

Analysis of Cost-Time Performance and Management Strategies for Construction Projects in Maros Regency

Muhammad Fhauzhan Hazhimah R.¹; Fahirah F.²;
Tutang Muhtar Kamaludin³; Herminawaty⁴; Ikhsan⁵

¹Master's Student in Civil Engineering, Graduate School, Tadulako University, Palu, Indonesia.

²Lecturer, Master's Program in Civil Engineering, Graduate School, Tadulako University, Palu, Indonesia.

³Lecturer, Master's Program in Civil Engineering, Graduate School, Tadulako University, Palu, Indonesia.

⁴Economic and Business Faculty, Bosowa University, Makassar, Indonesia.

⁵Lecturer in Civil Engineering, Ambon State Polytechnic, Ambon, Indonesia.

Publication Date: 2026/09/26

Abstract: Housing construction projects require effective cost and time control to minimize the risks of delays and cost overruns. This study aims to analyze cost and schedule performance, identify factors affecting project performance, and formulate mitigation strategies for two housing construction projects in Maros Regency. The study employs a quantitative approach using the *Earned Value Management* (EVM) method to evaluate cost and schedule performance, the *Relative Importance Index* (RII) to determine dominant factors, and the Pareto Chart to establish mitigation priorities. The results show that both projects experienced delays and cost overruns, as indicated by the *Schedule Performance Index* (SPI) values for Housing Project 1, which were 0.74 in Week 4 and 0.95 in Week 8, while for Housing Project 2, the *Schedule Performance Index* (SPI) values were 0.87 in Week 4 and 0.83 in Week-8 was 0.83. The *Cost Performance Index* (CPI) for Housing Project 1 was 1 in Week 4 and 0.99 in Week 8, while for Housing Project 2, it was 0.98 in Week 4 and 0.97 in Week 8. The dominant factors affecting project performance include weather conditions that hindered work progress, damage to materials during storage or installation, material quality that did not meet specifications, and increases in material prices. Pareto chart analysis shows that the main factors contribute a cumulative 67% to Housing Project 1 and 68% to Housing Project 2. Recommended mitigation strategies include schedule revisions, cost control, optimization of resource management, and improved coordination and periodic project evaluations to enhance the effectiveness of cost and time control.

Keywords: *Earned Value Management, Cost and Time Performance, Residential Construction Projects.*

How to Cite: Muhammad Fhauzhan Hazhimah R.; Fahirah F.; Tutang Muhtar Kamaludin; Herminawaty; Ikhsan (2026) Analysis of Cost-Time Performance and Management Strategies for Construction Projects in Maros Regency. *International Journal of Innovative Science and Research Technology*, 11(9), 1571-1580. <https://doi.org/10.38124/ijisrt/26sep860>

I. INTRODUCTION

A construction project is a one-time activity that is typically carried out within a limited timeframe. This implies that a project involves a series of complex and dynamic activities, such as the use of resources to achieve project benefits, as well as the steps and methods for implementing a plan. However, risks can sometimes arise in a project such as delays in project progress which inevitably lead to cost overruns beyond the planned budget. This is where mitigation efforts are needed to address potential adverse risks in the future [2].

In a construction project, there are various stages related to construction management, which involve various issues regarding the management of costs and the timing of work

execution. Therefore, a system for cost management and time management is required to ensure that the project is completed on time as planned and that the costs incurred align with the project's requirements. Project cost management is the control of a project to ensure its completion within budget [1].

Residential construction projects in Maros Regency have experienced significant growth in line with the increasing demand for quality housing. In the context of rapid urbanization, challenges such as land scarcity, the need for adequate infrastructure, and population growth must be addressed. Therefore, it is crucial to conduct an in-depth analysis of cost and time performance in housing construction projects; to resolve issues related to cost and time performance analysis in construction projects, a thorough study of construction management is required.

Construction management encompasses various stages of a construction project, including issues related to cost control and the scheduling of work activities. Therefore, to complete projects on time and within budget, effective project cost management and project schedule management systems are essential.

Project cost management is the process of planning, organizing, and monitoring the project activity schedule, where planning and scheduling provide specific guidelines for completing project activities more quickly and efficiently. Project time management is the control of a project to ensure its completion in accordance with the approved cost budget [3].

To address this, the importance of methods and techniques that can reveal all the data required for the control process is emphasized. This means there must be an integrated relationship between analyzing project progress and the amount of cost and time already spent on it, so that estimates or projections of funding requirements through the end of the project can be made based on certain assumptions. In this regard, the Earned Value method is one of the methods or techniques capable of revealing all the data required for the process of controlling time and costs [1].

The Earned Value method or technique presents three elements: the physical progress of the project reflecting the planned cost, the actual costs incurred, and the earned value derived from the costs incurred. From these three results, the relationship between cost and time performance can be determined. Based on the results of the cost and time performance calculations, the overall project performance is assessed based on these cost and time calculations [4].

