, valid, and appropriate for testing the proposed hypotheses.

4. RESULT AND DISCUSSION

4.1 Results

4.1.1 Validity Test

The validity test was conducted using Confirmatory Factor Analysis (CFA) to determine the ability of each item to represent its construct. An item is considered valid when its factor loading ≥ 0.50 and the significance level (p-value) < 0.05. All questionnaire items for the three variables (LMS, ITR, and LOE) demonstrated factor loadings between 0.71 and 0.89, exceeding the minimum threshold. The Kaiser-Meyer-Olkin (KMO) measure was 0.846, and the Bartlett's Test of Sphericity was significant at p < 0.001, confirming the adequacy of the data for factor analysis. All constructs are empirically valid and accurately measure their respective dimensions, supporting the structural integrity of the research instrument.

4.1.2 Reliability Test

The reliability test measured the internal consistency of each variable using Cronbach's Alpha. A coefficient value of ≥ 0.70 indicates acceptable reliability.

Table 3. Reliability test

Variable	No. of Items	Cronbach's Alpha	Interpretation
Library Management System (X_1)	7	0.942	Reliable

Information Technology Resources (X_2)	6	0.951	Reliable
Library Operational Efficiency (Y)	7	0.939	Reliable
Overall Instrument	**20**	**0.962**	**Highly Reliable**

Source: Data (2025)

The Cronbach's Alpha values for all variables exceed 0.90, indicating excellent internal consistency. This means the measurement items are stable and consistently capture the intended constructs

4.1.3 Regression Assumption Tests

The Kolmogorov–Smirnov test produced a significance value (Sig.) = 0.200 > 0.05, confirming that the residuals were normally distributed. The histogram and normal P–P plot further showed a bell-shaped curve, validating the assumption of normality.

a. Multicollinearity Test

Multicollinearity was assessed using Variance Inflation Factor (VIF) and Tolerance values.

Table 4. Multicollinearity test

Variable	Tolerance	VIF	Interpretation
Library Management System (X_1)	0.622	1.607	No multicollinearity
Information Technology Resources (X_2)	0.622	1.607	No multicollinearity

Source: Data (2025)

Since Tolerance > 0.10 and VIF < 10, no multicollinearity exists between the independent variables.

b. Heteroscedasticity Test

The Glejser test yielded significance values > 0.05 for all independent variables (X_1 = 0.473, X_2 = 0.289). This indicates that the residual variance is consistent (homoscedastic), confirming that the regression model does not suffer from heteroscedasticity.

4.1.4 Multiple Linear Regression Analysis

The regression analysis was conducted to examine the effect of LMS (X_1) and ITR (X_2) on LOE (Y). The regression equation derived is as follows, $Y=3.174+0.427X_1 +0.516X_2$

Table 5. Multiple Linear Regression Analysis

Variable	Coefficient (β)	t-Statistic	Sig.	Interpretation
(Constant)	3.174	—	—	—
Library Management System (X_1)	0.427	4.913	0.000	Significant
Information Technology Resources (X_2)	0.516	5.214	0.000	Significant

Source: Data (2025)

Model Summary:
- R = 0.873
- R^2 = 0.762
- Adjusted R^2 = 0.752
- $F_{(2,44)}$ = 70.431, Sig. = 0.000

The R^2 value of 0.762 indicates that 76.2% of the variation in Library Operational Efficiency can be explained jointly by the LMS and ITR variables, while the remaining 23.8% is influenced by other factors not included in this model

4.1.5 Hypothesis Testing

Table 6. Hypotesis Testing

Hypothesis	Statement	Sig. Value	Result
H_1	Library Management System (X_1) significantly affects Library Operational Efficiency (Y)	0.000	Accepted
H_2	Information Technology Resources (X_2) significantly affect Library Operational Efficiency (Y)	0.000	Accepted
H_3	LMS (X_1) and ITR (X_2) simultaneously affect Library Operational Efficiency (Y)	0.000	Accepted

Source: Data (2025)

All hypotheses (H_1, H_2, and H_3) are accepted, confirming that both independent variables individually and jointly—have significant positive effects on library operational efficiency.

