

Inhibiting Factors in the Implementation of the Sumbawa Shrimp Pond Construction Project Phase 1A (Main Facility Building) in West Nusa Tenggara Province

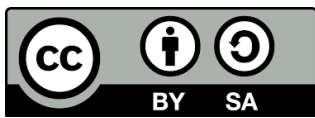
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manpower; material; construction method; project time performance

ABSTRACT

Construction delays remain a significant challenge because they increase costs, disrupt project schedules, and reduce the effectiveness of project delivery. This study aimed to examine the effects of manpower, materials, implementation methods, construction equipment, and contractor cash flow on the time performance of the Sumbawa Shrimp Pond Construction Project Phase 1A (Main Facility Building) in West Nusa Tenggara Province, Indonesia. A quantitative explanatory research design was employed. Data were collected through questionnaires distributed to 66 project personnel selected using purposive sampling based on their involvement in the project and minimum work experience of five years. Instrument validity and reliability were assessed using IBM SPSS Statistics 25, while the relationships among variables were analyzed using partial least squares structural equation modeling (PLS-SEM) with SmartPLS 4. The results showed that all five factors had positive and significant effects on project time performance. Materials had the strongest effect ($\beta = 0.442$; $t = 5.794$; $p < 0.001$), followed by contractor cash flow, implementation methods, manpower, and construction equipment. These findings indicate that effective material procurement and distribution, adequate financial availability, appropriate construction methods, competent workforce management, and reliable equipment collectively contribute to improved schedule performance. The study concluded that integrated resource management, with material management as the primary priority, is essential for minimizing delays and achieving project completion targets.



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INTRODUCTION

The marine and fisheries sector is one of Indonesia's strategic sectors, contributing to economic growth, food security, and the competitiveness of national export commodities (Citaningati & Herianingrum, 2025; Kusmaputri & Diswandi, 2024; Prayoga, 2022; Sulistijowati et al., 2023; Zaputra et al., 2025). One of the leading commodities in this sector is shrimp, which contributes significantly to foreign exchange earnings. Consequently, the development of shrimp aquaculture areas continues through the construction of adequate supporting infrastructure (Amri et al., 2024). Aquaculture infrastructure includes cultivation ponds, water inlet and outlet networks, water control structures, and other supporting facilities that must be developed in an integrated manner to support optimal production activities. Therefore, the success of shrimp pond infrastructure development depends greatly on the implementation of effective construction management to ensure that projects are completed according to predetermined cost, quality, and schedule targets.

Schedule performance is one of the primary indicators of construction project success. Timely completion reflects the ability of project managers to effectively control available resources and coordinate project activities (Husodo, 2026). However, construction delays remain a common problem encountered in various projects in Indonesia. Trianshy et al. (2022) reported that approximately 38% of construction projects in Indonesia experienced delays in completion. This condition demonstrates that schedule control remains a significant challenge in project implementation, as delays may result in schedule deviations, cost overruns, reduced productivity, and decreased overall project effectiveness.

A similar phenomenon occurred in the Shrimp Pond Construction Project Phase 1A developed by PT Inca Nusa Aquaculture in Lunyuk District, Sumbawa Regency, West Nusa Tenggara Province. The project involved earthwork, construction of shrimp cultivation ponds, water distribution systems, utilities, and operational support facilities with a relatively high level of complexity (Kerzner, 2022). Based on project monitoring results during the eighth-month evaluation period, the planned progress was 75%, whereas the actual progress reached only 55%, resulting in a 20% deviation between planned and actual work progress. This condition indicates a delay in project implementation and highlights the need to identify contributing factors to improve schedule control and project completion performance.

Previous studies have demonstrated that construction delays are influenced by various aspects of project management. Angelica and Puspasari (2024) and Faustine and Waty (2022) explained that workforce competence, experience, and productivity affect the smooth implementation of construction projects. Wahono and Prabowo (2024) revealed that delays in material procurement and distribution can hinder the achievement of project schedule targets. Furthermore, Fahirah et al. (2024), Susilo and Qona'ah (2023), and Hatmoko et al. (2022) demonstrated that construction methods, equipment productivity, and contractor cash flow conditions are also important factors affecting project schedule performance.