Therefore, the method or technique used is the Earned Value method. This method provides information on the project's performance status during a reporting period and offers forecasts of the costs required and the time needed to complete all work based on performance indicators at the time of reporting. This method has the advantage of allowing for the monitoring of the performance of ongoing activities and associated costs, as well as improving the effectiveness of the project activities being carried out. By regularly monitoring cost and time performance, project management can assess the overall performance of the project as well as the individual work packages within it. The results of these performance measurements can serve as an early warning system if inefficiencies in implementation are detected, allowing for corrective actions and adjustments to implementation methods to prevent cost overruns and delays in completion. This is what prompted the author's interest in researching this issue. Based on this description, the author will discuss the issue under the title "Cost-Time Performance Analysis and Management Strategies for a Residential Construction Project at Maros Regency."

II. METHOD

➤ Research Method

The research method used is a quantitative descriptive method with a case study approach. This study aims to analyze

the relationship between costs and project execution time and to determine strategies for addressing deviations or delays that occur on-site. The data used consist of primary and secondary data. Secondary data include project documents such as the Cost Estimate, implementation schedules, and work progress reports. Meanwhile, primary data include questionnaires, interviews, and documentation.

Data analysis was conducted using the Earned Value Method (EVM) to measure project cost and time performance using indicators such as Planned Value (PV), Earned Value (EV), and Actual Cost (AC). The results of the EVM analysis were used to determine whether the project was proceeding efficiently or experiencing delays and cost overruns. Next, an analysis of the factors influencing the cost and schedule of housing construction projects was conducted using the Relative Importance Index (RII) method to identify which factors affect project implementation. Finally, a strategy analysis was performed using questionnaires and interviews, and tested using the Pareto chart method to identify threats to the implementation of housing construction projects, thereby enabling the formulation of appropriate improvement strategies so that the project can be completed according to the planned timeline and budget.

➤ Research Location

This research was conducted at the TW Residence and EG Residence 1 housing complexes located in Maros Regency. The study period lasted 5 months.

➤ Data Collection Techniques

Data collection techniques refer to the methods used to gather data. In this study, secondary data was obtained from the contractors of the TW Residence and EG Residence 1 housing complexes.

• The Research Data Requirements are as Follows:

- ✓ The Cost Estimate contains a breakdown of the planned costs for each task in the project.
- ✓ The Time Schedule (Project Implementation Schedule) outlines the planned completion timeline for each phase of the work.
- ✓ The Project Progress Report covers weekly reports on the physical progress and costs of the project.

• In Addition, Primary Data was Collected, Namely:

- ✓ A questionnaire containing questions regarding the factors that influence the costs and timelines of housing construction projects.
- ✓ Sample Population

Purposive Sampling is a technique for determining a sample based on specific considerations and criteria established by the researcher. This technique was used because the required respondents are parties who possess knowledge, experience, and direct involvement in the implementation of housing construction projects. The criteria for respondents in this study include parties directly involved in project implementation and control, who understand the cost and time

aspects of the project, and who have experience in construction activities.

- ✓ Face-to-face interviews with project stakeholders.
- ✓ Documentation.

➤ Data Analysis Techniques

Data analysis is a crucial step in addressing the research questions and testing the research hypotheses. In this study, the analysis was conducted using three methods, namely:

• Earned Value Analysis Method

According to [5], Earned Value Analysis (EVA) is a project management technique used to measure a project's cost and schedule performance by comparing the plan (baseline) to actual results.

• RII (Relative Importance Index) Method

The formula is:

$$RII = \frac{W}{A \times N}$$

- ✓ Explanation: W = Weight assigned by the respondent (1–4)
- ✓ A = Highest value on the scale (e.g., 4)
- ✓ N = Number of respondents

The RII value ranges from 0 to 1, where:

- ✓ 0.80 – 1.00 → High
- ✓ 0.6 – 0.8 → High–Medium
- ✓ 0.4–0.6 → Medium
- ✓ 0.2–0.4 → Medium–Low
- ✓ 0 – 0.2 → Low

In this study, the RII method was used to identify and prioritize the factors that most significantly influence the cost and time performance of housing projects in Maros Regency based on questionnaire results from contractors and project owners.

• Pareto Chart Method

The steps for applying the Pareto method in this study include:

- ✓ Compiling Variables and Problem Indicators

- ✓ Developing an Assessment Questionnaire
- ✓ Collecting Respondent Data
- ✓ Calculating the Total Score for Each Factor
- ✓ Ranking Factors from Largest to Smallest
- ✓ Calculating Percentages and Cumulative Percentages

The formula is

$$\text{PERCENTAGE (\%)} = \frac{\text{Factor Values}}{\text{Total Value}} \times 100$$

- Creating a Pareto Chart

- ✓ X-axis: problem factors from highest to lowest score.
- ✓ Left Y-axis: problem values/frequencies.
- ✓ Right Y-axis: cumulative percentage.
- ✓ Create a bar chart for frequency + a curved line for the cumulative total (Pareto curve).

- Identifying Dominant Factors (Major Problems)
- Developing a Management Strategy Based on the Dominant Factors

III. RESULTS

This study aims to analyze cost and time performance in housing construction projects in Maros Regency, determine the factors influencing project cost and time performance, and identify management strategies for addressing these factors. The analysis was conducted using three approaches: the Earned Value Method (EVM) to evaluate project cost and time performance based on implementation data; the Relative Importance Index (RII) to determine the dominant factors affecting project cost and time performance; and the Pareto Chart to determine the level of importance of mitigation strategies based on respondents' perceptions.

