

Analysis of Budget Planning, Project Completion Time, and Infrastructure Quality on Budget Efficiency and Effectiveness

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Abstract

The budget is an integral part of a financial plan that reflects institutional policy decisions over a specific period. As an economic policy instrument, the budget plays a crucial role in income distribution and in promoting economic growth and stability. Within the framework of regional autonomy, budget management is carried out independently by local governments to prevent the concentration of power in the central government. This decentralization is expected to encourage more effective, efficient, and transparent public service delivery. This study was motivated by a research gap in the implementation of infrastructure projects, where the planning and document preparation processes are often carried out simultaneously with the physical implementation of the project. This has the potential to cause budget inefficiency and reduce the effectiveness of project achievement. This study aims to analyze the influence of Budget Planning, Project Completion Time, and Infrastructure Quality on Budget Efficiency and Effectiveness in infrastructure projects managed by the Public Works, Highways, and Water Resources Agency of Sidoarjo Regency. This study employs a quantitative approach, utilizing Partial Least Squares Structural Equation Modeling (PLS-SEM) analysis via SmartPLS software. The sample consists of 100 respondents selected using total sampling, as the entire relevant population was included as respondents.

Keywords: *Budget Planning; Project Completion Time; Infrastructure Quality; Budget Efficiency; Budget Effectiveness; PLS-SEM; Total Sampling.*

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INTRODUCTION

The public sector budget is used for accountability and management, as well as to implement programs funded by the government budget. The government uses the expenditure budget to fund programs and activities that affect public services, either directly or indirectly. An important part of the Regional Revenue and Expenditure Budget (APBD) is the budget. The budget is part of a financial plan that shows the policy decisions of an institution for the future. (J. Kanalung et al., 2018). The budget serves as a key economic policy tool to help achieve income equality and foster economic growth and stability. By utilizing available resources, regional development is undertaken to enhance the community's well-being. These resources include issues such as income, employment opportunities, business opportunities,

ineffective coordination and communication systems, and limitations in human resource knowledge. The completion of infrastructure projects is subject to time constraints and reporting requirements related to whether the funds have been optimally utilized. The budget implementation report presents a comparison between the budget and actual implementation during a specified reporting period. The purpose of budget implementation reporting is to provide regular information on the implementation of the budget (Y. Purwadi & M. Sari, 2015).

The implementation of Law No. 33 of 2004, along with the enactment of Law No. 23 of 2014, states that authority and rights for development are granted to local governments from the central government. However, what is more important is that local governments can manage the development process more effectively and efficiently because they better understand the needs and issues in their respective areas (R. Rahayu, 2016). Financial budget management is carried out independently to achieve decentralization, thereby preventing the concentration of power in one party, namely the central government. Decentralization is expected to function as a link in the process of transferring power and producing more effective and transparent services to the community. The government budget must involve regional financial management, including procedures for determining the amount of funds to be allocated to programs and activities funded by public money (D. Epriad & U. Harma, 2020). Local financial budgets are divided into two forms: the first is control, which shows how the government must achieve specific objectives. The second is planning, which outlines how public funds must be allocated, as authorized by the legislative body. One of the key components in economic development and community welfare is infrastructure development, specifically the construction of public facilities and infrastructure essential to the community. Adequate infrastructure enables people to access basic services, including education, healthcare, and economic opportunities (N. (Awainah et al., 2024). As in Sidoarjo Regency, the Public Works, Road Construction, and Water Resources Agency of Sidoarjo Regency has primary duties and functions based on Sidoarjo Regent Regulation Number 12 of 2022 concerning the Position, Organizational Structure, Duties and Functions, and Work Procedures of the Sidoarjo Regency Public Works, Highways, and Water Resources Agency, carries out infrastructure provision in the form of public works and water resources services, including the construction and maintenance of roads and bridges, irrigation channels, and drainage channels.

Optimizing the use of infrastructure budgets can transform regional assets into better-managed and more effective assets. The financial management process known as asset optimization aims to maximize the potential of assets in terms of physical condition, location, value, volume, legal status, and economic value. (Y. Yasir et al., 2020) Article 2 of Law Number 17 of 2003 on State Finance explains that regional revenues and expenditures, as well as regional assets, constitute state finance. Therefore, to avoid the loss of optimal state financial management, effective regional financial management must be prioritized. The concept of state finance encompasses all rights and obligations of the state, whether in the form of money, goods, or services. Effective and efficient budget management is a key factor in the success of infrastructure project implementation, particularly in the government sector. If achieved using the least amount of resources and funds, operational activities are considered efficient. Effective budget utilization is crucial for achieving objectives (Y. Ratukarangga & I. Aldino, 2024). The gap in this study includes

previous studies reviewed by (T. N Hikmah et al., 2024) on data collection related to optimization using the literature review method, from the study (F. Adjie et al., 2018) related to data collection techniques using quantitative descriptive methods, from the study (M. Zhafran et al., 2022) on data collection related to infrastructure and research location, and from the study (Widjanarko & Handayani, 2018) on data analysis techniques using Value for Money. This research is related to the level of budget optimization used by the Sidoarjo district government, enabling efficient implementation and effective infrastructure development. Delays in completing work can lead to increased operational costs for development. They may violate the contract agreed upon by the Public Works, Transportation, and Water Resources Department of Sidoarjo District, which has an important responsibility in providing infrastructure that supports economic growth and community welfare. The challenges frequently encountered include budget constraints, inadequate time allocation, limited human resource capacity to understand the development context, and challenges in project implementation, which often hinder the achievement of these targets (Widjanarko & Handayani, 2018).