Although previous studies have identified various factors contributing to construction delays, most research has focused on building projects, road infrastructure, or engineering, procurement, and construction (EPC) projects. Studies that simultaneously examine the effects of manpower, materials, construction methods, equipment, and contractor cash flow on schedule performance in shrimp pond construction projects remain limited. In contrast to conventional construction projects, shrimp pond development involves specific activities, including earthwork, aquaculture pond construction, water management networks, utilities, and supporting facilities, which require integrated resource planning and management.

Based on these conditions, this study aimed to analyze the effects of manpower, materials, construction methods, construction equipment, and contractor cash flow on the schedule performance of the Shrimp Pond Construction Project Phase 1A by PT Inca Nusa Aquaculture in West Nusa Tenggara Province. The findings are expected to contribute to construction management research, particularly in the area of project schedule control, and provide practical considerations for contractors and related stakeholders in improving project management effectiveness and achieving targeted completion schedules.

METHOD

The research was carried out through several stages arranged systematically to achieve the research objectives. The sequence of these stages is presented in the form of a flow diagram in Figure 1 below.

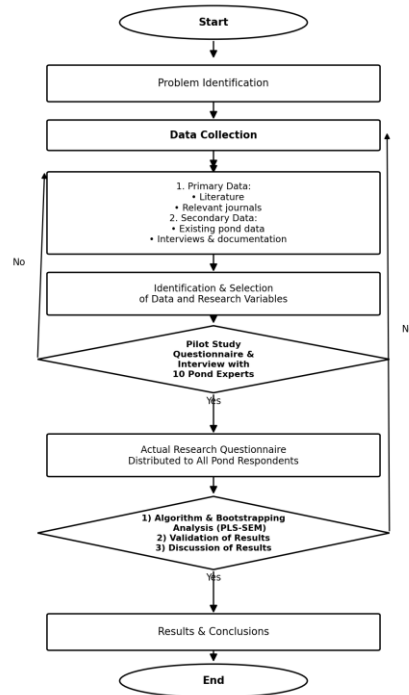


Figure 1. Research Flow Diagram

Research Approach

Quantitative research is a research approach used to test the relationships between variables based on numerical data analyzed using statistical techniques (Sugiyono, 2023). This study uses a quantitative approach with an explanatory research design to analyze the influence of Manpower, Material, Implementation Method, Construction Equipment, and Contractor Cash Flow factors on Project Time Performance.

Research Object and Respondents

The object of this study is the Shrimp Pond Construction Project Phase 1A (Main Facility Building) by PT Inca Nusa Aquaculture in Sumbawa Regency, West Nusa Tenggara Province. The research respondents are project personnel directly involved in planning, implementation, supervision, and project control activities, so that they possess information relevant to the research needs. To obtain data relevant to the research objectives, respondents were selected using a purposive sampling technique based on the criteria of having a minimum of five years of work experience and being directly involved in the project (Musa et al., 2026). Data were collected using a structured questionnaire distributed directly to respondents at the project site. The research population numbered 80 people, while the number of samples meeting the research criteria was 66 respondents. All distributed questionnaires were successfully collected, resulting in a 100% questionnaire return rate, so that all data could be used in the analysis process.

Selection and Grouping of Research Variables

The selection and grouping of variables was carried out by choosing indicators that align with the research's conceptual framework, so that each indicator could systematically represent the construct being measured (Noll, 2024). In this study, this process was carried out by compiling indicators representing each variable. The results of the selection and grouping of research variables are presented in Table 1 below.