➤ Cost and Time Performance of Housing Construction Projects in Maros Regency

• Results of the Earned Value Analysis for Housing Project 1

This study was conducted on The Wanua Residence Housing Development Project, located in Maros Regency, South Sulawesi Province. This project consists of 10 housing units per block, all of which are Type 36 homes that fall under the subsidized housing category.

Table 1 Types and Weights of Work

No.	Type of Work	Weight (%)
1	Foundation Work	6.48
2	Footing, Column, Wall, and Ring Beam Work	31.77
3	Plastering, Rendering, and Skimming Work	7.51
4	Roofing and Ceiling Work	13.82
5	Door, Window, and Frame Work	11.59
6	Plumbing and Sanitary Work	3.07
7	Electrical Installation Work	4.04
8	Flooring Work	10.72
9	Painting Work	5.92
10	Canopy Work	2.35
11	Carport Construction and Cleaning	2.73
TOTAL		100%

Table 2 Earned Value Results for Weeks 1–8

WEEK	PV/BCWS VALUE (Rp)	EV/BCWP VALUE (Rp)	ACTUAL COST/ACWP VALUE (Rp)
1	66,139,545.00	66,139,545.00	109,892,575.00
2	175,778,430.00	155,294,666.28	164,673,571.00
3	245,631,282.86	211,915,718.00	211,915,718.00
4	347,038,968.57	273,863,954.91	258,370,388.00
5	418,945,394.29	408,359,553.71	480,600,240.00
6	464,532,136.00	441,731,864.00	501,821,250.00
7	595,941,717.14	543,900,516.29	552,750,530.00
8	622,087,242.86	590,778,905.74	610,376,288.00

✓ *BCWS Calculation (Planned Value)*

BCWS is calculated based on the weekly planned weight multiplied by the contract value of one housing block, Rp844,177,700.00. For example, in week 4, a cumulative planned weight of 12.83% results in a PV value of Rp347,038,968.57. Cumulatively through week 14, the PV reaches 100%, or Rp844,177,700.00.

✓ *BCWP (Earned Value) Calculation*

BCWP represents the value of work completed based on the actual percentage of progress. By week 8, the BCWP reached Rp590,778,905.74, or 63.73%.

✓ *ACWP (Actual Cost) Calculation*

ACWP shows the actual costs incurred each week. As of Week 8, ACWP reached Rp610,376,288.00.

Table 3 Project Status Evaluation in Weeks 4 and 8

No.	Analysis Group	Week 4	Week 8
1	ACWP (Actual Cost)	Rp258,370,388.00	Rp610,376,288.00
2	BCWP (Earned Value)	Rp273,863,954.91	Rp590,778,905.74
3	BCWS (Planned Value)	Rp347,038,968.57	Rp622,087,242.86
4	SV	-Rp73,175,013.66	-Rp31,308,337.12
5	CV	Rp15,493,566.91	-Rp19,597,382.26
6	BEAC / BAC	Rp840,177,700.00	Rp840,177,700.00
7	EAC	Rp840,177,700.00	Rp848,664,343.43
8	VAC / OVERRUN	Rp0.00	-Rp8,486,643.43
9	CPI	1	0.99
10	SPI	0.74	0.95
11	Delay	34 Days	5 Days

Table 3 shows the interpretation results as follows:

- ✓ Week 4 SPI Value < 1 (0.74) = Project Is Behind Schedule
- ✓ SPI Value for Week 8 < 1 (0.95) = The project is behind schedule
- ✓ CPI Value for Week 4 = (1) = Project costs are not higher than planned (Cost Overrun) CPI Value for Week 8 < 1

(0.99) = Project costs are higher than planned (Cost Overrun)

- ✓ Negative SV Value = Schedule Delay
- ✓ Positive CV Value in Week 4 = No Cost Overrun
- ✓ Week 8 CV Value is Negative = Cost Overrun Occurs
- ✓ Negative VAC Value = Final Costs Are Expected to Exceed the Initial Budget