Based on the above background, an effective budget optimization strategy is necessary to maximize results with the available resources. This study focuses on analyzing efficient and effective strategies for budget optimization in infrastructure projects implemented by the Sidoarjo District Public Works, Road Construction, and Water Resources Agency. The researcher found problems in financial budget management related to infrastructure spending. Where financial optimization and budget reporting should not conflict with the timing of project implementation and completion, the researcher chose the title "Analysis of Budget Optimization for Infrastructure Projects at the Public Works and Water Resources Department of Sidoarjo District." The research questions for this study are:

- Do budget planning variables affect budget efficiency in the Public Works and Water Resources Agency of Sidoarjo Regency?
- Do budget planning variables affect budget effectiveness in the Public Works and Water Resources Agency of Sidoarjo Regency?
- Does the project completion time variable affect budget efficiency in the Public Works and Water Resources Agency of Sidoarjo Regency?
- Does the project completion time variable affect budget effectiveness in the Public Works and Water Resources Agency of Sidoarjo Regency?
- Does the quality of infrastructure influence budget efficiency in the Public Works and Water Resources Agency of Sidoarjo Regency?
- Does the quality of infrastructure influence the effectiveness of the budget in the Public Works and Water Resources Agency of Sidoarjo Regency?

The preparation process cannot be separated from various previous research references and literature used. These are used to support the validity of the data and analysis conducted. The sources mentioned here include scientific books, academic journals, research reports, and relevant laws and regulations. The purpose of combining these references is to produce a comprehensive, accurate, and accountable report. The following are some previous studies conducted by previous researchers.

Table 1. Previous Research

No	Title	Method	Results	Discussion
1	Analysis of the Efficiency of Cost and Time Budget Planning in the Savyavasa Luxury Residence Project (Prakoso, 2023)	Descriptive Quantitative, EVM	CPI > 1 (cost efficient), SPI < 1 (late delivery)	Earned Value Management calculations indicate that the project is cost-efficient, but it is experiencing delays in its schedule.
2	Analysis of the Efficiency and Effectiveness of Road Maintenance Budget Utilization in the Public Works Department of Ende Regency (Timba & Sayang, 2023)	Descriptive Quantitative	Low physical effectiveness, budget waste occurs	Budget utilization has not been fully efficient as some work packages have not been completed as planned.
3	Analysis of the Effectiveness and Efficiency of Budget Utilization in the Transportation Agency of Tana Toraja Regency (Pinimba & Lintin, 2022)	Descriptive Quantitative	Effectiveness 95 to 108%, high efficiency	The average budget realization achieved an excellent level of effectiveness, and actual costs were lower than the available budget.
4	Analysis of Budget Realization in Assessing the Effectiveness and Efficiency of Performance at the Road and Bridge Research and Development Center of the Ministry of Public Works and Public Housing in Bandung (Hatimatunnisari & Kosasih, 2019)	Descriptive Quantitative	Highly effective (>100%), efficiency not yet optimal	The effectiveness rate reached 103.8%, but some activities showed low efficiency because they did not produce maximum output.
5	Analysis of Effectiveness and Efficiency of Budget Implementation at BAPPEDA and LITBANG in Dompu Regency (Supriyantony, 2024)	Descriptive Quantitative	High effectiveness and efficiency during 2018–2022	Budget implementation exhibits efficient and effective trends, as demonstrated by the timely and appropriate realization of funds.

Source: Researcher's analysis (2025)

Previous studies have not comprehensively examined the relationship between budget planning, project completion time, and infrastructure quality and their impact on budget efficiency and effectiveness. Furthermore, the descriptive approach employed has not yielded an integrative conceptual model that explains the simultaneous influence of variables in the context of infrastructure project implementation.

Budget

A budget can be defined as a list of costs required to do something. From the government's perspective, a budget is a manifestation of the policies that the government intends to implement. Furthermore, these policies are formulated into programs to be implemented, along with the costs incurred in carrying out these activities. A budget is a written financial statement prepared by the government consisting of estimated revenues to be received, programs approved for implementation, and the allocation of costs to carry out these activities within a specified period. (M. Prima, 2024).

Local Government Accounting

Financial accounting for local government entities (regencies, cities, or provinces) is the process of identifying, measuring, recording, and reporting financial transactions. It is used as information for economic decision-making by external parties of local government entities (regencies, cities, or provinces). External parties

of local government entities require data from the Local Government Financial Accounting system. To ensure that the financial management of local governments meets economic, efficiency, and effectiveness standards, as well as transparency and accountability, the stages of local government financial management must be carried out. (Hanik & Karyanti, 2014), (Qur'ani & Panggiarti, 2023). Local government financial reports provide information on the results of local government economic activities, including asset and financial structures (M. Prima, 2024). The purpose of local government financial reporting is to assist decision-making and demonstrate that the reporting entity is responsible for the funds entrusted to it. The local government financial management process consists of three stages:

- Planning Stage.
- Implementation Stage.
- Performance Reporting and Evaluation Stage.

Infrastructure Projects

According to J. Kanalung et al. (2018), Infrastructure includes roads, bridges, irrigation channels, ports, airports, and other public facilities. Better energy, transportation, and communication can reduce production costs and time. Infrastructure development projects have several characteristics, including:

- Capital intensity and longevity
Infrastructure projects may not generate positive cash flow initially because the pre-development and construction phases involve high risks and costs, as well as long-term financing requirements that require investor funds.
- Economies of scale and externalities
To increase revenue and generate social benefits, infrastructure projects often involve monopolies over natural resources such as roads or water resources. Although infrastructure project financing payments may not be fully covered, externalities continue to provide economic and social benefits that are difficult to measure.
- Opaqueness
There are no clear benchmarks for measuring the performance of infrastructure projects, and those involved in financing feel more threatened. Uncertainty arises because infrastructure projects are typically not transparent, and investors lack the necessary information to assess risks. (J. Kanalung et al., 2018)

Budget Realization Report (LRA)

A budget implementation report is a report that contains information on how the revenue, expenditure, and financing of an entity have occurred, compared to the three budget items. Through the budget implementation report, the primary objective is to determine the amount of financial resources that will be allocated to support central and local government operations, as well as to identify the associated risks with those economic resources. Like other analytical tools, financial ratio analysis is forward-looking; therefore, analysts must be able to adjust current factors to future factors that may impact the financial position or specific operating results. To conduct ratio comparisons, analysts must not only follow standard ratios but also consider changes in the percentage of financial ratios within a company. Comparing

current ratio figures with those from previous periods will reveal changes in the company's ratios and trends in its financial condition (R. Rahayu, 2016).

