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Factors Affecting the Delay of the Raw Water Intake Circular Installation Project

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ABSTRACT*: Often times in the implementation of these projects there were unwanted and unknown delays. This delay is very detrimental to the parties involved, the contractor and the project owner itself. The completion of the Project for the Installation of the Siring Raw Water Intake for the Pulang Pisau PLTU was delayed for 14 days. The delay in the construction work of the Pulang Pisau PLTU was caused by various factors, including labor, characteristics and environment the place.*

The results showed that simultaneously there was an influence between the independent variables (labor, materials, equipment, characteristics of the place and environment) regarding the delay in the Raw Water Intake installation project at the Pulang Pisau power plant, while only partial testing environment which has an influence on delays in project work.

The approach used in dealing with delays in the Raw Water Intake installation project is to use an operations management approach through the Just In Time (JIT) approach, as well as through the planning, scheduling and control phases as a strategic step in minimizing project delays.

KEYWORDS*: project delays, labor, materials, equipment, place and environmental characteristics.*

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I. INTRODUCTION

Each construction project generally has a specific implementation plan and schedule, when the project implementation should be started, when it must be completed, how the project will be carried out, and how the resources are provided. Making plans for a construction project always refers to the estimates that existed at the time the development plan was made, therefore problems can arise if there is a mismatch between the plans that have been made and the actual reality. So that the impact that often occurs is delays in project implementation time which can also be accompanied by an increase in the cost of implementing the project. In this study, it discusses the Siring Raw Water Intake Installation Project for the Pulang Pisau PLTU, which experienced a delay of 14 days due to a rework on the concrete pile cap. so that the implementation of the Siring Raw Water Intake installation project for the Pulang Pisau power plant has only been achieved ± 70% of the physical work with the remaining work contract 90 days or the remaining 30% of the realization of the project completion. Besides that, the casting of the capping beam with imprecise shape still uses the conventional formwork method and when the river sediment dredging works in the Raw Water Intake pump area there is a delay due to land permit issues to the surrounding community, while on the one hand the problem is the delay in the construction work of the Siring Installation. The Raw Water Intake of the Pulang Pisau PLTU is located in the installation of a concrete sheet pile. This concrete sheet pile work functions as a retaining wall on the river bank so that river water erosion does not occur. The flow of river water continuously eroding the surface or on the sides of the river will have an impact on the formation of canyons, ravines, or valleys. The delay in the construction work of the Pulang Pisau PLTU was caused by various factors, including labor, materials, equipment, characteristics and the environment.

This study analyzes the factors of delays in the project for the installation of the Siring Raw Water Intake of the Pulang Pisau power plant and the approaches that can be taken.

The tests of this study were (1) measuring the influence of various factors on the delay in the installation of the Siring Raw Water Intake at the Pulang Pisau PLTU, (2) developing an approach to dealing with delays in the work of the Pulang Pisau PLTU Siring Installation Project.

II. LITERATURE REVIEW

Through this research, the factors that influence project delays require identification of the causal variables and measuring their level of influence as well as an approach that can be taken in overcoming project delays through a preliminary study, namely observation. Measuring the causes of project delays through determining the sample using random sampling and a sample size of 40 people, then collecting data using a questionnaire to respondents using a Likert scale who is competent in the field of project implementation. Furthermore data analysis using classical assumption test, multiple linear regression analysis and through the Just In Time approach.

III. RESEARCH METHODS

This research was taken to determine the cause of the delay in the project work on the installation of the Raw Water Intake PLTU Pulang Pisau siring with special attention to the quality of the work. Therefore, it is necessary to identify the causal variables and measure the level of their influence. Furthermore, an approach is developed to overcome the influence of these variables.

Preliminary study by making observations at the job site. Observation, namely data collection by conducting direct field visits to be researched which makes the source of data collection observable and studied based on existing data, such as at the Pulang Pisau power plant. Then do an interview (interview). Sampling was done using random sampling techniques and the sample size in this study was 40 people.