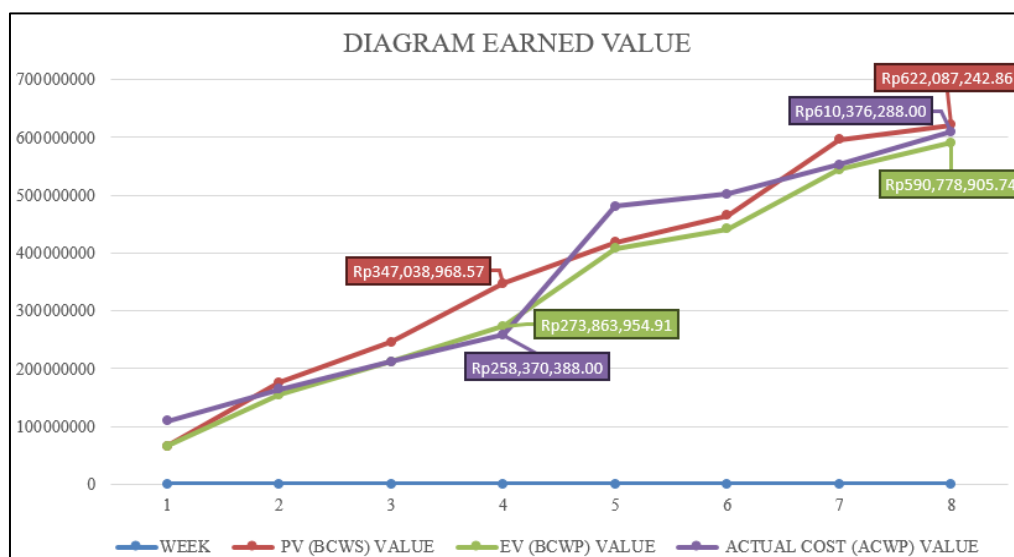


Fig 1 S-Curves for Week 4 and Week 8 of Housing Project 1

Based on Figure 1, in the fourth week, the ACWP was Rp258,370,388.00, the BCWP was Rp273,863,954.91, and the BCWS was Rp347,038,968.57. A BCWP value lower than the BCWS indicates a delay, while a BCWP greater than the ACWP indicates cost efficiency. This is supported by a CV of Rp15,493,566.91 and a CPI of 1.00, which indicate cost-efficient performance. Meanwhile, an SV of -Rp73,175,013.66 and an SPI of 0.74 indicate that project progress has reached approximately 74% of the plan. Thus, in the fourth week, the project experienced a delay, but cost utilization remained efficient.

In week 8, the ACWP was Rp610,376,288.00, the BCWP was Rp590,778,905.74, and the BCWS was Rp622,087,242.86. The fact that the BCWP value is lower

than both the ACWP and the BCWS indicates cost inefficiency and a delay in work progress. This is indicated by a CV of -Rp19,597,382.26 and a CPI of 0.97, as well as an SV of -Rp31,308,337.12 and an SPI of 0.99. Thus, in week 8, the project experienced both cost overruns and delays in execution.

• Results of the Earned Value Analysis for Housing Project 2

This study was conducted on the Esa Garden Residence Housing Development Project, located in Maros Regency, South Sulawesi Province. This project consists of 10 housing units per block, all of which are Type 36 homes that fall under the subsidized housing category.

Table 4 Types and Weights of Work

No.	Type of Work	Weight (%)
1	Foundation Work	7.04
2	Footing, Column, Wall, and Ring Beam Work	25.90
3	Plastering, Rendering, and Skimming Work	8.16
4	Roofing and Ceiling Work	15.01
5	Door, Window, and Frame Work	12.59
6	Plumbing and Sanitary Work	3.34
7	Electrical Installation Work	4.39
8	Flooring Work	11.64
9	Painting Work	6.43
10	Canopy Work	2.55
11	Carport Construction and Cleaning	2.96
TOTAL	100%	

Table 5 Earned Value Results for Weeks 1–7

WEEK	PV/BCWS VALUE (Rp)	EV/BCWP VALUE (Rp)	ACTUAL COST/ACWP VALUE (Rp)
1	50,513,462.86	50,513,462.86	66,139,545.00
2	109,995,099.00	108,419,675.29	121,625,291.00
3	245,631,282.86	200,887,752.00	202,297,252.00
4	291,418,451.43	254,077,353.14	259,289,188.00
5	373,358,652.57	360,303,704.00	375,175,060.00
6	480,814,883.24	423,880,162.67	435,210,512.00
7	578,511,366.67	482,690,654.00	496,785,654.00

✓ BCWS Calculation (Planned Value)

BCWS is calculated based on the weekly plan weight multiplied by the contract value of one housing block, which is Rp855,212,700.00. For example, in week 4, a cumulative planned weight of 12.22% results in a PV value of Rp291,418,451.43. Cumulatively through week 15, the PV reaches 100%, or Rp855,212,700.00.

✓ BCWP (Earned Value) Calculation

BCWP represents the value of work completed based on the actual percentage of progress. By week 7, BCWP reached Rp482,690,654.00, or 45.03%.

✓ ACWP (Actual Cost) Calculation

ACWP shows the actual costs incurred each week. As of Week 7, ACWP reached Rp496,785,654.00.

Table 6 Evaluation of Project Status in Weeks 4 and 7

NO	Analysis Group	Week 4	Week 7
1	ACWP (Actual Cost)	Rp259,289,188.00	Rp496,785,654.00
2	BCWP (Earned Value)	Rp254,077,353.14	Rp482,690,654.00
3	BCWS (Planned Value)	Rp291,418,451.43	Rp578,511,366.67
4	SV	-Rp37,341,098.29	-Rp95,820,712.67
5	CV	-Rp5,211,834.86	-Rp14,095,000.00
6	BEAC / BAC	Rp854,212,700.00	Rp854,212,700.00
7	BETC	Rp612,383,007.00	Rp383,012,418.56
8	EAC	Rp871,645,612.24	Rp880,631,649.48
9	VAC / OVERRUN	-Rp17,432,912.24	-Rp26,418,949.48

10	CPI	0.98	0.97
11	SPI	0.87	0.83
12	Delay	15 Days	20 Days

• *Table 6 Shows the Following Interpretation Results:*

- ✓ SPI Value for Week 4 < 1 (0.87) = Project Is Experiencing a Delay
- SPI Value for Week 8 < 1 (0.83) = The project is behind schedule.