Table 1. Selection and Grouping of Research Variables

Variable	Indicator	Code
Manpower (MP)	Number of workers	X1.1
	Worker competence	X1.2
	Worker experience	X1.3
	Worker productivity	X1.4
	Worker discipline	X1.5
	Worker coordination	X1.6
Material (MT)	Material needs planning	X2.1
	Material availability	X2.2
	Accuracy of material procurement	X2.3
	Material quality	X2.4
	Material storage	X2.5
	Material distribution	X2.6
Implementation Method (MPL)	Suitability of the implementation method	X3.1
	Sequence of work implementation	X3.2
	Availability of supporting resources	X3.3
	Technical capability of the implementer	X3.4
	Supervision of implementation	X3.5
	Control of implementation	X3.6
Construction Equipment (PK)	Equipment availability	X4.1
	Suitability of equipment type	X4.2
	Equipment condition	X4.3
	Equipment maintenance	X4.4
	Equipment mobilization	X4.5
	Equipment productivity	X4.6
Contractor Cash Flow (CF)	Availability of working capital	X5.1
	Accuracy of payment from the project owner	X5.2
	Project cost control	X5.3
	Cash flow planning	X5.4
	Cash flow control	X5.5
	Accuracy of payment to suppliers and workers	X5.6
	Conformity of work progress	Y1.1

Variable	Indicator	Code
Project Time Performance (KW)	Accuracy of project completion time	Y1.2
	Delay control	Y1.3
	Implementation schedule control	Y1.4
	Work acceleration	Y1.5

Research Hypotheses

A hypothesis is a conjecture or statement formulated based on theory to test the relationships between variables through statistical analysis (Memon et al., 2021). The hypotheses were developed based on the relationships between variables that have been formulated in the research framework. In this study, the hypotheses are used to test the influence of Manpower (X1), Material (X2), Implementation Method (X3), Construction Equipment (X4), and Contractor Cash Flow (X5) on Project Time Performance (Y1). The hypothesis testing in this study is as follows.

- Hypothesis 1 (H1): Manpower (X1) has a positive and significant effect on Project Time Performance (Y1).
- Hypothesis 2 (H2): Material (X2) has a positive and significant effect on Project Time Performance (Y1).
- Hypothesis 3 (H3): Implementation Method (X3) has a positive and significant effect on Project Time Performance (Y1).
- Hypothesis 4 (H4): Construction Equipment (X4) has a positive and significant effect on Project Time Performance (Y1).
- Hypothesis 5 (H5): Contractor Cash Flow (X5) has a positive and significant effect on Project Time Performance (Y1).

To provide an overview of the relationships between the variables tested, the research hypothesis model is presented in Figure 2.

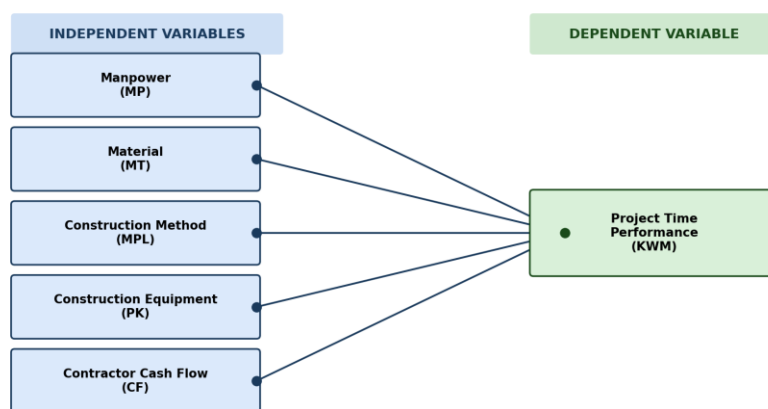


Figure 2. Research Hypothesis Model

Data Analysis

Data analysis in the initial stage of the study was conducted to evaluate the quality of the research instrument before it was used in the actual research stage. Instrument testing

included reliability and validity testing using IBM SPSS Statistics version 25 software. The results of the instrument reliability test are presented in Table 2.