IV. RESULT AND DISCUSSION

4.1. RESULT

4.1.1 Instrument Testing

1. Validity test

Table IV.1. Validity Test Results

Item	*Item-total Correlation*	*R-Table*	**Information**
		Project Delay (Y)	
Y_1	0.722	0.320	Valid
Y_2	0.774	0.320	Valid
Y_3	0.738	0.320	Valid
Y_4	0.733	0.320	Valid
Y_5	0.572	0.320	Valid
		Labor (X_1)	
$X_{1.1}$	0.555	0.320	Valid
$X_{1.2}$	0.916	0.320	Valid
$X_{1.3}$	0.856	0.320	Valid
$X_{1.4}$	0.758	0.320	Valid
$X_{1.5}$	0.657	0.320	Valid
$X_{1.6}$	0.618	0.320	Valid
		Material / Material (X_2)	
$X_{2.1}$	0.529	0.320	Valid
$X_{2.2}$	0.529	0.320	Valid
$X_{2.3}$	0.487	0.320	Valid
$X_{2.4}$	0.487	0.320	Valid
		Equipment (X_3)	
$X_{3.1}$	0.650	0.320	Valid
$X_{3.2}$	0.713	0.320	Valid
$X_{3.3}$	0.588	0.320	Valid
$X_{3.4}$	0.636	0.320	Valid
		Spot Characteristics (X_4)	
$X_{4.1}$	0.679	0.320	Valid
$X_{4.2}$	0.932	0.320	Valid
$X_{4.3}$	0.734	0.320	Valid
		Environment (X_5)	
$X_{5.1}$	0.984	0.320	Valid

Based on Table 3.1, the results of the validity test show that all question items in the questionnaire have item-total correlation> r-table 0.320, so that from these results all question items are valid.

2. Reliability Test

Table IV.2. Reliability Test Results

Item	**Cronbach Alfa**	**0.60**	**Information**
	Project Delay (Y)		
Y	0.835	0.60	Reliable
	Labor (X_1)		

X_1	0.884		0.60	Reliable
		Material / Material (X_2)		
X_2	0.963		0.60	Reliable
		Equipment (X_3)		
X_3	0.929		0.60	Reliable
		Spot Characteristics (X_4)		
X_4	0.686		0.60	Reliable
		Environment (X_5)		
X_5	0.967		0.60	Reliable

Based on Table 3.2 the results obtained from the dependent and independent variable items show the Cronbach Alfa value> 0.60, it can be concluded that the research instrument can be declared reliable.

4.1.2 Classic assumption test

1. Normality test

Table IV.3. Tests of Normality

	Kolmogorov-Smirnova			Shapiro-Wilk		
	Statistics	Df	Sig.	Statistics	df	Sig.
X1	.274	40	.000	.809	40	.000
X2	.312	40	.000	.797	40	.000
X3	.213	40	.000	.900	40	.002
X4	.228	40	.000	.876	40	.000
X5	.282	40	.000	.795	40	.000
Y	.291	40	.000	.773	40	.000

a. Lilliefors Significance Correction

The test results using the Kolmogorov Smirnov and Shapiro-Wilk Tests of Normality showed a significance <0.05, that is, all variables were abnormal. However, researchers used the second option, namely the central limit theorem. The central limit argument states: if the data is large (n ≥30), then the data is considered to be normally distributed (Gani and Amalia, 2015: 114-115). Given the research data of 40 respondents (n = 40), the central limit proposition can be used for further testing with regression assumptions.

2. Multicollinearity Test

Table IV.4. VIF value

Variable	**VIF**	**Information**
Labor (X_1)	1,098	Symptoms of Multicollinearity
Material / Material (X_2)	1,842	Symptoms of Multicollinearity
Equipment (X_3)	1,713	Symptoms of Multicollinearity
Spot Characteristics (X_4)	1,119	Symptoms of Multicollinearity
Environment (X_5)	1,248	Symptoms of Multicollinearity

The results of the multicollinearity test showed the results of the Collinearity Statistics, the VIF values for X_1 (1.098), X_2 (1.842), X_3 (1.713), X_4 (1.119), and X_5 (1.248) all variables were below 10 (VIF <10), so all the research variables were not symptomatic of multicollinearity.

3. Heteroscedasticity Test

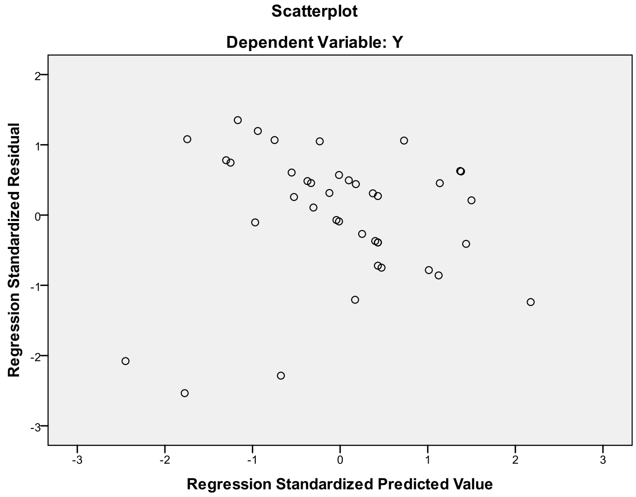

Figure IV.1. Scatterplot pattern

Based on the results of the scatterplot, it shows that the points that spread above and below or around the number 0 are obtained, the data points do not collect only above or below, the data distribution does not form a wavy wavy pattern then narrows and widened again, so that the results do not show heteroscedasticity symptoms.

