

## **Optimization of Data-Driven School Financial Management to Improve Operational Budget Efficiency at Private Schools under the Pancasila Education Foundation, Langkat Regency**

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### **Abstract**

This study aims to analyze the effectiveness of implementing the e-RKAS (Electronic School Activity and Budget Plan) system in improving financial management efficiency at schools under the Pancasila Education Foundation in Sawit Seberang, Langkat Regency. The research uses a quantitative approach with a pre-experimental one-group pretest-posttest design, comparing conditions before and after the implementation of the e-RKAS system. The sample consisted of 25 respondents, including principals, treasurers, operators, and teachers. Measurements were carried out using four main indicators: budget realization ratio, number of budget deviations, timeliness of reporting, and user satisfaction. Data were analyzed using the Paired Sample T-Test in SPSS version 26. The findings indicate a significant improvement across all indicators after the implementation of e-RKAS ( $p < 0.05$ ). The e-RKAS system effectively enhanced budget realization accuracy, reduced deviations, accelerated financial reporting, and improved user satisfaction. These results confirm that digitalizing school financial management strengthens efficiency, transparency, and accountability in managing education funds. This study offers important implications for the development of digital transformation policies in the education sector, particularly in encouraging the adoption of e-RKAS in private schools and in regions with limited resources.

**Keywords:** e-RKAS, school financial management, budget efficiency, education digitalization, financial accountability.

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### **INTRODUCTION**

Education plays a crucial role in advancing a nation. Optimal educational quality does not rely solely on curriculum and teaching methods, but also on the ability to manage finances effectively and efficiently. Therefore, school financial management has become an increasingly significant aspect, considering the diverse sources of funding received by schools from the government, communities, and private institutions (Adzkiya et al., 2024).

A financial system functions as a mechanism that regulates and records the movement of funds within an organization or institution. Its role is vital in supporting decision-making processes and monitoring the use of financial resources. In today's digital era, advances in computerized technology across various sectors, including basic education institutions, demand attention to the ongoing dynamics of technological change and its impact on human resources. One notable form of

innovation is the adoption of web-based applications, which have become increasingly popular due to their accessibility without requiring installation. This development aligns with the growing need for efficiency in daily activities. The use of reliable computerized systems not only improves human resource performance but also accelerates the achievement of organizational goals (Wardani, 2025).

School financial management is a critical component in ensuring the effectiveness, efficiency, and accountability of school operational fund utilization. Poor financial management exposes schools to risks such as budget deviations, late reporting, and suboptimal resource use. Therefore, the implementation of data-based systems such as e-RKAS (Electronic School Activity and Budget Plan) is essential to maximize operational budget efficiency (Yadi & Mursalin, 2025).

Advancements in information technology provide opportunities for schools to shift toward more integrated and accountable digital financial management systems. A study by Lena Rusmiyati et al. (2025) in the article "Transformasi Manajemen Keuangan Sekolah di Era Digital" states that the implementation of digital financial systems such as e-RKAS and ARKAS can improve planning effectiveness, reporting efficiency, and accountability in the management of school education funds.

One of the policy instruments currently implemented by the Indonesian government is e-RKAS, an electronic school budgeting and planning system. This application is designed to improve the governance of BOS funds, making them more transparent, timely, and efficient. The World Bank's evaluation report, "Leading Schools Digitally: Evaluation of the e-RKAS System in Indonesia," indicates that schools that have implemented e-RKAS experience increased efficiency and accuracy in financial reporting (The World Bank, 2020).

However, the adoption of this system has not been evenly distributed and is not yet fully optimized, particularly in private schools that still face limitations in human resources and digital infrastructure. These schools often encounter challenges such as low digital literacy among financial administrators, limited technical training, and resistance to shifting from manual to electronic systems (Pane et al., 2025). One example is the private school under the Pancasila Education Foundation in Sawit Seberang, Langkat Regency, which began implementing e-RKAS in 2024. The school is currently transitioning from a manual financial system to a data-based system, providing an opportunity to empirically measure the extent to which e-RKAS improves operational budget efficiency, reduces budget deviations, and accelerates financial reporting accuracy.

