

THE INFLUENCE OF APPARATUS HUMAN RESOURCE QUALITY AND BUDGET MANAGEMENT EFFECTIVENESS ON SMART CITY IMPLEMENTATION IN LHOKSEUMAWA CITY

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ABSTRACT

This study aims to analyze the influence of the quality of apparatus human resources (HR) and the effectiveness of budget management on the implementation of Smart City in Lhokseumawe City, both simultaneously and partially. An associative quantitative approach was employed, using a census method covering 50 employees of the Regional Financial Management Agency (BPKD) of Lhokseumawe City. Likert-scale questionnaires were transformed using the Successive Intervals Method (MSI) prior to analysis with multiple linear regression. All instruments satisfied valid and reliable criteria. Classical assumption tests confirmed normal residual distribution, absence of multicollinearity, and homoscedasticity. The F-test revealed that HR quality and budget management effectiveness simultaneously exerts a positive and significant influence on Smart City implementation. Partially, HR quality and budget management effectiveness each exhibit a positive and significant effect. The adjusted R^2 indicates that both variables explain 66.6% of the variance in Smart City implementation. These findings imply that simultaneously improving HR competence alongside strengthening budget management effectiveness represents a key strategy for enhancing Smart City implementation in Lhokseumawe City.

Keywords: HR Quality; Budget Management Effectiveness; Smart City Implementation; BPKD; Multiple Linear Regression

A. Introduction

The rapid advancement of information and communication technology has brought about fundamental changes in governance, particularly regarding public services and regional development. Local governments are required to adapt to these dynamics to ensure that governance functions effectively, efficiently, transparently, and accountably. One strategic adaptation available to local

governments is the implementation of the "Smart City" concept—an urban development approach grounded in the use of digital technology.

At its core, the Smart City concept represents an effort to integrate information technology into governance systems to enhance bureaucratic performance, the quality of public services, and community well-being. Smart City implementation does not focus solely on technological sophistication; it also demands a governance framework that is integrated, responsive, and oriented toward the needs of the community.

In Indonesia, Smart City implementation is not merely a voluntary initiative but is backed by a formal legal framework that is binding on all local governments. Presidential Regulation Number 95 of 2018 concerning the Electronic-Based Government System (SPBE) mandates that all government agencies—including local governments—integrate information technology into their administrative and operational processes. As part of the national movement toward "100 Smart Cities" initiated by the Ministry of Communication and Informatics, the Lhokseumawe City Government is bound by this regulatory framework.

Successful Smart City implementation cannot rely solely on the availability of technological infrastructure. Two key factors largely determine the extent to which a Smart City program can operate optimally at the local government level: the quality of the civil service workforce and the effectiveness of budget management. These two factors are interconnected and directly influence the local government's capacity to plan, operate, and sustain the Smart City program comprehensively. The quality of government personnel is a key determinant in the successful implementation of a Smart City. Officials possessing adequate competence, technical skills, and digital literacy are better equipped to manage the technology-based systems established within the Smart City framework. Conversely, limited personnel competence can hinder the optimal use of technological systems, even when the available infrastructure is adequate. Pratama and Nugroho (2020) found that the quality of government personnel is a primary factor in the success of electronic government systems; officials with sufficient digital literacy and technical competence proved capable of operating systems optimally, resulting in more efficient and targeted public services. Aligning with these findings, Sari (2021) emphasizes that low personnel capacity directly impedes the use of technology in public services, regardless of the scale of infrastructure investment.

In Lhokseumawe City, efforts to implement a Smart City have begun to materialize through various technology-based public service initiatives, such as the development of the Simpati and Sindang applications to support data integration and government activity planning (Antara, 2024). However, implementation on the ground has not yet reached optimal levels. This is evident from the uneven utilization of digital systems across regional government agencies and disparities in the ability of personnel to operate and manage the provided technology.

In addition to personnel quality, effective budget management is a crucial factor determining the success of Smart City implementation. Smart City programs generally require substantial investment, covering information technology

infrastructure procurement, public service application development, and personnel capacity building. Data on Lhokseumawe City's Locally-Generated Revenue (PAD) realization indicates that, from 2019 to 2024, actual revenue has consistently failed to meet established targets. In 2022, the realization of Locally-Generated Revenue (PAD) reached only IDR 68.21 billion against a target of IDR 88.26 billion (77.28 percent), whereas in 2023, realization stood at IDR 67.90 billion against a target of IDR 75.12 billion (90.39 percent) (BPKD Lhokseumawe, 2024). This situation indicates that the fiscal capacity of Lhokseumawe City still faces significant limitations.