4.1.3 Analysis of Regression Results

The regression equation for the effect of the level of labor, materials, equipment, site characteristics, and the environment on project delays is as follows:

$$\mathbf{Y = 12.538- 0.678X_1 + 0.314X_2 -0.164X_3 + 0.453X_4 + 0.948X_5}$$

The constant (B_0) is 12,538, this means that if there are no changes in the variables of labor (X_1), materials (X_2), equipment (X_3), place characteristics (X_4), and environment (X_5) that affect the project delay of 12,538 Labor (X_1) has a coefficient value of 0.678 and is negative, this indicates that labor has a relationship in the opposite direction. This implies that if the workforce has increased by one unit, the project delay has decreased by 0.678, assuming the other variables are constant (Ceteris Paribus). Material (X_2) has a coefficient value of 0.314 and is positive, this indicates that the material (material) has a unidirectional relationship.

Meanwhile, Equipment (X_3) has a coefficient value of 0.164 and is negative, this indicates that the equipment has a relationship in the opposite direction. This implies that if the equipment increases by one unit, the project delay will decrease by 0.164, assuming the other variables are constant (Ceteris Paribus). Place Characteristics (X_4) has a coefficient value of 0.453 and is positive, this indicates that the characteristics of the place have a unidirectional relationship. This implies that if the characteristics of the place have increased by one unit, the project delay will increase by 0.453, assuming the other variables are constant (Ceteris Paribus). Environment (X_5) has a coefficient value of 0.948 and is positive, This shows that the environment has a unidirectional relationship. This implies that if the environment increases by one unit, the project delay will increase by 0.948, assuming the other variables are constant (Ceteris Paribus).

4.1.4 Hypothesis test

1. Determination (R2 Test)

The regression results showed the relationship between Labor, Materials, Equipment, Place and Environment Characteristics to project delays, the R2 (R-Square) value was 0.344. This means that 34.4% of the variation in project delays can be explained by 5 (five) independent variables, namely the variables of labor, materials, equipment, characteristics of the place and environment, while the remaining 65.6% is explained by other variables outside the model.

2. Simultaneous Significance Test (Test F)

Based on the test results, it is known that the .F_{count} value is 3.562 which means F_{count} (3.562> 2.49) .F_{kritis} and the significance is 0.011 which indicates <0.05, which means that Labor, Materials, Equipment, Place and Environment Characteristics simultaneously influence project delays.

3. Significance Test of Individual Parameters (t Statistical Test)

Table IV.5. Partial Test

Variable	t	t_{kritis}	Sig value.	Information
Labor (X_1)	-1,761	-2,021	0.087	Not significant
Material (X_2)	1,000	2,021	0.324	Not significant
Equipment (X_3)	-0,616	-2,021	0.542	Not significant
Spot Characteristics (X_4)	1,104	2,021	0.277	Not significant
Environment (X_5)	2,172	2,021	0.037	Significant

Based on five independent variables, the results showed that the variables of Labor, Materials, Equipment, and Characteristics of the place did not significantly influence project delays indicated by each variable> 0.05. Meanwhile, environmental variables only affect project delays.

4.1.5 Just In Time Approach

Table IV.6 Just In Time Analysis

No.	Comparison Factors	JIT Terms	Company Condition
1	*Layout* Erection	*Layout* based on the mapping of the staked area.	The company layout corresponds to the mapping of the staked area.
2	Manpower Training	Training is carried out regularly to improve the expertise and skills of HR	Company training has been carried out regularly.
3	Establish a stream of simplification	Check and evaluate the time of the erection process, measure the waiting time for materials (construction) and identify delays (congestion). Piling line according to job. Availability of locations for construction materials. Machine operators can communicate easily, and are simple and logical.	The company has carried out inspection and evaluation activities, the company has identified delays, the operator has met the job requirements and can communicate easily and simply and logically
4	Kanban Pull System	the contractor does not receive materials from the supplier if it is damaged	The company will re-check the materials through the supplier in the form of electronic data exchange in the form of EDI (Electronic Data Interchange) which is required to access the online purchase database.
5	Eliminate Congestion	Implement a prevention system so that congestion does not occur in the erection process.	PT. Putra Kanca provides engine backup to anticipate congestion in the piling process.
6	Total Productive Maintenance	Equipment / machines are checked and cleaned regularly	The company has carried out regular machine cleaning.