Table 2. Pilot Study Reliability Test Results

Variable	Number of Indicators	Cronbach's Alpha	Description
X1	6	0.916	Reliable
X2	6	0.902	Reliable
X3	6	0.862	Reliable
X4	6	0.928	Reliable
X5	6	0.918	Reliable
Y1	5	0.858	Reliable

Note: Minimum threshold for Cronbach's Alpha = 0.700.

Based on the reliability test results in Table 2, all research variables have a Cronbach's Alpha value above the minimum threshold of 0.700, ranging from 0.858 to 0.928. These results indicate that all variables have a good level of internal consistency, so the research instrument is declared reliable and suitable for use in the main research stage.

After confirming that the instrument had a good level of consistency, a validity test was then conducted on each indicator using Corrected Item-Total Correlation analysis. This test aims to ensure that each statement item has an adequate relationship with the variable's total score, so that it can accurately measure the research construct (Marianti et al., 2023). An indicator is declared valid if the calculated r-value is greater than the r-table value at a 5% significance level.

Table 3. Pilot Study Validity Test Results

Indicator	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	r-Table
X1.1	16.9333	24.961	0.798	0.3610
X1.2	16.6000	25.007	0.801	0.3610
X1.3	16.7667	24.668	0.796	0.3610
X1.4	16.8000	27.821	0.664	0.3610
X1.5	16.7333	24.340	0.825	0.3610
X1.6	16.6667	25.816	0.701	0.3610
X2.1	15.5333	24.395	0.701	0.3610
X2.2	15.6000	24.455	0.782	0.3610
X2.3	15.8333	23.523	0.792	0.3610
X2.4	15.5667	25.564	0.659	0.3610
X2.5	15.8000	23.683	0.764	0.3610
X2.6	15.8333	23.730	0.704	0.3610
X3.1	17.6667	18.851	0.755	0.3610
X3.2	17.2667	20.685	0.550	0.3610

Indicator	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	r-Table
X3.3	17.2667	20.133	0.671	0.3610
X3.4	17.3667	18.999	0.633	0.3610
X3.5	17.2000	19.752	0.612	0.3610
X3.6	17.0667	18.133	0.718	0.3610
X4.1	16.5667	24.944	0.815	0.3610
X4.2	16.5000	25.362	0.789	0.3610
X4.3	16.4000	24.662	0.754	0.3610
X4.4	16.7333	24.892	0.810	0.3610
X4.5	16.7000	25.803	0.848	0.3610
X4.6	16.2667	25.926	0.749	0.3610
X5.1	15.3000	24.631	0.761	0.3610
X5.2	15.6000	26.524	0.721	0.3610
X5.3	15.6000	24.938	0.779	0.3610
X5.4	15.6000	24.800	0.793	0.3610
X5.5	15.4333	26.323	0.714	0.3610
X5.6	15.4667	25.430	0.842	0.3610
Y1.1	13.9000	12.645	0.781	0.3610
Y1.2	14.1667	12.902	0.737	0.3610
Y1.3	13.6667	14.023	0.581	0.3610
Y1.4	13.8667	15.292	0.559	0.3610
Y1.5	14.1333	12.257	0.723	0.3610

Note: r-Table value at 5% significance level = 0.3610.

Based on the validity test results in Table 3, all indicators have a Corrected Item-Total Correlation (calculated r) value greater than the r-table value of 0.3610. The calculated r-values range from 0.550 to 0.848, so that all statement items on the Manpower, Material, Implementation Method, Construction Equipment, Contractor Cash Flow, and Project Time Performance variables are declared valid. Thus, no indicators were eliminated, as all indicators met the validity and reliability criteria and were suitable for use as instruments in the actual research stage.

The next stage was carried out by analyzing the data using the PLS-SEM method through SmartPLS 4 software. In addition to testing the relationships between variables, this analysis was also used to evaluate the quality of the measurement model (outer model) through validity and reliability testing, as well as to evaluate the structural model (inner model) to determine the model's ability to explain the relationships between the research variables.