B. Research Method

This study employs a quantitative approach with an associative research design. The independent variables are the quality of bureaucratic human resources (X_1) and the effectiveness of budget management (X_2), while the dependent variable is the implementation of the Smart City concept (Y) in Lhokseumawe City. The research population consists of all 50 employees at the Lhokseumawe City Regional Financial Management Agency (BPKD), comprising civil servants (PNS), government employees with work agreements (PPPK), and honorary staff. A saturated sampling technique (census) was used, meaning all 50 employees served as the research sample (Sugiyono, 2022).

The research instrument consists of a five-point Likert scale questionnaire (ranging from Strongly Agree = 5 to Strongly Disagree = 1), developed based on the indicators for each variable. Variable X_1 is measured via 9 statements covering the dimensions of knowledge (3 items), skills (3 items), and work attitude (3 items). Variable X_2 is measured via 9 statements covering budget planning (3 items), budget execution (3 items), and supervision and accountability (3 items). Variable Y is measured via 9 statements covering smart governance (3 items), smart public services (3 items), and technological infrastructure readiness (3 items).

Prior to use, the instrument underwent validity testing using corrected item-total correlation (calculated r -value > table r -value of 0.2787) and reliability testing using Cronbach's Alpha (> 0.70). Ordinal data were then transformed into an interval scale using the Method of Successive Intervals (MSI) before being analyzed via multiple linear regression using SPSS. Classical assumption tests included the normality test (Kolmogorov-Smirnov), multicollinearity test (VIF and Tolerance), and heteroscedasticity test (Glejser). The research model is formulated as follows: $Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + e$, where Y represents Smart City implementation, X_1 represents the quality of bureaucratic human resources, X_2 represents the effectiveness of budget management, β_0 is the constant, β_1 and β_2 are regression coefficients, and e is the error term. Hypothesis testing was conducted using the F-test (simultaneous) at a significance level of $\alpha = 0.05$ and the t-test (partial) at a significance level of $\alpha = 0.05$.

D. Results and Discussion

This study was conducted at the Regional Financial and Asset Management Agency (BPKAD) of Lhokseumawe City, a Regional Government Agency (OPD) within the Lhokseumawe City Government. BPKAD is tasked with assisting the

Mayor in carrying out governmental affairs related to regional financial and asset management, in accordance with statutory regulations. In performing its duties, BPKAD plays a role in budget planning, budget execution, financial administration, reporting, and regional financial accountability. In line with the digitalization of government, BPKAD Lhokseumawe supports the implementation of the "Smart City" concept by utilizing information systems and technology in regional financial management; this aims to enhance effectiveness, efficiency, transparency, and accountability, thereby fostering good governance.

The study involved 50 respondents, comprising the entire staff of BPKAD Lhokseumawe: 25 from the Budget Division, 15 from the General Affairs Section, and 10 from the Secretariat Section.

Table 1 Respondent Characteristic

No	Gender	Total (people)	Percent (%)
1	Male	23	46
2	Female	27	54
	Total	50	100

Source: Research Results, 2026

Based on Table 1, out of 50 respondents, 23 (46%) were male and 27 (54%) were female, indicating that the composition of BPKD Lhokseumawe City employees in this study was dominated by female.

Table 2 Respondent Characteristic

No	Age	Total (people)	Percent (%)
1	< 20 year	2	4
2	20–30 year	17	34
3	31–40 year	24	48
4	> 40 year	7	14
	Total	50	100

Source: Research Results, 2026

Based on Table 2, the majority of respondents fall into the 31–40 age group (24 individuals or 48%), followed by the 20–30 age group (17 individuals or 34%), the group aged over 40 (7 individuals or 14%), and the group aged under 20 (2 individuals or 4%). These data indicate that the majority of the personnel involved in this study are of productive age and possess relatively mature work experience.

Table 3 Respondent Characteristic

No	Work of Duration	Total (People)	Percent (%)
1	< 1 year	6	12
2	1 – 5 year	19	38
3	> 5 year	25	50

Total	50	100
Source: Research Results, 2026		

Based on Table 3, the largest group of respondents (25 individuals or 50%) had more than five years of work experience, followed by those with one to five years of experience (19 individuals or 38%) and those with less than one year of experience (6 individuals or 12%). This relatively high level of work experience reflects the staff's adequate capacity to support the execution of government duties.