The urgency of this research lies in supporting the transformation of financial management in private schools, particularly the Pancasila Education Foundation School in Sawit Seberang, Langkat Regency, toward a more transparent, accountable, and efficient data-based system. This study is expected to make a significant contribution to the school in developing modern and responsible financial governance. Based on this background, the research aims to analyze the optimization of data-driven school financial management through e-RKAS in improving operational budget efficiency. Additionally, the study measures changes in four key indicators: budget realization ratio, number of budget deviations, timeliness of reporting, and user satisfaction after the implementation of e-RKAS.

To measure these four indicators, the Paired Sample T-Test can be applied. This test compares two measurements taken from the same subjects. Its purpose is to determine whether the observed differences are statistically significant (Novita Sari

Maria et al., 2025). This test falls under the category of parametric statistical tests, which requires the assumption of normality to be met. If this assumption is not fulfilled, alternatives include using nonparametric tests or applying data transformation (Mustafidah et al., 2020).

## METHODOLOGY

This study employed a quantitative method using a pre-experimental design, specifically the one-group pretest-posttest design. The main characteristic of pre-experimental designs is the absence of a control group and the use of non-random sampling. In the one-group pretest-posttest design, the research is conducted through two measurement stages, namely before the intervention (pretest) and after the intervention (posttest), to examine differences in outcomes caused by the treatment (Kaporina et al., 2023). This approach was used to measure the extent to which the implementation of the e-RKAS system improved the efficiency of the school's operational budget by comparing conditions before and after system implementation.

According to Sugiyono (2021), quantitative research methods are used to study specific populations or samples, collect data using research instruments, and analyze data statistically to test predetermined hypotheses. This study was carried out at the Private School of the Pancasila Education Foundation in Sawit Seberang, Langkat Regency, which began implementing the e-RKAS system in 2024. The research location was selected using purposive sampling because the school is transitioning from a manual to a data-based digital financial system. Purposive sampling was used based on the researcher's judgment to ensure the selected site aligned with the research objectives (Arikunto, 2019).

The study population consisted of all educators and education personnel at the Private School of the Pancasila Education Foundation who were involved in or affected by the implementation of e-RKAS, namely the school treasurer, operator, principal, and teachers. Because the population size was small, the sampling technique used was total sampling, meaning the entire population (25 respondents) was included in the study. This technique aligns with Nasution (2021), who stated that total sampling is appropriate when the population is fewer than 30 individuals and all members can be fully observed. The research variable was the efficiency of the school's operational budget after the implementation of e-RKAS, measured through four main indicators (Trimilutin & Ahmad, 2025).

**Table 1.** Variables and Operational Definitions

No	Indicator	Operational Definition	Unit
1	Budget Realization Ratio (BRR)	The degree of alignment between planned funds and their actual realization in school activities.	% (score 0-100)
2	Budget Deviation (BD)	Frequency and magnitude of budget errors or misallocations. Lower values indicate higher efficiency.	% (score 0-100)
3	Timeliness of Reporting (TR)	The school's compliance in submitting financial reports on time according to the Education Office schedule.	Days of delay (converted to efficiency score 0-100)
4	System User Satisfaction (SUS)	Perceptions of principals, treasurers, operators, and teachers regarding ease, speed, and accuracy of the e-RKAS system.	Score (0-100)

Data Collection Techniques consisted of two stages of questionnaire administration:

1. Pre-test → conducted before the implementation of e-RKAS (first month).
2. Post-test → conducted three months after training and implementation.

The questionnaire was selected because it can quantitatively measure attitudes and perceptions (Joshi et al., 2015). Data were analyzed using parametric statistics because the 0–100 scoring scale is interval and met normality assumptions. Documentation included secondary data from budget realization reports, school RKAS documents, and BOS and SPP financial reports before and after e-RKAS implementation. Interviews were conducted with the school principal, treasurer, and e-RKAS operator to strengthen quantitative findings.