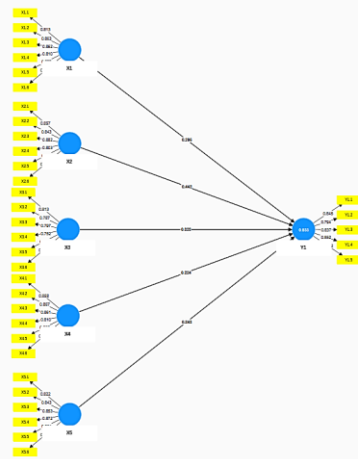


Figure 3. Final Outer Loading Results without Indicator Elimination (PLS-SEM)

RESULTS AND DISCUSSION

Hypothesis testing used a 95% confidence level with a significance level (α) of 0.05. A hypothesis is declared accepted if the t-statistic value > 1.96 and the p-value < 0.05 . The results of the hypothesis testing are shown in Figure 4 and Table 4.

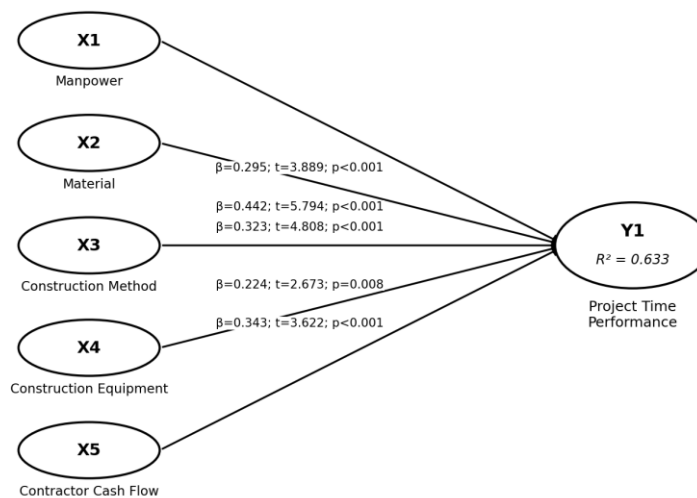


Figure 4. PLS-SEM Bootstrapping Results

Table 4. Hypothesis Testing Results

Relationship	Path Coefficient	t-statistic	p-value
MP → KW	0.295	3.889	<0.001
MT → KW	0.442	5.794	<0.001
MPL → KW	0.323	4.808	<0.001
PK → KW	0.224	2.673	0.008
CF → KW	0.343	3.622	<0.001

- 1) Hypothesis 1 (H1): Manpower (MP) has a positive and significant effect on Project Time Performance (KW), with a t-statistic value of $3.889 > 1.96$ and a p-value $< 0.001 < 0.05$.

- 2) Hypothesis 2 (H2): Material (MT) has a positive and significant effect on Project Time Performance (KW), with a t-statistic value of $5.794 > 1.96$ and a p-value $< 0.001 < 0.05$.
- 3) Hypothesis 3 (H3): Implementation Method (MPL) has a positive and significant effect on Project Time Performance (KW), with a t-statistic value of $4.808 > 1.96$ and a p-value $< 0.001 < 0.05$.
- 4) Hypothesis 4 (H4): Construction Equipment (PK) has a positive and significant effect on Project Time Performance (KW), with a t-statistic value of $2.673 > 1.96$ and a p-value of $0.008 < 0.05$.
- 5) Hypothesis 5 (H5): Contractor Cash Flow (CF) has a positive and significant effect on Project Time Performance (KW), with a t-statistic value of $3.622 > 1.96$ and a p-value $< 0.001 < 0.05$.

In addition to testing the main hypotheses, the test results for all indicators on each variable also show outer loading values that meet the validity criteria, as they are above the minimum threshold of 0.70. This indicates that all indicators are able to represent the construct being measured, making them suitable for use in the model analysis.