Instrument Test Results

Validity testing was conducted using corrected item-total correlation, with an r-table value of 0.2787 (df = 48, $\alpha = 5\%$). The validity test results indicate that all statement items across the three variables yielded r-calculated values greater than the r-table value of 0.2787.

Table 4 Summary of Validity Test Results

Variable	rstat	rtab	Note
Quality of Civil Service Human Resources (X1)	0,9493 – 0,9852	0,2787	Valid
Budget Management Effectiveness (X2)	0,9552 – 0,9847	0,2787	Valid
Smart City Implementation (Y)	0,9500 – 0,9805	0,2787	Valid
Source: Research Results, 2026			

Reliability test results using Cronbach's Alpha indicate that all variables have values well above the minimum threshold of 0.70.

Table 5 Reliability Test Results

No	Variable	Cronbach's Alpha	Standard	Note
1	Quality of Civil Service Human Resources (X1)	0,9918	0,70	Reliabel
2	Budget Management Effectiveness (X2)	0,9937	0,70	Reliabel
3	Smart City Implementation (Y)	0,9905	0,70	Reliabel
Source: Research Results, 2026				

Data Transformation using the Method of Successive Intervals (MSI)

Data obtained from research questionnaires were initially on an ordinal scale (Likert scale 1–5). To enable analysis using parametric statistical methods—specifically multiple regression analysis—the ordinal data were first transformed into interval-scale data using the Method of Successive Intervals (MSI). The MSI

procedure involved the following steps: (1) calculating the frequency of each score; (2) calculating proportions; (3) calculating cumulative proportions; (4) determining the density values of the normal distribution function; (5) calculating the Scale Value (SV); and (6) determining the Transformed Value (TV) by shifting the SV values so that the minimum value became 1. For instance, the MSI transformation for item X1_1 yielded the following results: an ordinal score of 2 became 1.0000; a score of 3 became 2.1459; a score of 4 became 3.0392; and a score of 5 became 4.0606. The Transformed Values (TV) resulting from the MSI transformation were subsequently used in place of the ordinal data for all further statistical analyses.

Classical Assumption Test Results

Normality Test through The Kolmogorov-Smirnov normality test yielded a Test Statistic value of 0.069 and an Asymp. Sig. (2-tailed) value of 0.200 (> 0.05); therefore, the residuals are considered normally distributed, and the normality assumption is met.

Table 6 Normality Test Results (Kolmogorov-Smirnov)

Note	Unstandardized Residual
N	50
Test Statistic	0,069
Asymp. Sig. (2-tailed)	0,200
Resume	Normal distribution

Source: Research Results, 2026

Multicollinearity Test, shows a Tolerance value of 0.643 (> 0.10) and a VIF of 1.556 (< 10) for both independent variables; therefore, there is no indication of multicollinearity between variables X1 and X2.

Table 7 Multicollinearity Test Results

Variable	Tolerance	VIF	Note
Quality of Civil Service Human Resources (X1)	0,643	1,556	NO Multikolinearitas
Budget Management Effectiveness (X2)	0,643	1,556	NO Multikolinearitas

Source: Research Results, 2026

Heteroskedasticity Test through The Glejser test for heteroskedasticity yielded significance values of 0.883 for variable X1 and 0.857 for variable X2; since both values exceed 0.05, heteroskedasticity is absent, and the assumption of homoskedasticity is met

Table 8 Heteroskedasticity Test Results (Uji Glejser)

Variable	t	Sig.	Note
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Quality of Civil Service Human Resources (X ₁)	-0,148	0,883	FREE Heteroskedastisitas
Budget Management Effectiveness (X ₂)	-0,182	0,857	FREE Heteroskedastisitas

Source: Research Results, 2026

Multiple Linear Regression Analysis Results

Multiple linear regression analysis was used to determine the influence of the variables "Quality of Apparatus Human Resources" (X₁) and "Budget Management Effectiveness" (X₂) on the variable "Smart City Implementation" (Y), both simultaneously and partially.