- ✓ CPI Value for Week 4 < 1 (0.98) = Project costs are higher than planned (Cost Overrun)
- ✓ CPI Value for Week 8 < 1 (0.97) = Project costs are higher than planned (Cost Overrun)
- ✓ Negative SV Value = Schedule Delay
- ✓ Negative CV Value = Cost Overrun
- ✓ Negative VAC Value = Final Cost Expected to Exceed Initial Budget

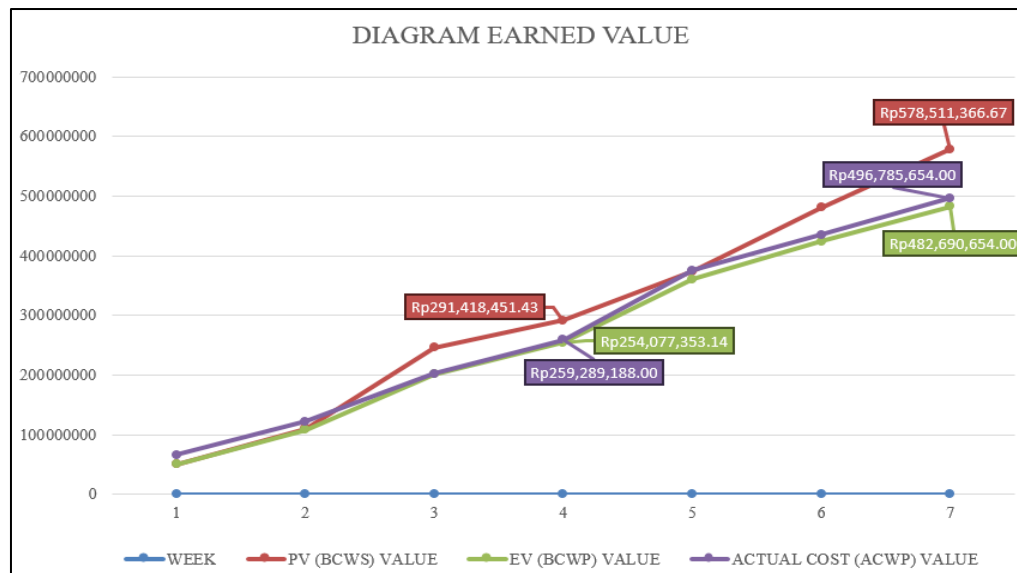


Fig 2 S-Curves for Week 4 and Week 8 of Housing Project 2

Based on Figure 2, in the fourth week, the ACWP was Rp258,370,388.00, the BCWP was Rp273,863,954.91, and the BCWS was Rp347,038,968.57. A CV value of Rp15,493,566.91 and a CPI of 1.00 indicate efficient cost utilization. Meanwhile, an SV of -Rp73,175,013.66 and an SPI of 0.74 indicate that the project is behind schedule, with approximately 74% of the planned work completed. Thus, cost performance is efficient, but schedule performance has not met the plan.

In Week 8, the ACWP was Rp610,376,288.00, the BCWP was Rp590,778,905.74, and the BCWS was Rp622,087,242.86. A CV value of -Rp19,597,382.26 and a CPI of 0.97 indicate that cost utilization is not yet efficient. Additionally, an SV of -Rp31,308,337.12 and an SPI of 0.99 indicate a delay relative to the schedule. Thus, in Week 8, the project experienced cost inefficiency and a delay in implementation.

➤ *Factors Affecting Cost and Time Performance in Housing Construction Projects in Maros Regency*

• *Results of the Relative Importance Index Test for Housing 1*

Table 7 Results of the RII Test for Housing 1

Code	Factor Description	RII Value	Rank
P1	Insufficient workforce on this project to complete the work on schedule	0.737	4
P2	Insufficient workforce productivity on this project to meet work targets	0.645	7
P3	Incompatibility of the construction methods used in this project with site conditions and the type of work	0.697	6
P4	Lack of proper project planning and scheduling, which hindered the smooth execution of the work	0.658	7
P5	Inaccuracies in the cost estimates prepared at the beginning of the project, leading to inaccuracies and discrepancies with actual implementation costs	0.724	5
P6	Changes or increases in material prices that have a significant impact on project implementation costs	0.697	6
P7	Materials in this project that were damaged during storage or installation	0.803	2
P8	Delays in material delivery	0.632	8

P9	Unavailability of materials at the project site to meet work requirements	0.711	5
P10	The quality of materials received at the project site is substandard and does not meet specifications	0.763	3
P11	Construction equipment on this project suffered damage during use	0.500	10
P12	Construction equipment was unproductive, thus failing to support the acceleration of work	0.605	9
P13	Insufficient availability of construction equipment on the project to meet work requirements	0.697	6
P14	Weather conditions at the project site that frequently hinder the work process	0.816	1