(Next)

Table IV.6 (Extention)

No.	Comparison Factors	JIT Terms	Company Condition
6	Total Productive Maintenance	so that the machine is in a stable condition during the erection process.	
7	Process Capability, Statical Process Control	Availability of statistical records related to the process of erection progress in carrying out corrective instructions if you experience problems.	Putra Kanca companies have statistical records availability.
8	Suppliers	Has few suppliers and has long term contracts.	Has many suppliers and has long term contracts.

The approach to using Just In Time has a simplicity, but easy to understand, where suppliers can produce their products and deliver their products exactly when they are sold. PT. Putra Kanca basically has implemented Just In Time in theory, where the company has met the requirements of the JIT and orders the material from the supplier when the material seems to be running out, but the problem is PT. Putra Kanca is a delay in material delivery so that a shortage of construction materials causes compensable delays which have an effect on low productivity which causes project delays.

From this research, it is evident that project delays are caused by material supply factors caused by delays in delivery of goods so that it has an effect on the shortage of construction materials as the project construction process, so that in overcoming project work delays due to shortages of construction goods due to delays, it can be applied Just In Time using the inventory process terminology as shown in Figure IV.2.

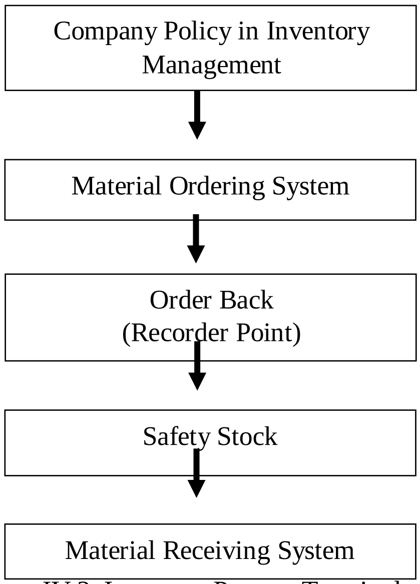

Figure IV.2. Inventory Process Terminology

Inventory Process Terminology Analysis

a. Company Policy in Inventory Management

Management of construction goods inventories is based on policies issued by the company itself in the form of

1) Construction material inventory system in inventory management is not fully the responsibility of the project. Several sub-sections are the responsibility of the project, some project needs such as material management are carried out by suppliers through stages such as determining project material requirements, storing materials, controlling material supplies, purchasing materials and transporting and distributing ordered materials as needed so that they will not causing waste.

2) The remaining material stock has a certain percentage depending on the material item.

b. Material Ordering System

Putra Kanca Company in the process of ordering materials has made an order according to the necessary requirements such as ordering construction materials by calculating when the material will be used and the time until the material is delivered to the location, so it does not store too long which will affect the savings in storage costs. All construction materials that have arrived at the project site are the autonomous responsibility of the project manager (Project Management) as a policy responsibility, while incoming materials are the responsibility of logistics.

c. Rebooking (Recorder Point)

The Putra Kanca Company ordered materials locally, meaning that it did not take long to bring in materials in the process of installing the Raw Water Intake siring. Re-ordering of materials can be done at least 3 days before project use so that the logistics provider of the production always updates the schedule through electronic data exchange in the form of EDI (electronic data interchange) which is needed as an access to online purchasing database.

d. Safety Supplies

In the process of supplying material supplies, PT. Putra Kanca as a contractor has not taken inventory management into account. The JIT approach can be done through an inventory management attitude, namely the principle of inventory management, namely seek zero inventory.

e. Material Receiving System

The mechanism in the material receiving system has no special provisions. In the Just In Time approach, PT. Putra Kanca can receive materials via kanban (control card). Kanban is a system that contains a series of signals in controlling the material receiving process. This system has the aim of being a signer according to more project material needs.

V. CONCLUTIONS AND SUGGESTIONS

Based on the results of the research, it shows as follows: First, simultaneously there is an influence between the independent variables (labor, materials, equipment, characteristics of the place and the environment) on the delay in the Raw Water Intake installation project at the Pulang Pisau power plant, while only partial testing is the environment that has influence on delays in project work. Second, the approach used in dealing with delays in the Raw Water Intake installation project is to use an operations management approach through the Just In Time (JIT) approach.

Based on the results of the analysis carried out, the researchers gave the following suggestions: first, for further research to increase the number of respondents in obtaining truly valid results and the need to add independent variables as factors that influence project delays. Second, it is necessary to pay attention to the conditions of late delivery of goods as well as shortages of construction materials to take steps to minimize losses.

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