Budget Planning

Budget planning is the process of systematically determining revenue and expenditure estimates to support the achievement of development program objectives. An accurately planned budget plays a crucial role in preventing waste and ensuring the efficient implementation of projects. Prakoso and Isfahani (2023) state that the accuracy of budget planning has a direct impact on cost efficiency. In the case study of the Savyavasa construction project, budget planning was proven to reduce expenditures (Cost Performance Index > 1), although delays still occurred due to deficiencies in scheduling (Schedule Performance Index < 1) (Prakoso, 2023). The following are indicators of Budget Planning, according to Miel & Rock (2023).

- Accuracy of project cost calculations.
- Appropriateness of budget allocation to needs.
- Efficiency in the budget preparation process.
- Consistency between budget planning and the results of previous project evaluations.
- Compliance with regulations related to budgeting.

Project Completion Time

Project completion timeliness is an important indicator in budget management and program efficiency. Project delays can lead to increased indirect costs and reduced budget effectiveness. Timba and Sayang (2022) revealed that road maintenance not carried out according to schedule caused inefficiencies in budget realization, with many physical programs not being completed on time. (Timba & Sayang, 2023). The following are indicators of Project Completion Time, according to PMI (2021).

- Compliance with the planned project schedule.
- Frequency of project delays.
- Project completion duration compared to initial target.
- Ability to manage the risk of delays.

Infrastructure Quality

The quality of infrastructure development outcomes serves as a benchmark for the success of public projects, resulting from the interaction between planning, implementation, and budget control. Hatimatunnisani (2021) states that high budget effectiveness does not necessarily reflect good infrastructure quality, as there are still projects that are budget-efficient but fail to deliver optimal outputs. (Hatimatunnisari & Kosasih, 2019). The following are indicators of infrastructure quality, as per the Ministerial Regulation (2019).

- Compliance with Indonesian National Standards (SNI).
- Level of infrastructure resilience to load and time.
- Satisfaction of infrastructure users.
- Frequency of repairs required after project completion.

Budget Efficiency

Budget efficiency reflects the extent to which spending can be realized using minimal resources without compromising the quality of work. Kholifaturrahmah, Murjana, and Arsana (2022) indicate that budget efficiency at the Regional Development Planning Agency (BAPPEDA) and Research and Development Agency (LITBANG) of Dompu Regency falls into the very high category, characterized by budget realization that is lower than the plan. However, all activity targets are still achieved (Sari et al., 2023). The following are indicators of budget efficiency according to (Gozali, 2018)

- Comparison between actual costs and planned budget.
- Minimization of resource waste.
- Efficiency in the use of materials and labor.
- Project cost ratio per unit of output (cost per unit output).

Budget Effectiveness

Budget effectiveness is a measure of the success of budget use in achieving predetermined objectives. A budget is considered adequate if the results of its implementation align with or exceed the planned targets. (Biduri, 2025) In their study of the Transportation Department of Tana Toraja Regency, Pinimba and Lintin (2022) found that budget utilization demonstrated very high effectiveness, with an average activity realization rate of 95–108% of the target. The following are indicators of budget effectiveness according to (C. Asset)

- Achievement of project objectives by established indicators.
- The impact of infrastructure on public services.
- Alignment between project outputs and community needs.
- Adjustment of project results based on evaluation and user feedback.

Effective budget planning plays a crucial role in enhancing budget efficiency. (Mahmudi, 2019) states that systematic planning allows for optimal use of resources, reduces waste, and minimizes the risk of misallocation of funds. Research by Mardiasmo (Mardiasmo, 2020) also supports this, finding that well-planned budgets can manage project costs more effectively, thereby achieving maximum efficiency.

H1: The Effect of Budget Planning on Budget Efficiency

Budget planning not only contributes to efficiency but also to the effectiveness of budget utilization. According to Harahap & Rachman (2021), careful planning increases the likelihood of achieving project objectives as planned. In another study, Sari & Purnomo (2021) demonstrated that thorough planning can produce project outcomes that align with community needs, thereby strengthening the link between the budget and expected benefits.

H2: The Influence of Budget Planning on Budget Effectiveness

Timeliness in project completion is a key factor in maintaining budget efficiency. A study by Sunjaya (2018) found that project delays frequently result in unplanned increases in operating costs. Additionally, Yusuf (2017) explains that

effective time management can help reduce cost overruns resulting from overtime or additional contracts.

H3: The Effect of Project Completion Time on Budget Efficiency

Timeliness not only affects efficiency but also the effectiveness of budget utilization. A study by Arief & Hartono (2019) found that completing projects on schedule enables them to achieve their strategic objectives without compromising the quality of the results. Similarly, Sari & Purnomo (2021) stated that effective time management ensures that each stage of a project supports its ultimate goal.

H4: The Effect of Project Completion Time on Budget Effectiveness

Good infrastructure quality contributes to budget efficiency by reducing the need for future repairs and maintenance. According to research (Teman & Wijaya, 2019), projects with high quality standards tend to have lower maintenance costs. Additionally, Yusuf (2017) emphasizes that quality assurance in the early stages of construction prevents waste throughout the project life cycle.

H5: The Effect of Infrastructure Quality on Budget Efficiency

The quality of infrastructure is closely related to budget effectiveness. According to Sari & Purnomo (2021), high-quality projects ensure that the intended benefits are achieved. (Harahap & Rachman, 2021) also found that well-designed infrastructure increases user satisfaction and extends the useful life of projects.