The research instrument was a closed-ended questionnaire using a numerical scale (0–100) based on the four indicators of data-based school financial efficiency:

1. Budget Realization Ratio (BRR)
2. Budget Deviation (BD)
3. Timeliness of Reporting (TR)
4. System User Satisfaction (SUS)

Each indicator consisted of four items, producing a total of 16 items. Respondents assigned a score between 0 and 100 for each statement, with the following interpretation:

1. 0–49 = Low / Inefficient
2. 50–74 = Moderately Efficient
3. 75–100 = Highly Efficient

Final scores for each indicator were calculated using the mean of the four items, for example:

$$RRA_i = \frac{RRA_{1i} + RRA_{2i} + RRA_{3i} + RRA_{4i}}{4}$$

The average values from pre-test and post-test were then analyzed. Data Analysis was performed using the Paired Sample T-Test with SPSS version 26. Before conducting the test, normality of pre-test and post-test scores was assessed using the Shapiro–Wilk test because the sample size was < 50 (Sugiyono, 2021). Decision criteria: (1) Sig. > 0.05 → data are normally distributed, (2) Sig. ≤ 0.05 → data are not normally distributed, and analysis proceeds with the Wilcoxon Signed-Rank Test.

If the data met the normality assumption, the Paired Sample T-Test was applied. According to Putri et al. (2023), this test is used to compare two mean values from the same group measured at two different times. The hypotheses tested were: Null Hypothesis ( $H_0$ ): There is no significant difference between pre-test and post-test results after implementing e-RKAS ( $p\text{-value} > 0.05$ ). Alternative Hypothesis ( $H_1$ ): There is a significant difference between pre-test and post-test results after implementing e-RKAS at the Private School of the Pancasila Education Foundation, Sawit Seberang, Langkat Regency.

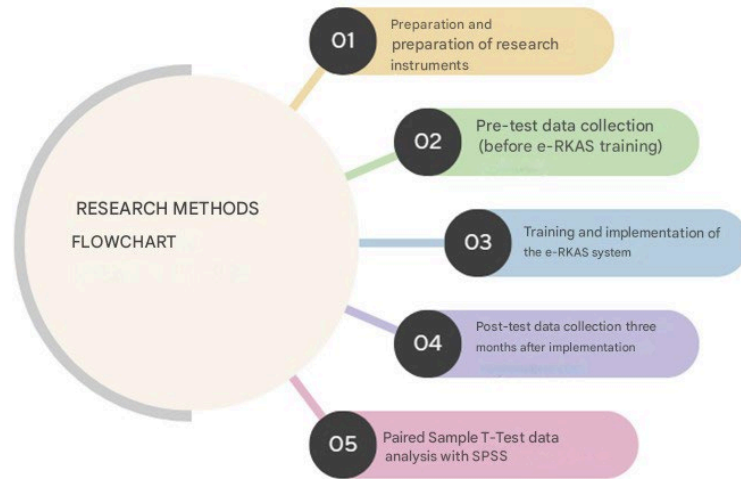


Figure 1. Method Flowchart

## RESULTS AND DISCUSSION

### Budget Realization Ratio (BRR)

Before testing the hypothesis, a normality test was conducted on the pretest and posttest data using the Shapiro–Wilk test.

Table 2. Shapiro–Wilk Normality Test for BRR

Group	W (Shapiro–Wilk)	p-value	Description
Budget Realization Ratio (BRR Pretest)	0.961	0.443	Normally Distributed
Budget Realization Ratio (BRR Posttest)	0.962	0.460	Normally Distributed

The normality test results show that the pretest data had a W value of 0.961 with a p-value of 0.443, while the posttest data had a W value of 0.962 with a p-value of 0.460. Since both p-values are greater than 0.05, the pretest and posttest data are normally distributed. Therefore, further analysis can be conducted using parametric statistical testing. To determine whether there is a significant difference between the pretest and posttest values, a paired t-test was performed with a significance level of 5% (0.05).

Table 3. Paired Sample T-Test for BRR

Test	Statistic	Value	Conclusion
Paired Sample T-Test	t	-50.020	p-value < 0.05 → Alternative hypothesis (H1) accepted
	df	24	
	p-value	0.000	
	CI (95%)	[-17.410-16.030]	

The t-test results indicate that  $t = -50.020$  with degrees of freedom ( $df$ ) = 24 and a p-value = 0.000. Since the p-value is less than 0.05, it can be concluded that there is a significant difference between the pretest and posttest results. The 95% confidence interval for the difference in mean values falls between -17.410 and -16.030, indicating a statistically significant negative difference between the pretest and posttest scores. The mean difference of -16.720 confirms an increase in scores after the intervention.