Table 9 Multiple Linear Regression Analysis Results

Variable	Coefficient B	Std. Error	Beta	t	Sig.
Constanta	2,748	2,664	--	1,032	0,308
Quality of Civil Service Human Resources (X ₁)	0,587	0,102	0,591	5,738	0,000
Budget Management Effectiveness (X ₂)	0,313	0,100	0,322	3,129	0,003

Source: Research Results, 2026

Based on Table 9, the multiple linear regression equation obtained is: $\hat{Y} = 2.748 + 0.587 X_1 + 0.313 X_2 + \epsilon$. The constant value of 2.748 indicates that when both independent variables are zero, the value of Smart City implementation is 2.748. The coefficient for X₁ (0.587) means that a one-unit increase in the quality of bureaucratic human resources leads to a 0.587-unit increase in Smart City implementation (*ceteris paribus*). The coefficient for X₂ (0.313) indicates that a one-unit increase in the effectiveness of budget management results in a 0.313-unit increase in Smart City implementation. The fact that the coefficient for X₁ is larger than that for X₂ suggests that the quality of bureaucratic human resources exerts a relatively more dominant influence on Smart City implementation.

Table 10 F-test Results

Model	Sum Squares	of df	Mean Square	F_stat	Sig.
Regression	2232,577	2	1116,289	49,909	0,000
Residual	1051,226	47	22,367	--	--
Total	3283,804	49	--	--	--

Source: Research Results, 2026

Based on Table 10, the calculated F-value is 49.909 with a significance level of 0.000 (< 0.05). The calculated F-value (49.909) far exceeds the F-table value of 3.1951 at $\alpha = 5\%$ ($df_1 = 2$; $df_2 = 47$). Consequently, H_0 is rejected and H_1 is accepted, indicating that the quality of bureaucratic human resources (X_1) and the effectiveness of budget management (X_2) simultaneously have a positive and significant effect on Smart City implementation (Y) in Lhokseumawe City.

Table 11 T-test Results

Variable	t_stat	t_table	Sig.	Note
Quality of Civil Service Human Resources (X_1)	5,738	2,0117	0,000	Has a significant effect (+)
Budget Management Effectiveness (X_2)	3,129	2,0117	0,003	Has a significant effect (+)

Source: Research Results, 2026

The variable of bureaucratic human resource quality (X_1) yielded a calculated t-value of 5.738 (greater than the t-table value of 2.0117) with a significance level of 0.000 (less than 0.05); thus, H_2 is accepted: the quality of bureaucratic human resources has a positive and significant partial effect on Smart City implementation. The variable of budget management effectiveness (X_2) yielded a calculated t-value of 3.129 (greater than the t-table value of 2.0117) with a significance level of 0.003 (less than 0.05); thus, H_3 is accepted: the effectiveness of budget management has a positive and significant partial effect on Smart City implementation.

Table 12 Coefficient of Determination Results

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	0,825	0,680	0,666	4,7293

Source: Research Results, 2026

The Adjusted R^2 value of 0.666 indicates that the variables of bureaucratic human resource quality and budget management effectiveness, taken together, explain 66.6% of the variation in Smart City implementation at the Lhokseumawe City BPKD. Meanwhile, the remaining 33.4% is explained by factors outside this research model, such as leadership commitment, organizational culture, the quality of technological infrastructure, and internal control systems.

The Simultaneous Influence of Apparatus Human Resource Quality and Budget Management Effectiveness on Smart City Implementation

Simultaneous testing results demonstrate that the quality of apparatus human resources and the effectiveness of budget management jointly exert a positive and significant influence on Smart City implementation ($F = 49.909$; $\text{Sig.} = 0.000$). These findings indicate that the success of Smart City implementation is not determined by any single factor in isolation but is the result of synergy between

apparatus competence and the availability of effectively managed budgets. Personnel possessing the requisite knowledge, skills, and positive work attitudes are better equipped to optimally utilize digital-based information systems. Conversely, effective budget management ensures the availability of financial resources needed to support infrastructure development and the sustainable operation of Smart City programs.

These findings align with Putri and Wijaya (2022), who demonstrated that human resource readiness and budgetary support are determining factors in the success of Smart City implementation. Maulana (2023) also established that the synergy between apparatus competence and financial governance simultaneously exerts a significant influence on the performance of local government organizations. In public sector management theory, the success of modern governance is determined not solely by the adoption of technology, but also by the quality of the human resources managing that technology and the availability of adequate budgets (Anthopoulos, 2017). The Adjusted R^2 value of 0.666 reinforces the argument that these two variables substantially explain the variation in Smart City implementation.