H6: The Influence of Infrastructure Quality on Budget Effectiveness

METHODOLOGY

This study was conducted at the Public Works and Spatial Planning Agency of Sidoarjo Regency. The selection of the research location was based on the fact that numerous infrastructure projects are funded by the regional budget (APBD) and the state budget (APBN), making it highly relevant to analyze their budget efficiency and effectiveness. This study employs a quantitative descriptive research approach, a type of research that systematically and measurably describes specific phenomena or characteristics of a population or group using numerical data. (F. Adjiem et al., 2018) Therefore, the researcher collected data using this method. The selection of the location is based on the intensity of infrastructure projects funded by the APBD and APBN, making it highly relevant for analysis in terms of budget efficiency and effectiveness. This type of research is quantitative and descriptive, aiming to systematically and measurably explain the relationship between the variables studied.

The method used is a survey method, which involves collecting data through the distribution of questionnaires to respondents selected based on specific criteria. The population in this study consisted of all employees and related parties directly involved in the planning, implementation, and supervision of infrastructure projects at the Sidoarjo District Public Works and Water Resources Office, totaling 100 people.

The sampling technique used is total sampling, which involves all members of the population as research respondents. This method was chosen based on the consideration that the entire population has relevant characteristics and meets the research criteria, namely being directly involved in the infrastructure project cycle and having adequate understanding of budget planning and implementation. By using total sampling, the data obtained is expected to be more representative and able to describe the actual conditions comprehensively.

Primary data was obtained through the distribution of questionnaires designed based on research variable indicators, using a 1–5 Likert scale to measure respondents' perceptions. The questionnaires were distributed online using the Google Form platform. The questionnaire link was shared with employees and related parties within the Sidoarjo Regency Public Works, Highways, and Water Resources Agency (PUBMSDA). Respondents were selected purposively, specifically those directly involved in the planning, implementation, and evaluation of infrastructure projects.

The online method was chosen to facilitate questionnaire distribution, expand the respondent reach, and minimize geographical and time constraints. Additionally, respondents were provided with a brief explanation of the research objectives and instructions for completing the questionnaire via a written message sent alongside the Google Form link.

Secondary data was obtained through official documents from the PUBMSDA Office, including:

- Work Plan and Budget Report (RKA)
- Project progress report
- Project audit and evaluation report
- Budget realization data

Data processing and analysis were performed using SmartPLS (Partial Least Squares Structural Equation Modeling) software with the following steps:

- Data Preparation
- Perform data cleaning to remove incomplete or invalid data.
- Enter data into Excel/CSV format according to SmartPLS requirements..

The Outer Model Test is used to test the suitability of indicators in forming constructs, consisting of:

- Convergent validity: using AVE (Average Variance Extracted) with criteria > 0.5 .
- Discriminant validity: using the Fornell-Larcker criteria.
- Construct Reliability: using Cronbach's Alpha and Composite Reliability (CR), both must be > 0.7 .

The Inner Model Test is used to assess the relationship between latent constructs.:

- Path Coefficients: measure the strength of influence between variables.
- Bootstrapping: used to test the significance of a relationship by looking at the t-statistic and p-value.

Table 2. Operational Definition of Variables

No	Variable	Operational Definition	Indicator	Measurement Scale
1	Budget Planning	A systematic process of determining revenue and expenditure estimates to support development objectives and improve project efficiency (Prakoso & Isfahani, 2023)	<ul style="list-style-type: none"> ▪ Accuracy of project cost calculations ▪ Appropriateness of budget allocation to needs ▪ Efficiency of the budget preparation process ▪ Consistency with previous project evaluations ▪ Compliance with budget regulations 	Likert 1-5
2	Project Completion Time	The level of compliance of project implementation with the planned schedule has an impact on budget efficiency (Biduri, 2025)	<ul style="list-style-type: none"> ▪ Adherence to project schedule ▪ Project delay frequency ▪ Duration compared to initial target ▪ Ability to manage the risk of delays 	Likert 1-5
3	Infrastructure Quality	The level of conformity of project results with technical standards and user satisfaction as a measure of project success (Hatimatunnisani, 2021)	<ul style="list-style-type: none"> ▪ Compliance with SNI ▪ Resistance to load and time ▪ Public satisfaction ▪ Post-project repair frequency 	Likert 1-5
4	Budget Efficiency	Ability to implement budgets with minimal resources without compromising the quality of results (Kholifaturrahmah et al., 2022)	<ul style="list-style-type: none"> ▪ Actual costs vs. planned costs ▪ Minimization of waste ▪ Efficiency in the use of materials and labor ▪ Cost per unit output 	Likert 1-5
5	Budget Effectiveness	The successful use of the budget in achieving the project's established objectives (Biduri, 2025)	<ul style="list-style-type: none"> ▪ Project goal achievement ▪ Impact on public services ▪ Alignment of output with needs ▪ Adjustments based on user feedback 	Likert 1-5

Source: Researcher's analysis (2025)

RESULTS AND DISCUSSION

Validity Test. Convergent validity and discriminant validity are components that form validity measurement. Convergent validity analysis is determined using the loading factor parameter and AVE (Average Variance Extracted) value. Convergent validity is the correlation between indicator scores and construct scores. The convergent validity value represents the loading factor of the latent variable on its indicators. It is expected to have a value greater than 0.7 and an AVE (average variance extracted) greater than 0.5. As shown in Table 1, all indicators in this study are valid because the loading factor values produced by each indicator are greater than 0.7.

Another tool for measuring validity is AVE (Average Variance Extracted). The AVE value must be greater than 0.5. This is illustrated in the table below. The Budget Planning variable has the highest AVE value of 0.773. Meanwhile, the variable with the lowest AVE value is Budget Efficiency with a value of 0.658. As shown in Table 4, all AVE values for each variable exceed 0.5. It can be concluded that the loading factor and AVE values have met the Convergent Validity requirements. In Discriminant Validity, several tests were carried out by examining the Fornell-Larcker and cross-loadings values. The Fornell-Larcker criterion and AVE values for each indicator, as reported in the SmartPLS output results, are as follows.