Based on the analysis, it can be concluded that there was a significant improvement in the posttest scores compared with the pretest scores. This finding indicates that the intervention provided during the study had a positive effect on the alignment between planned and realized funds in school activities. The results

demonstrate that the implementation of e-RKAS had a significant impact on improving the financial management efficiency of the Pancasila Education Foundation School in Sawit Seberang, Langkat, as measured through the Budget Realization Ratio (BRR). These findings align with Suteja & Safuan (2025), who reported that schools implementing e-RKAS experienced greater transparency, efficiency, and accountability in managing BOS funds compared with those still using manual systems.

### Budget Deviation (BD)

Before testing the hypothesis, a normality test was conducted on the pretest and posttest data using the Shapiro–Wilk test.

**Table 4.** Shapiro–Wilk Normality Test for BD

Group	W (Shapiro–Wilk)	p-value	Description
Budget Deviation (BD Pretest)	0.962	0.450	Normally Distributed
Budget Deviation (BD Posttest)	0.947	0.217	Normally Distributed

Based on the results above, the p-values for both the BD pretest data (0.450) and the BD posttest data (0.217) are greater than  $\alpha = 0.05$ , indicating that both datasets are normally distributed. Thus, the normality assumption is met, and the analysis can proceed with the parametric Paired Sample T-Test.

**Table 5.** Paired Sample T-Test for BD

Test	Statistic	Value	Conclusion
Paired Sample T-Test	t	71.548	p-value < 0.05 → Alternative hypothesis ( $H_1$ ) accepted
	df	24	
	p-value	0.000	
	CI (95%)	[23.774–25.186]	

Based on the Paired Sample T-Test results, the value of  $t = 71.548$  with a p-value = 0.000 (< 0.05). This indicates that  $H_0$  is rejected and  $H_1$  is accepted, meaning there is a significant difference in the number of budget deviations before and after the implementation of e-RKAS.

The 95% Confidence Interval (23.774 to 25.186) does not include zero, further confirming that the difference between the two measurements is real and did not occur by chance.

These results demonstrate that the implementation of e-RKAS significantly reduced the frequency and magnitude of budget deviations or misallocations during the budgeting period at the Pancasila Education Foundation School in Sawit Seberang, Langkat. This finding aligns with The World Bank (2020), which reported that the implementation of ARKAS/e-RKAS reduces input errors, accelerates reporting, and increases transparency and accuracy in the use of BOS and tuition funds.

### Timeliness of Reporting (TR)

Before testing the hypothesis, a normality test was conducted on the pretest and posttest data using the Shapiro–Wilk test.

**Table 6.** Shapiro–Wilk Normality Test for TR

Group	W (Shapiro–Wilk)	p-value	Description
Timeliness of Reporting (TR Pretest)	0.943	0.173	Normally Distributed
Timeliness of Reporting (TR Posttest)	0.880	0.077	Normally Distributed

Based on the Shapiro–Wilk test results in Table 6, the p-values for the TR pretest (0.173) and TR posttest (0.077) are both greater than  $\alpha = 0.05$ . This indicates that the data are normally distributed. In other words, the distribution of reporting timeliness scores, both before and after the implementation of e-RKAS, does not significantly deviate from a normal distribution.

Thus, the normality assumption is met, and the analysis can proceed using the parametric Paired Sample T-Test to examine differences between the two conditions.

**Table 7.** Paired Sample T-Test for TR

Test	Statistic	Value	Conclusion
Paired Sample T-Test	t	27.676	p-value < 0.05 → alternative hypothesis (H <sub>1</sub> ) accepted
	df	24	
	p-value	0.000	
	CI (95%)	[7.292–8.468]	

The Paired Sample T-Test results show  $t = 27.676$  with a p-value of 0.000 ( $< 0.05$ ). This indicates that the null hypothesis (H<sub>0</sub>) is rejected and the alternative hypothesis (H<sub>1</sub>) is accepted. Therefore, there is a statistically significant difference in reporting timeliness before and after the implementation of e-RKAS.

The 95% confidence interval (7.292–8.468), which does not include zero, further supports that the observed change is real and not due to chance. The positive t-value indicates an improvement in financial reporting performance, where reporting became more efficient and timely after the implementation of the e-RKAS system at the Pancasila Education Foundation School in Sawit Seberang, Langkat.