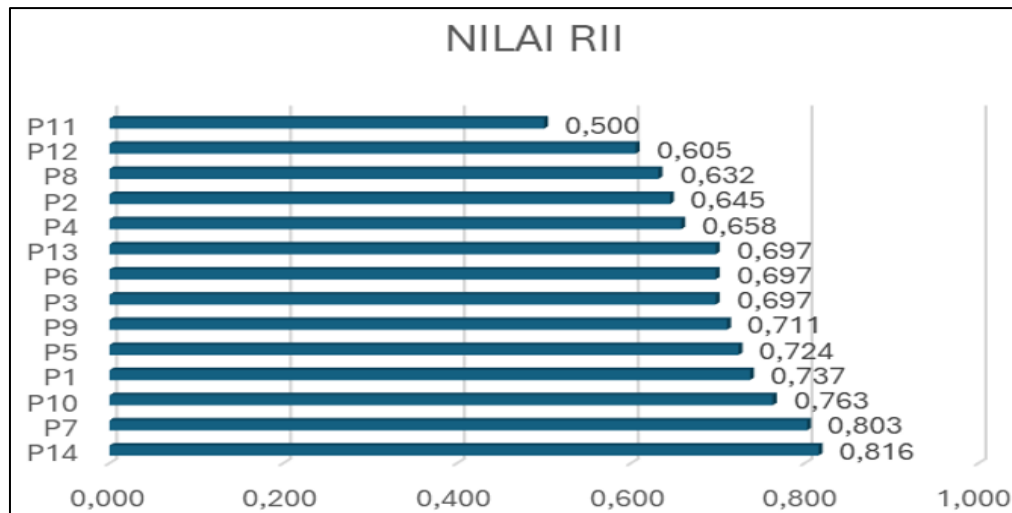


Fig 3 Graph of RII Test Results for Housing Project 1

Based on Figure 3, three dominant factors influencing the cost and time performance of housing construction projects in Maros Regency were identified. The first, coded P14, is “Weather conditions at the project site that frequently hinder the work process,” with an RII value of 0.825 and a rank of 1. The second factor, coded P7, is “Materials in this project that are damaged during storage or installation,” with

an RII value of 0.788 and a rank of 2; and the third factor, coded P10, is “The quality of materials received at the project site is substandard and does not meet specifications,” with an RII value of 0.763 and a rank of 3. Thus, these are the three most important factors and top priorities in decision-making, requiring attention when developing solutions.

- Results of the Relative Importance Index Test for Housing 2

Table 8 RII Test Results for Housing 2

Code	Factor Description	RII Value	Rank
P1	Insufficient workforce on this project to complete the work on schedule	0.711	6
P2	Insufficient labor productivity on this project to meet work targets	0.684	8
P3	Incompatibility of the construction methods used in this project with site conditions and the type of work	0.684	8
P4	Lack of proper project planning and scheduling, which hindered the smooth execution of the work	0.684	8
P5	Inaccuracies in the cost estimates prepared at the beginning of the project, leading to inaccuracies and discrepancies with actual implementation costs	0.724	5
P6	Changes or increases in material prices that have a significant impact on project implementation costs	0.776	2
P7	Materials in this project that were damaged during storage or installation	0.803	1
P8	Delays in material delivery	0.408	12
P9	Unavailability of materials at the project site to meet work requirements	0.737	4
P10	The quality of materials received at the project site is substandard and does not meet specifications	0.763	3
P11	Construction equipment on this project suffered damage during use	0.566	11
P12	The lack of productivity of construction equipment, which hindered the acceleration of work	0.632	10
P13	Insufficient availability of construction equipment on the project to meet work requirements	0.697	7
P14	Weather conditions at the project site that frequently hinder the work process	0.671	9

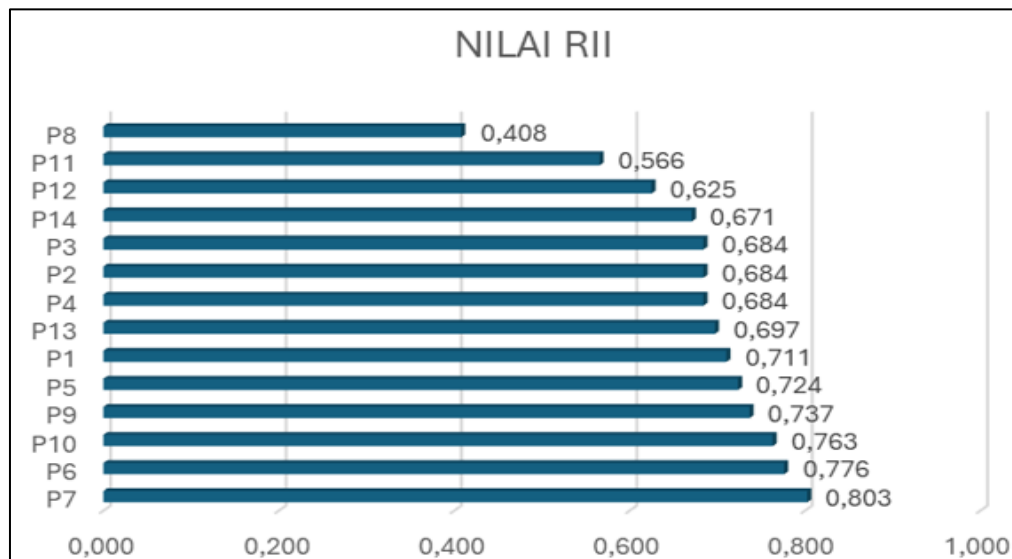


Fig 4 Graph of RII Test Results for Housing Project 2

Based on Figure 4, three dominant factors influencing the cost and time performance of housing construction projects in Maros Regency were identified. First, code P7 is “The presence of materials in this project that were damaged during storage or installation,” with an RII value of 0.813 and a rank of 1. The second factor, coded P6, is “Changes or increases in material prices that have a significant impact on

project implementation costs,” with an RII value of 0.778 and a rank of 2; and the third factor, coded P10, is “The quality of materials received at the project site is substandard and does not meet specifications,” with an RII value of 0.750 and a rank of 3. Thus, these factors are the most important and the top priority in decision-making and require attention when developing solutions.