Table 3. Loading Factor Values

Indicator	(X1) Budget Planning	(X2) Project Completion Time	(X3) Infrastructure Quality	(Y1) Budget Efficiency	(Y2) Budget Effectiveness
X1.1	0,919				
X1.2	0,881				
X1.3	0,852				
X1.4	0,875				
X1.5	0,866				
X2.1		0,886			
X2.2		0,843			
X2.3		0,803			
X2.4		0,849			
X3.1			0,832		
X3.2			0,840		
X3.3			0,873		
X3.4			0,843		
Y1.1				0,796	
Y1.2				0,836	
Y1.3				0,814	
Y1.4				0,799	
Y2.1					0,851
Y2.2					0,868
Y2.3					0,839
Y2.4					0,807

Source: Researcher's analysis (2025)

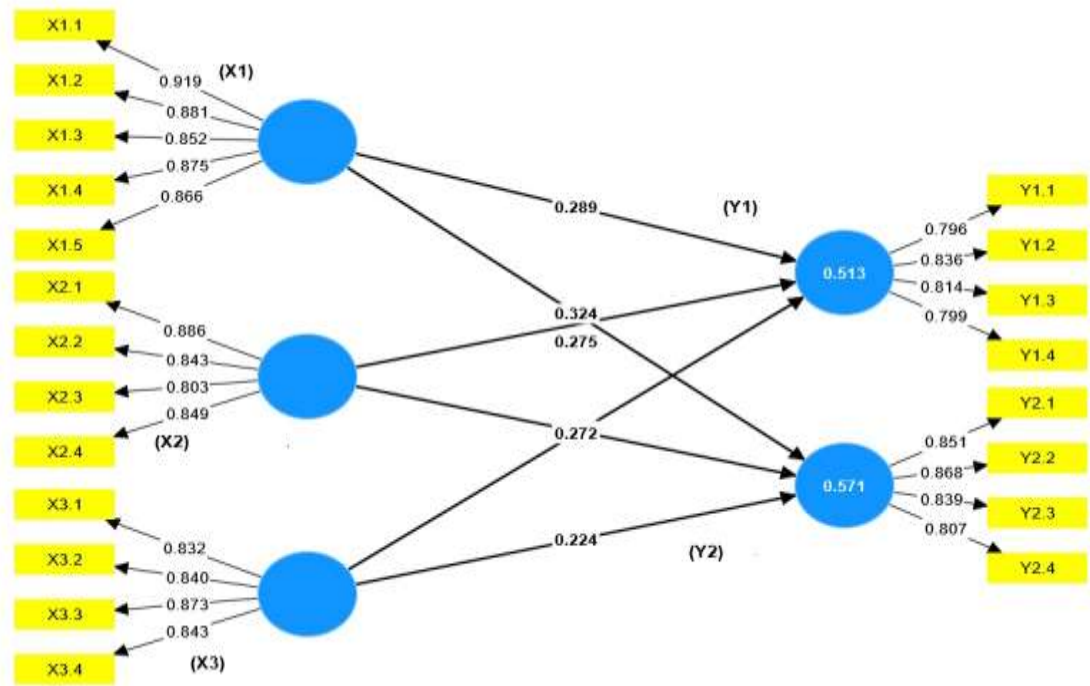


Figure 1. Loading Factor Test Results

Source: Researcher's analysis (2025)

Table 4. Average Variance Extracted (AVE)

Variable	Average variance extracted (AVE)
(X1) Budget Planning	0,773
(X2) Project Completion Time	0,715
(X3) Infrastructure Quality	0,718
(Y1) Budget Efficiency	0,658
(Y2) Budget Effectiveness	0,708

Source: Researcher's analysis (2025)

Table 5. Fornel Larcker

Variable	(X1) Budget Planning	(X2) Project Completion Time	(X3) Infrastructure Quality
(X1) Budget Planning	0,879		
(X2) Project Completion Time	0,594	0,846	
(X3) Infrastructure Quality	0,559	0,657	0,847
(Y1) Budget Efficiency	0,604	0,625	0,613

Source: Researcher's analysis (2025)

The validity test of characteristics through the Fornell-Larcker criteria table shows that the first variable value must be greater than each variable construct, as shown in Table 5. Budget Planning has a value of 0.879, which is greater than the other variables. The Project Completion Time variable has a value of 0.846, which is greater than the values of the other variables, and the Infrastructure Quality variable has a value of 0.847, which is also greater than the values of the other variables. Therefore, it can be concluded that all variables meet the requirements of the discriminant validity test.

Table 6. Cross Loading

Indicator	Budget Planning	Project Completion Time	Infrastructure Quality	Budget Efficiency	Budget Effectiveness
X1.1	0,919	0,541	0,522	0,582	0,623
X1.2	0,881	0,563	0,559	0,528	0,596
X1.3	0,852	0,499	0,459	0,477	0,488
X1.4	0,875	0,527	0,440	0,525	0,565
X1.5	0,866	0,478	0,470	0,534	0,556
X2.1	0,532	0,886	0,615	0,534	0,532
X2.2	0,522	0,843	0,562	0,497	0,565
X2.3	0,418	0,803	0,526	0,511	0,566
X2.4	0,535	0,849	0,522	0,566	0,600
X3.1	0,474	0,460	0,832	0,499	0,424
X3.2	0,463	0,589	0,840	0,587	0,587
X3.3	0,540	0,604	0,873	0,508	0,620
X3.4	0,407	0,555	0,843	0,472	0,444
Y1.1	0,507	0,383	0,431	0,796	0,509
Y1.2	0,520	0,486	0,521	0,836	0,482
Y1.3	0,503	0,581	0,576	0,814	0,717
Y1.4	0,428	0,559	0,446	0,799	0,544
Y2.1	0,595	0,619	0,555	0,644	0,851
Y2.2	0,554	0,529	0,496	0,534	0,868
Y2.3	0,498	0,534	0,521	0,570	0,839
Y2.4	0,519	0,567	0,520	0,602	0,807

Source: Researcher's analysis (2025)

Based on Table 7, it can be seen that each variable has a cross-loading factor value above 0.7, meaning that the variables in this study meet the requirements. The heterotrait-monotrait ratio (HTMT) must be less than 1 so that it can be said to meet the requirements of discriminant validity.