4.2 Discussion

4.2.1 Effect of Library Management System on Operational Efficiency

The results demonstrate that the Library Management System (LMS) has a positive and significant effect on Library Operational Efficiency (β = 0.427, $p < 0.05$). This supports prior studies (e.g., Shanmugam, 2020; Ramadhan & Anjasmara, 2024), which found that the adoption of integrated LMS solutions enhances workflow efficiency, reduces manual errors, and improves user service quality. In Pekanbaru's private universities, effective LMS utilization allows librarians to automate cataloging, circulation, and reporting processes, leading to higher time efficiency and reduced administrative workload.

4.2.2 Effect of Information Technology Resources on Operational Efficiency

The results indicate that Information Technology Resources (ITR) significantly influence Library Operational Efficiency (β = 0.516, $p < 0.05$). This finding aligns with Wetherbe (2014) and Purwani et al. (2025), who emphasize that robust IT infrastructure, skilled staff, and adequate digital tools are essential for optimizing library operations. The higher beta coefficient (0.516) compared to LMS (0.427) suggests that the technological capacity and competence of library staff contribute more strongly to efficiency than system functionality alone.

4.2.3 Combined Influence of LMS and ITR

The simultaneous effect of LMS and ITR (F = 70.431, $p < 0.001$) demonstrates their complementary relationship. Libraries that combine well-structured management systems with reliable IT resources achieve greater automation, faster service delivery, and stronger data security. This synergy supports the Resource-Based View (RBV) theory, emphasizing that sustainable efficiency emerges when technological resources are strategically integrated and managed as core organizational capabilities.

5. Conclusion

This study examined the effect of the Library Management System (LMS) and Information Technology Resources (ITR) on Library Operational Efficiency (LOE) within private university libraries in Pekanbaru, Indonesia. The results demonstrated that both variables have a significant and positive impact, individually and collectively, on operational efficiency. The integration of an effective LMS enhances automation, accuracy, and responsiveness in library operations, while strong IT resources comprising infrastructure, software, and staff competence amplify these outcomes. Collectively, these elements account for 76.2% of the variation in operational efficiency, highlighting the central role of technology and digital capacity in improving library performance.

Theoretically, this research reinforces the Resource-Based View (RBV) framework by empirically confirming that technological and informational assets represent strategic internal

resources that contribute to organizational efficiency. The findings extend existing knowledge by positioning library systems and IT capabilities not merely as tools but as strategic enablers of institutional competitiveness in the digital era. This supports the argument that the effectiveness of academic libraries is increasingly determined by their ability to integrate technological systems with skilled human resources, aligning with broader theories of digital transformation and knowledge management.

Despite its valuable contributions, this study acknowledges several limitations. First, the research was confined to four private universities in a single city, which may limit generalizability across different institutional contexts. Second, the use of a cross-sectional survey design restricts the ability to infer long-term causal relationships between the variables studied. Third, the reliance on self-reported questionnaire data may introduce subjective bias, as respondents' perceptions may not always reflect objective operational performance. These constraints should be considered when interpreting the results.

For future research, it is recommended that scholars expand the study to include a broader geographic scope, incorporating both public and private universities across multiple regions. Longitudinal research could provide deeper insights into how technological integration influences library performance over time. Moreover, incorporating qualitative approaches such as interviews or case studies would enrich understanding of the behavioral and managerial factors influencing LMS and IT resource utilization. Future studies may also explore mediating variables such as digital literacy, innovation culture, or leadership support to gain a more comprehensive understanding of efficiency dynamics in academic libraries.

In conclusion, this study underscores the growing importance of technology-driven management in academic library operations. The successful synergy between robust IT infrastructure and an integrated library management system is proven to enhance efficiency, service quality, and institutional adaptability. The theoretical and empirical evidence presented here offers a strong foundation for universities and policymakers to prioritize digital capacity-building and sustainable innovation in library services, ensuring that academic libraries remain vital pillars of learning and research in the digital age..

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