Analysis

Based on the test results using the PLS-SEM method, all research hypotheses are declared accepted because each independent variable has a positive and significant effect on Project Time Performance. The findings of the analysis for each hypothesis can be explained as follows.

Effect of Manpower on Project Time Performance

The Manpower variable has a positive and significant effect on Project Time Performance, with a t-statistic value of 3.889 and a p-value < 0.001 . This result shows that the number of workers, competence, experience, productivity, discipline, and coordination of the workforce play a role in supporting the achievement of the project completion time target. This finding is in line with the research of Angelica and Puspasari (2024), who state that workforce productivity is one of the main factors determining the success of construction project implementation. In addition, Faustine and Waty (2022) also explain that a workforce with high competence and productivity is able to increase work efficiency so that project delays can be minimized.

Effect of Material on Project Time Performance

The Material variable has a positive and significant effect, with a t-statistic value of 5.794, the largest value compared to the other variables. This result shows that material needs planning, material availability, procurement accuracy, material quality, storage, and material distribution are the most dominant factors in improving project time performance. This research finding is supported by Wayrah et al. (2021), who state that effective material management can improve the smoothness of project implementation and reduce the potential for delays.

Effect of Implementation Method on Project Time Performance

The Implementation Method variable has a positive and significant effect on Project Time Performance, with a t-statistic value of 4.808. This shows that an appropriate implementation method, a systematic work sequence, the technical capability of the implementer, as well as supervision and control of implementation, can improve the

effectiveness of project completion. This finding is in line with the research of Fahirah et al. (2025), who state that an appropriate implementation method contributes to improved project time performance.

Effect of Construction Equipment on Project Time Performance

The Construction Equipment variable has a positive and significant effect on Project Time Performance, with a t-statistic value of 2.673 and a p-value of 0.008. This result shows that the availability, condition, maintenance, and optimal utilization of construction equipment can support the smoothness of work implementation. This research result is in line with Susilo and Qona'ah (2023), who state that construction equipment productivity affects work implementation efficiency, thereby supporting project completion according to the established schedule.

Effect of Contractor Cash Flow on Project Time Performance

The Contractor Cash Flow variable has a positive and significant effect on Project Time Performance, with a t-statistic value of 3.622 and a p-value < 0.001. Good cash flow conditions enable contractors to meet project operational needs, make timely payments to suppliers and workers, and maintain the smooth implementation of the project. This finding is supported by the research of Hatmoko et al. (2022), who state that delays in payment from the project owner to the contractor can disrupt cash flow, thereby impacting project implementation delays. In addition, Salim (2023) explains that good cash flow management is one of the important factors in maintaining the continuity of construction project activities.

CONCLUSION

This study concluded that manpower, materials, construction methods, construction equipment, and contractor cash flow had positive and significant effects on the schedule performance of the Sumbawa Shrimp Pond Construction Project Phase 1A. Material management had the strongest effect ($\beta = 0.442$; $t = 5.794$; $p < 0.001$), followed by contractor cash flow ($\beta = 0.343$), construction methods ($\beta = 0.323$), manpower ($\beta = 0.295$), and construction equipment ($\beta = 0.224$). These findings indicate that improving project schedule performance requires integrated management of material planning and availability, financial stability, construction methods, workforce capability, and equipment readiness. Therefore, project managers should prioritize timely material procurement and distribution while maintaining adequate cash flow and coordinating other project resources to minimize delays and achieve completion targets.

Future research should examine similar variables across multiple shrimp pond construction projects and different geographical locations to improve the generalizability of findings. Further studies may also incorporate additional factors, including weather conditions, design changes, supply chain disruptions, project owner decisions, regulatory constraints, and risk management practices. Longitudinal or mixed-method approaches are recommended to capture variations in project performance over time and provide deeper insights into the mechanisms underlying construction delays. Comparative studies involving different project types, contract arrangements, and project scales may further validate the proposed model and support the development of more comprehensive delay mitigation strategies.

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