Table 7. Loading Factor

Variable	(X1) Budget Planning	(X2) Project Completion Time	(X3) Infrastructure Quality	(Y1) Budget Efficiency
(X2) Project Completion Time	0,662			
(X3) Infrastructure Quality	0,618	0,751		
(Y1) Budget Efficiency	0,687	0,729	0,712	
(Y2) Budget Effectiveness	0,718	0,772	0,705	0,819

Source: Researcher's analysis (2025)

Table 8. Heterotrait-monotrait ratio (HTMT)

Variable	Heterotrait-monotrait ratio (HTMT)
(X2) Project Completion Time - (X1) Budget Planning	0,662
(X3) Infrastructure Quality - (X1) Budget Planning	0,618
(X3) Infrastructure Quality - (X2) Project Completion Time	0,751
(Y1) Budget Efficiency - (X1) Budget Planning	0,687
(Y1) Budget Efficiency - (X2) Project Completion Time	0,729
(Y1) Budget Efficiency - (X3) Infrastructure Quality	0,712
(Y2) Budget Effectiveness - (X1) Budget Planning	0,718
(Y2) Budget Effectiveness - (X2) Project Completion Time	0,772
(Y2) Budget Effectiveness - (X3) Infrastructure Quality	0,705
(Y2) Budget Effectiveness - (Y1) Budget Effectiveness	0,819

Source: Researcher's analysis (2025)

Table 9. Cronbach's Alpha

Variable	Cronbach's alpha
(X1) Budget Planning	0,926
(X2) Project Completion Time	0,867
(X3) Infrastructure Quality	0,870
(Y1) Budget Efficiency	0,827
(Y2) Budget Effectiveness	0,862

Source: Researcher's analysis (2025)

From Table 9, it can be seen that all indicators in each variable have met the reliability test requirements, specifically a Cronbach's alpha value greater than 0.6. Composite reliability is used to test the reliability of the indicators in the variables. If the composite reliability value is greater than 0.7, a variable can be declared valid.

Table 10. Composite Reliability Value

Variable	Composite reliability (rho_a)
(X1) Budget Planning	0,930
(X2) Project Completion Time	0,868
(X3) Infrastructure Quality	0,878
(Y1) Budget Efficiency	0,832
(Y2) Budget Effectiveness	0,865

Source: Researcher's analysis (2025)

As shown in Table 10, all variables have a composite reliability value greater than 0.7. Thus, it can be concluded that all variables in this study meet the requirements. Therefore, this study can proceed to the inner model testing stage.

VIF is a factor that measures the increase in variance of the regression coefficient compared to orthogonal independent variables that are linearly related to it. The VIF value increases as the correlation between independent variables increases. A VIF value greater than 5 can be used as an indicator of multicollinearity. The results of the multicollinearity test in this study show that the VIF value is <5, so it can be concluded that all indicators are free from multicollinearity.

Table 11. R-Square

Variable	R-square
(Y1) Budget Efficiency	0,513
(Y2) Budget Effectiveness	0,571

Source: Researcher's analysis (2025)

Based on Table 11, it can be seen that the R-Square value of the Budget Efficiency Variable is 0.513, indicating that the Budget Planning Variable, Project Completion Time Variable, and Infrastructure Quality Variable influence the Budget

Efficiency Variable by 51.3%. Other variables influence the remaining 48.7%. The R-Square value for the Budget Effectiveness Variable is 0.571, indicating that the Budget Planning Variable, Project Completion Time Variable, and Infrastructure Quality Variable influence the Budget Effectiveness Variable by 57.1%. In comparison, other variables influence the remaining 42.9%.

According to Gozali (2021), the effect size (f^2) is used as a measure to determine the inverse of the model. The f^2 value consists of 0.02 (weak), 0.15 (moderate), and 0.35 (strong).

Table 12. F-Square

Variable	(Y1) Budget Efficiency	(Y2) Budget Effectiveness
(X1) Budget Planning	0,102	0,146
(X2) Project Completion Time	0,076	0,126
(X3) Infrastructure Quality	0,079	0,061

Source: Researcher's analysis (2025)

Based on Table 12, Budget Planning Variables influence Budget Efficiency Variables of 0.102 (weak) and Budget Effectiveness Variables of 0.146 (weak). Project Completion Time Variables influence Budget Efficiency Variables of 0.076 (weak) and on Budget Effectiveness Variables of 0.126 (weak). The Infrastructure Quality Variable influences the Budget Efficiency Variable by 0.079 (weak) and the Budget Effectiveness Variable by 0.061 (weak).

The PLS model was also evaluated using Q2 Predictive Relevance. This is evident in Table 10.

Table 13. Construct Crossvalidated Redundancy

Variabel	Q ² (=1-SSE/SSO)
(Y1) Budget Efficiency	0,324
(Y2) Budget Effectiveness	0,383

Source: Researcher's analysis (2025)

Based on the results of processing the predictive relevance values for the Budget Efficiency Variable (0.324 > 0) and the Budget Effectiveness Variable (0.383 > 0), it can be seen that both are statistically significant. Therefore, it can be stated that the amount of data diversity explained by the research model is 32.4% and 38.3%. The remaining 67.6% and 61.7% are attributed to factors outside the scope of this study. Therefore, it can be concluded that this study has good goodness of fit.