These findings are consistent with Lena Rusmiyati et al. (2025), who reported that the use of ARKAS/e-RKAS improves the efficiency of BOS fund reporting because data can be automatically compiled, reducing delays and strengthening financial accountability.

### System User Satisfaction (SUS)

Before testing the hypothesis, a normality test was conducted on the pretest and posttest data using the Shapiro–Wilk test.

**Table 8.** Shapiro–Wilk Normality Test for SUS

Group	W (Shapiro–Wilk)	p-value	Description
System User Satisfaction (SUS Pretest)	0.950	0.257	Normally Distributed
System User Satisfaction (SUS Posttest)	0.980	0.887	Normally Distributed

Based on Table 8, the normality test results show that the SUS pretest had a W value of 0.950 with a p-value of 0.257, while the SUS posttest had a W value of 0.980 with a p-value of 0.887. Since both p-values are greater than 0.05, it can be concluded that the data are normally distributed before and after the intervention. These results indicate that the System User Satisfaction data meet the normality assumption, meaning the distribution does not significantly deviate from a normal curve. Therefore, parametric analysis such as the Paired Sample T-Test is appropriate for further testing.

**Table 9.** Paired Sample T-Test for SUS

Test	Statistic	Value	Conclusion
Paired Sample T-Test	t	-62.062	p-value < 0.05 → alternative hypothesis (H <sub>1</sub> ) accepted
	df	24	
	p-value	0.000	

CI (95%) [-21.740-20.340]

The results of the Paired Sample T-Test show that  $t = -62.062$  with a  $p$ -value =  $0.000 (< 0.05)$ . This means  $H_0$  is rejected and  $H_1$  is accepted, indicating a statistically significant difference in user satisfaction before and after the implementation of e-RKAS.

The 95% confidence interval (-21.740 to -20.340), which does not cross zero, further confirms that this difference is real and not due to chance. The negative  $t$ -value indicates a significant increase in average user satisfaction scores after the implementation of e-RKAS, because the posttest scores were higher than the pretest scores.

Thus, it can be concluded that the implementation of e-RKAS significantly improved system user satisfaction in terms of ease of use, access speed, and accuracy of generated financial data at the Pancasila Education Foundation School in Sawit Seberang, Langkat. These findings align with Hidayah et al. (2024), who reported that user satisfaction with e-RKAS was in the high category, with influential factors including ease of access, intuitive system interface, and improved efficiency in financial reporting.

## CONCLUSION

Based on the results of the Paired Sample T-Test analysis, this study demonstrates that the implementation of e-RKAS (Electronic School Activity and Budget Plan) has a significant impact on improving financial management efficiency at the Pancasila Education Foundation School in Sawit Seberang, Langkat Regency. All four indicators tested showed clear differences before and after system implementation, indicating that digitalizing school financial management can generate measurable positive changes.

First, the Budget Realization Ratio (BRR) showed a significant improvement after the implementation of e-RKAS ( $t = -50.020$ ;  $p < 0.05$ ), indicating better alignment between planned budgets and actual expenditures. This reflects improved efficiency in school financial management, which had previously been less optimal.

Second, for the Budget Deviation (BD) indicator, the analysis revealed a significant decrease after e-RKAS implementation ( $t = 71.548$ ;  $p < 0.05$ ). This means that the frequency of allocation errors and budget deviations declined because the system supports automated validation and transaction recording processes.

Third, the Timeliness of Reporting (TR) indicator also showed a significant improvement ( $t = 27.676$ ;  $p < 0.05$ ). After the implementation of e-RKAS, financial reporting became faster, more punctual, and more efficient because the system is capable of automatically compiling data. This reflects stronger administrative discipline and enhanced accountability in reporting.

Fourth, the System User Satisfaction (SUS) indicator demonstrated a significant difference with  $t = -62.062$  and  $p$ -value =  $0.000$ , indicating a substantial increase in satisfaction levels after the implementation of e-RKAS. Teachers, treasurers, and principals experienced greater ease of use, faster access, and more accurate financial data output. This shows that the success of digital transformation in financial management is not only measured by technical efficiency but also by user acceptance and comfort.

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