➤ *Strategies for Addressing Costs and Timelines in Residential Construction Projects in Maros Regency*

• *Results of the Pareto Diagram Analysis for Housing Project 1*

Table 9 Results of Respondent Responses for Housing Project 1

Code	Description of Management Strategy	Number of Respondents		
		YES	NO	TOTAL
P1	Has the allocation of labor and equipment been optimized to avoid idle time?	11	8	19
P2	Are regular cost evaluations conducted to prevent project cost overruns?	14	5	19
P3	Does the project routinely monitor labor productivity levels?	13	6	19
P4	Is there a process for quickly and accurately rescheduling work when conditions on-site change?	16	3	19
P5	Has the project prepared a list of risks and mitigation measures before work began?	10	9	19

Table 10 Percentage Results and Cumulative Percentages for Housing 1

Variable Code	Frequency	Percentage	Cumulative Percentage
P4	16	25%	25%
P2	14	22%	47%
P3	13	20%	67%
P1	11	17%	84%
P5	10	16%	100%
TOTAL	64	100%	

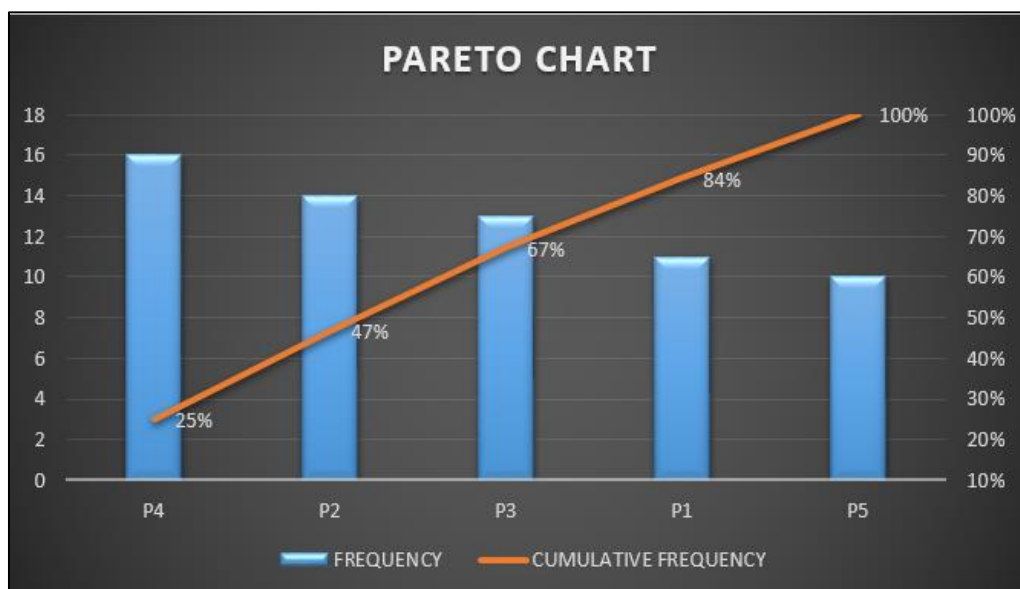


Fig 5 Percentage Diagram of Housing Management Strategies 1

According to Figure 5, the data collection and analysis results show that the blue bars represent the frequency of each factor, while the red lines represent the cumulative percentage contribution of each housing management strategy.

Based on the data processing results, all identified factors were ranked according to their frequency values from highest to lowest. Next, percentage and cumulative

percentage calculations were performed to determine each factor's contribution to the overall problem. The analysis results show that Code P4, Code P2, and Code P3 have the highest frequencies compared to other factors and account for a cumulative percentage of 67%. This figure indicates that these three factors are the most influential primary causes for minimizing project delays and cost overruns.

• *Results of the Pareto Chart Analysis for Housing Project 2*

Table 11 Results of Housing Project 2 Respondent Responses

Code	Description of Mitigation Strategies	Number of Respondents		
		YES	NO	TOTAL
P1	Has the allocation of labor and equipment been optimized to avoid idle time?	11	8	19
P2	Are regular cost evaluations conducted to prevent project cost overruns?	14	5	19
P3	Does the project routinely monitor labor productivity levels?	13	6	19
P4	Is there a process for quickly and accurately rescheduling work when conditions on-site change?	16	3	19
P5	Has the project prepared a list of risks and mitigation measures before work began?	10	9	19

Table 12 Percentage Results and Cumulative Percentages for Housing 2

Variable Code	Frequency	Percentage	Cumulative Percentage
P4	16	25%	25%
P2	14	22%	47%
P3	13	20%	67%
P1	11	17%	84%
P5	10	16%	100%
TOTAL	64	100%	