This value indicates the extent to which the model has been thoroughly researched and validated. This value determines the cumulative percentage that indicates the model's value. The following are the results of the fit model from the research model.

Table 14. Model Fit

Data	Estimated model
SRMR	0,079
d_ULS	1,431
d_G	0,955
Chi-square	492,806
NFI	0,718

Source: Researcher's analysis (2025)

In Table 11, the Estimated Model value of 0.645 indicates a model fit of 64.5%. The results conclude that the model has a 64.5% fit for the research model.

Table 15. Hypothesis Test Results

Variable	Original sample (O)	Sample mean (M)	Standard deviation (STDEV)	T statistics (O/STDEV)	P values
(X1) Budget Planning → (Y1) Budget Efficiency	0,289	0,297	0,129	2,246	0,025
(X1) Budget Planning → (Y2) Budget Effectiveness	0,324	0,328	0,103	3,156	0,002
(X2) Project Completion Time → (Y1) Budget Efficiency	0,275	0,272	0,128	2,144	0,032
(X2) Project Completion Time → (Y2) Budget Effectiveness	0,330	0,330	0,118	2,811	0,005
(X3) Infrastructure Quality → (Y1) Budget Efficiency	0,272	0,268	0,119	2,276	0,023
(X3) Infrastructure Quality → (Y2) Budget Effectiveness	0,224	0,221	0,099	2,265	0,024

Source: Researcher's analysis (2025)

The criteria for accepting a hypothesis are that the T-statistic must be greater than 1.96 and the P-value must be less than 0.05; then H_a is accepted and H_o is rejected, and vice versa.

First Hypothesis Test

The test results show that Budget Planning has a positive and significant effect on Budget Efficiency, with a coefficient of 0.289, a t-statistic value of 2.246, and a p-value of 0.025. These findings suggest that the more effectively the budget planning process is carried out, the higher the project's budget efficiency will be. This is particularly evident in the accuracy of project cost calculations, which is the foundation for preventing budget overruns. Additionally, aligning budget allocations with project needs helps avoid spending funds on unnecessary items, thereby enhancing the efficiency of resource allocation. Efficiency in the budget preparation process also helps expedite approval and implementation, without requiring extensive revisions, thereby avoiding the waste of time and resources. Thus, these indicators demonstrate that precise planning is not merely a technical matter but a strategic approach to maximizing the value of every dollar spent.

Second Hypothesis Test

Budget planning has also been proven to have a positive and significant effect on budget effectiveness, with a coefficient value of 0.324, a t-statistic of 3.156, and a p-value of 0.002. This means that comprehensive planning can improve the success of achieving project objectives by planned targets. The interconnection between indicators such as planning consistency and previous project evaluation results enables learning from experience, thereby preventing past mistakes from recurring. Other indicators, such as compliance with regulations, ensure that projects are carried out by legal and administrative norms, thereby streamlining processes without bureaucratic obstacles. Thus, sound planning is not only cost-efficient but also effective in addressing real public needs, as reflected in the indicator of alignment between project outputs and community needs.

Third Hypothesis Test

Project completion time has a positive and significant influence on Budget Efficiency, with a coefficient of 0.275, a t-statistic of 2.144, and a p-value of 0.032. The timeliness of project implementation has been proven to have a direct impact on budget efficiency, considering that delays in work often result in additional operational costs, contract extensions, and penalty fees. Indicators such as project delay frequency and completion duration compared to the initial target are key to maintaining efficiency. Poor time management not only increases the budget but also impacts workforce productivity and the economic value of the project. Conversely, projects that effectively manage delay risks demonstrate high efficiency by avoiding expenditures outside the base budget.

Fourth Hypothesis Test

Project completion time also has a significant effect on Budget Effectiveness, with a coefficient of 0.330, t-statistic of 2.811, and p-value of 0.005. This indicates that when projects are completed on schedule, the benefits can be immediately felt by the community, thereby increasing the real impact of budget utilization. Project schedule compliance directly supports the achievement of project objectives, as delays mean delayed public services. Additionally, projects completed on time allow for quick adjustments to project outcomes based on evaluations and user feedback, creating a healthy feedback loop and driving continuous improvement. Effectiveness is no longer just about budget absorption rates, but also about how quickly the budget is transformed into public benefits.

Fifth Hypothesis Test

The results indicate that Infrastructure Quality has a positive and significant impact on Budget Efficiency, with a coefficient of 0.272, a t-statistic of 2.276, and a p-value of 0.023. Infrastructure built with high quality has proven to reduce the need for post-project repair or maintenance costs. Indicators such as load-bearing capacity, durability over time, and the frequency of repairs after the project are highly contributing factors in saving long-term budgets. Infrastructure that is robust and compliant with Indonesian National Standards (SNI) avoids unexpected costs due to structural failures. This means that high-quality initial investments can reduce maintenance expenses, ensuring that projects remain efficient throughout their lifecycle.

Sixth Hypothesis Test

Infrastructure quality also has a significant influence on budget effectiveness, with a coefficient of 0.224, t-statistic of 2.265, and p-value of 0.024. This indicates that the better the quality of infrastructure projects, the greater their ability to meet the needs and expectations of the community. Public satisfaction indicators for infrastructure users are the primary reflection of the effectiveness of infrastructure. When infrastructure is rarely damaged and provides direct benefits, such as improving accessibility or accelerating mobility, the budget used is considered adequate. Additionally, aligning project outcomes with user evaluations allows for design flexibility tailored to local needs, thereby enhancing the efficiency and impact of the budget on public services. The coefficient value is 0.224, the t-statistic is 2.265, and the p-value is 0.024. Infrastructure built with consideration for quality and

community needs (indicators: community satisfaction, alignment of outputs with needs, and structural resilience) will provide broader benefits, making the budget used effectively.