The Partial Effect of Civil Servant Human Resource Quality on Smart City Implementation

Individually, the quality of civil servant human resources was found to have a positive and significant effect on Smart City implementation ($\beta = 0.587$; $t = 5.738$; Sig. = 0.000). The regression coefficient of 0.587 represents the highest value in the model, indicating that the quality of civil servant human resources is the dominant predictor. Civil servants possessing strong competence, knowledge, and skills are better equipped to operate, manage, and optimize the various information technology-based systems that form the backbone of the Smart City program. This finding carries a significant implication: investing in the enhancement of civil servant competence—particularly through education and digital literacy training—yields a greater impact in driving the successful implementation of Smart Cities.

These results align with the findings of Pratama and Nugroho (2020), who stated that the quality of civil servant human resources is a primary determinant of success in implementing electronic-based government systems. Sari (2021) further emphasized that adequate civil servant capacity directly improves the quality of information technology-based public services. Theoretically, this can be explained through Sedarmayanti's (2013) framework of civil servant competence: robust knowledge of regulations and digital technology enables civil servants to utilize Smart City systems optimally; technical skills facilitate the operation of digital platforms; and a disciplined, adaptive work attitude ensures the sustainability of the Smart City program according to plan.

The Partial Effect of Budget Management Effectiveness on Smart City Implementation

Budget management effectiveness has a positive and significant partial effect on Smart City implementation ($\beta = 0.313$; $t = 3.129$; $\text{Sig.} = 0.003$). Effective budget management—encompassing the dimensions of planning, execution, and oversight/accountability—is proven to enhance the smooth and optimal execution of Smart City programs. Effective budget management ensures that fund allocations for technology infrastructure development, information system procurement, digital device maintenance, and human resource training are carried out in a timely and targeted manner, in accordance with established plans.

These findings align with Wijaya (2022), who states that the budget is a key factor influencing the success of Smart City implementation in local government. Hidayat and Ramadhan (2022) also demonstrated that budget management effectiveness positively impacts regional development performance. Anthopoulos (2017) emphasizes that effective budget management is a crucial prerequisite for optimal and sustainable Smart City implementation. Although the coefficient for X_2 (0.313) is lower than that for X_1 (0.587), the effect remains substantial and statistically significant, indicating that without well-managed budgets, even competent human resources would be unable to implement Smart Cities optimally.

D. Conclusions and Recommendations

Based on the research findings and discussion, three main conclusions can be drawn. First, the quality of bureaucratic human resources and the effectiveness of budget management simultaneously exert a positive and significant influence on Smart City implementation at the Lhokseumawe City BPKD ($F = 49.909$; $\text{Sig.} = 0.000$; Adjusted $R^2 = 0.666$). Together, these two variables explain 66.6% of the variation in Smart City implementation, while the remaining 33.4% is influenced by factors not examined in this study.

Second, the quality of bureaucratic human resources has a positive and significant partial effect on Smart City implementation, exhibiting the largest regression coefficient ($\beta = 0.587$; $t = 5.738$; $\text{Sig.} = 0.000$), which confirms its position as the dominant predictor. The results indicate that higher quality bureaucratic human resources—encompassing knowledge, skills, and work attitudes regarding information technology—lead to greater success in Smart City implementation. Enhancing the capacity and competence of the bureaucracy is a key factor in realizing an effective and sustainable Smart City.

Third, the effectiveness of budget management has a positive and significant partial effect on Smart City implementation ($\beta = 0.313$; $t = 3.129$; $\text{Sig.} = 0.003$). The findings show that more effective budget management—covering planning, execution, oversight, and accountability—results in smoother and more optimal Smart City implementation. Strengthening budget governance to ensure it is effective, transparent, and accountable is a crucial factor in supporting the successful implementation of the Smart City initiative in Lhokseumawe City.

Based on the research findings, it is recommended that the Lhokseumawe City Regional Financial and Asset Management Agency (BPKD) and the Lhokseumawe City Government: (1) prioritize continuous programs to enhance civil

servant competence—specifically regarding digital literacy, the utilization of Smart City technology, and regulatory understanding—given that the quality of human resources has proven to be a dominant predictor of successful Smart City implementation; (2) strengthen the mechanisms for planning, budgeting, execution, and oversight regarding funds allocated for Smart City programs to ensure financial resources are utilized effectively and accountably; and (3) optimize Smart City implementation by bolstering information technology infrastructure, integrating digital service systems across agencies, and conducting periodic evaluations of ongoing programs. Future researchers are advised to incorporate variables such as leadership commitment, organizational culture, or internal control systems, and to expand the scope of the study to include all regional government agencies (OPD) in Lhokseumawe City.

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