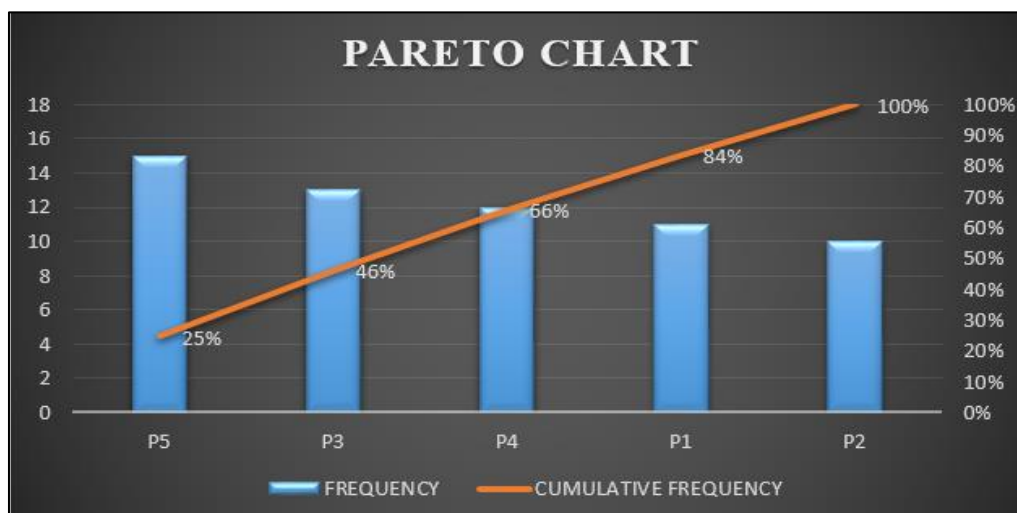


Fig 6 Percentage Diagram of Housing Management Strategies 2

According to Figure 6, the data collection and analysis results show that the blue bars represent the frequency of each factor, while the red lines represent the cumulative percentage contribution of each housing management strategy.

Based on the data processing results, all identified factors were ranked according to their frequency values from highest to lowest. Next, percentage and cumulative percentage calculations were performed to determine each factor's contribution to the overall problem. The analysis results show that Codes P5, P3, and P4 have the highest frequencies compared to other factors and account for a cumulative percentage of 66%. This figure indicates that these three factors are the most influential primary causes for minimizing project delays and cost overruns.

IV. CONCLUSION

Based on the earned value analysis, both housing projects in Maros Regency experienced delays and cost inefficiencies, as indicated by SPI and CPI values below 1. At the end of the observation period, Housing Project 1 had an SPI of 0.95 and a CPI of 0.99, while Housing Project 2 had an SPI of 0.83 and a CPI of 0.97.

Analysis using the *Relative Importance Index* (RII) method showed that the dominant factors for Housing Project 1 included weather, material damage, and material quality, while for Housing Project 2 they included material damage, increases in material prices, and material quality.

Based on the Pareto Chart analysis, the dominant factors for Housing Complex 1 are P4, P2, and P3, accounting for a cumulative 67%, while for Housing Complex 2, they are P5, P3, and P4, accounting for a cumulative 67%. These factors need to be prioritized in the project control strategy.

ACKNOWLEDGMENTS

The author would like to thank Dr. Ir. Fahirah F., ST., MT., as the primary advisor, and Dr. Ir. Tutang Muhtar Kamaludin, ST., M.Si., as the co-advisor, for their guidance

and direction throughout this research. The author also extends gratitude to the Master's Program in Civil Engineering at Tadulako University for facilitating this research.

REFERENCES

- [1]. Asmaroni, D., & Setiawan, A. (2020). Application of the Earned Value Analysis Method to Cost and Time in Residential Building Construction Projects (Case Study of the Residential Building Construction Project by PT. Graha Praja Kencana in Ceguk Village, Tlanakan Subdistrict, Pamekasan Regency). *Ge-STRAM: Journal of Civil Planning and Engineering*, 3(1), 31–39. <https://doi.org/10.25139/jprs.v3i1.2439>.
- [2]. Baihaqi, A. H., Afriandini, B., & Suksmono, A. K. (2023). Cost and Time Analysis of a Project Using the Earned Value Method and the Time-Cost Trade-Off Method. *Surya Beton: Journal of Civil Engineering*, 7(2), 90–101. <https://doi.org/10.37729/suryabeton.v7i2.3754>
- [3]. Biemo, S. W., Abduh, M., & Wirahadikusuma Reini, D. P. N. (2006). The Earned Value Concept for Project Management. *Journal of Civil and Environmental Engineering*, 1–13.
- [4]. Furuhiho, X., Setiawan, L., Slameto, J., Ramadhan, R. N., & Susanto, R. H. (2023). Cost and Time Control Planning for the STIE Tazkia Cendikia Bogor Apartment Complex Construction Project Using the Earned Value Method. *Journal of Social Science Research*, 3, 7591–7600.
- [5]. PMI. (2017). A Guide to the Project Management Body of Knowledge (PMBOK), 6th Edition (PMI, 2017). In *Project Management Institute* (Vol. 6). <http://www.citeulike.org/group/14887/article/9008974>.