Discussion

The Effect of Budget Planning on Budget Efficiency

Budget planning is a crucial initial stage that significantly influences the efficiency of infrastructure project implementation. Research findings indicate that budget planning has a positive and significant impact on budget efficiency within the Public Works, Road Development, and Water Resources Department of Sidoarjo Regency. This demonstrates that the more precise and well-developed the planning process, the more optimal the use of available public funds. In the context of the Public Works, Road Development, and Water Resources Department, budget planning involves not only estimating project costs but also an allocation process that considers project complexity, geographical location, existing infrastructure conditions, and resource availability. When the budget is systematically prepared, including realistic cost calculations, material requirements, labor needs, and implementation timelines, the potential for deviations or wastage can be minimized. Weaknesses in planning, such as overestimating or underestimating budgets, frequently result in inefficiencies during project implementation. Conversely, planning based on evaluations of previous projects enables the development of a more rational budget that is responsive to on-site challenges. Efficiency here also means that allocated funds are used productively and appropriately, supporting project success without the need for additional funding during implementation.

The Influence of Budget Planning on Budget Effectiveness

Budget effectiveness refers to the extent to which public funds are utilized to achieve predetermined project objectives. The findings of this study indicate that comprehensive and consistent budget planning has a significant impact on budget effectiveness in the Public Works and Water Resources Agency. Effectiveness is reflected when project outcomes provide tangible benefits to the community, such as improved accessibility, reduced flooding, smoother transportation, or improved environmental conditions. This is highly dependent on how well field needs are identified during the planning stage. Planning that is carried out merely as a formality without a technical and participatory approach risks producing projects that are irrelevant or have little impact. Within the Department of Public Works, Roads, and Natural Resources, alignment between budget plans and actual project conditions is crucial for achieving development objectives. When regulatory aspects, feasibility studies, and past evaluations are used as references in budget formulation, the effectiveness of public fund utilization improves. In other words, planning serves as the foundation for successful budget implementation.

The Effect of Project Completion Time on Budget Efficiency

Time is a crucial element in project management, particularly in terms of cost control and management. Based on the study's results, achieving project completion within the scheduled timeframe has a positive and significant impact on budget efficiency. At the Public Works and Water Resources Agency, budget efficiency can be disrupted if projects are delayed. Delays often result in increased operational

costs, overtime labor expenses, additional rental costs for heavy equipment, and even fines or penalties. Additionally, discrepancies between the actual implementation timeline and the initial plan can lead to a decrease in the effectiveness of the initial planning that has been established. Conversely, projects completed on time have a high likelihood of finishing within the allocated budget. Effective time management also reflects efficient human resource and logistics planning. Cross-unit coordination, certainty in permits, and readiness of tender documents are key factors supporting timeliness and efficiency.

The Effect of Project Completion Time on Budget Effectiveness

The timeliness of project completion not only impacts efficiency but also significantly influences the effectiveness of budget utilization. If infrastructure projects are completed on schedule, their benefits can be immediately felt by the community, thereby driving the achievement of regional development goals. At the Public Works, Roads, and Natural Resources Department of Sidoarjo Regency, projects completed on time provide certainty of service to the community, such as smooth transportation, reduced flooding, and improved connectivity between areas. Conversely, delays hinder the distribution of benefits and create a negative perception of local government performance. Additionally, effectiveness is compromised when project delays result in construction outcomes that no longer align with current conditions and needs. In this context, time is a strategic factor in ensuring that allocated budgets deliver outputs and outcomes consistent with development plans.

The Effect of Infrastructure Quality on Budget Efficiency

Research indicates that high-quality infrastructure contributes to budget efficiency and effectiveness. In projects managed by the Public Works Agency, quality is a key factor in reducing post-project maintenance and repair costs. Infrastructure built by technical standards and with high durability will be more economical in the long term. If construction quality is poor, the potential for early damage will trigger budget waste for repairs or rehabilitation. Therefore, quality control during project implementation, the selection of competent contractors, and the use of materials according to technical specifications are key factors in achieving efficiency. By ensuring quality from the outset, the Public Works Department can avoid unexpected costs and ensure that the budget allocated truly provides long-term value. This also supports the principle of value for money in public financial management.

The Influence of Infrastructure Quality on Budget Effectiveness

Finally, the quality of infrastructure has also been proven to have a significant impact on budget effectiveness. Projects built with high quality are better equipped to meet community needs and withstand dynamic environmental conditions. This is important for the Public Works and Spatial Planning Department in realizing optimal public services. Effectiveness is not only about whether a project is completed, but also whether the results are helpful, sustainable, and in line with user expectations. When infrastructure is easily damaged or fails to function as intended, the allocated budget becomes less effective, as its benefits are not fully realized. Ensuring quality also impacts public satisfaction and strengthens the local

government's image in providing professional public services. Therefore, maintaining quality is not merely a technical matter but is closely tied to the moral responsibility of using public funds.

CONCLUSION

Based on the results of research conducted on Budget Planning Analysis, Project Completion Time, and Infrastructure Quality on Budget Efficiency and Effectiveness at the Public Works, Highways, and Water Resources Agency of Sidoarjo Regency, it was found that the three independent variables studied had a positive and significant effect on both budget efficiency and effectiveness. Careful and structured budget planning has proven to improve the efficiency of fund utilization and ensure the effectiveness of budget objectives. Furthermore, project completion on schedule supports efficiency by avoiding potential cost overruns and delays, and has an impact on increasing the overall effectiveness of development programs.

On the other hand, good infrastructure quality contributes significantly to budget efficiency by reducing long-term maintenance costs and increasing effectiveness because the infrastructure built can be used optimally according to its intended purpose. Overall, this study emphasizes the importance of integrating mature budget planning, proper project implementation time management, and quality assurance of infrastructure results as a unified strategy in supporting efficient and effective budget management.

Therefore, the Public Works and Water Resources Department of Sidoarjo Regency is expected to continue strengthening cross-functional coordination, improving the quality of planning and supervision, and committing to the implementation of high-quality projects to provide optimal and sustainable public services.

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