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# Influential Factors against Delays in Wharf Construction

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**Abstract:- Risk factors in a dock construction work that results in delays include labor, materials, equipment and weather conditions which are factors studied in this study. The purpose of this study is to analyze the risk of delays that occur by identifying the dominant factor as the cause of the delay that will occur and the relationship between bound variables and free variables and identifying work items that most affect performance in the dock construction project. The data analysis method used in this study is statistical analysis using SPSS ver.26.0 and Relative Importance Index (RII). Based on the results of the study, it was concluded that the first factor that influenced the most dominant cause of delay was the number of workers with a value of 5.43, material quality and tool conditions with the same value of 5.38. Secondly, the relationship between the free variables to delays (bound variables) on the dock construction project shows the result that the correlation of labor, materials, tools is declared valid. The third is the work that occupies the four highest orders that have great potential in contributing delays, namely mobilization and demobilization work with a value of 0.990, erection of an inclined pile foundation with a value of 0.981, erection of an upright pile foundation with a value of 0.971 and splicing of piles with a value of 0.952.**

***Keywords:-*** *Dock project; risk identification; delay.*

## I. INTRODUCTION

The pier is one of the port facilities in the form of construction that is on the edge of the sea or that juts out into the sea which is designed to have a certain depth for a place to rest ships. One type of construction that has a high risk factor is the construction of a pier. In a project there are many goals that are planned from the beginning as the target for the project. Timeliness of project completion is one of the targets to be addressed, problems will arise if there is a project delay that causes losses to both the owner and contractor [1]. Many risks in construction projects occur during the process of carrying out construction activities, therefore the parties responsible for their implementation have an important role in identifying risks and planning risk responses so that during the construction activity process there are no disturbances that result in delays or other things. unwanted things. [2].

In contrast to the two previous studies, Septiani et al. (2015) identified risks from the planning stage to implementation, thus dividing the risks into eight groups, namely licensing (pre-construction), design and study, land acquisition, financing, development (construction), risk equipment, force majeure and social politics. Different sources of risk can occur because each object of a different problem can pose different risks. In addition, the different assessment points of view between each researcher can also cause the risk grouping to be different.

In connection with this, it is very necessary for the Contractor to carry out a risk analysis in development projects, especially projects that have high risks such as piers. The results of several existing journals related to risk analysis of a construction project work, there are several variables that cause delays in a project including extreme weather, equipment, materials, human resources, work methods, design, work location, site conditions and repetitive work, while for the dependent variable is the problem of project performance with time delays in the execution of work. This study has the aim of identifying the highest level of independent variables as the dominant factor in causing delays that will occur and the relationship between the dependent variable and the independent variable as well as identifying the work items that have the most influence on performance in the dock construction project.

## II. METHODOLOGY

The data collected for 17 projects is data from supervising consultants and implementing contractors during the wharf construction project until it is completed and also the questionnaire data obtained from experts in the field of wharf construction, is expected to produce an appropriate analysis of the factors that affect the competence of a project manager. on the quality of construction projects, so that the results obtained are in accordance with the topic and objectives. After all the data has been collected, then data analysis is carried out in a quantitative way, namely project progress report data and questionnaire data processed according to the method used. Questionnaires were distributed to expert service providers, namely Project Managers, Site Managers and Supervisory Consultants. The questionnaire aims to determine the highest level factors as the cause of work delays and the relevance of a risk to the dock construction work and to find out which work items are the most dominant for work delays. The questions contained in the questionnaire consisted of 22 questions to be processed using the SPSS method of Logistic/Dichotomous Regression and Linear Regression, while 21 questions were processed using the Relative Importance Index (RII) method. The data that has been collected from 17 projects is in the form of work progress reports as long as the project is running until the project is completed/declared as ending, the report is sourced from the supervisory consultant and Project

Manager, with the aim of obtaining probabilities related to the cause, impact, and mitigation variables for delays, then processing the data recapitulation by tabulating the progress of each project by evaluating the influencing factors every week and providing progress on the progress of work in the field in the form of percentages. After that, the data processing process is carried out using logistic regression analysis, which is used to explain the relationship between the response variables in the form of dichotomous/binary data and the independent variables in the form of interval scale data and or categories [3].

The type of measurement scale in this study used a nominal measurement scale and an interval measurement scale. Determining the value of the Nominal measurement scale on the evaluation of the independent variables as follows:

| No | Variable Evaluation | Score |
|---|---|---|
| 1 | Faster | 1 |
| 2 | Slower | 0 |

Table 1: Variable Evaluation Value Measurement Scale

The value of the measurement scale interval of 1 to 5 on the dependent variable/time performance is as follows:

| No | Performance Percentage Range Faster/Slower (%) | Score | Description |
|---|---|---|---|
| 1 | - 60 % ≤ s.d < - 100 % | 1 | SL |
| 2 | - 30 % ≤ s.d < - 60 % | 2 | L |
| 3 | + 20 % ≤ s.d < - 20 % | 3 | TW |
| 4 | + 60 % ≤ s.d < + 20 % | 4 | C |
| 5 | + 100 % ≤ s.d < + 60 % | 5 | SC |

TABLE 2 Time Performance Interval measurement scale

Description:
SL = Very slow
L = Slow
TW = On time
C = Fast
SC = Very fast

To determine the effect of the independent variables on the dependent variables together (overall) in the model, the Likelihood Ratio Test can be used. The hypothesis is as follows:

Ho: $\beta 1 = \beta 2 = ... = \beta p = 0$ (there is no effect of the independent variable simultaneously on the dependent variable)

H1: there is at least one $\beta j \neq 0$ (there is an effect of at least one independent variable on the dependent variable) For j = 1,2,...,p

The test statistics used are:

$$G^2 = -2\ln\frac{L_o}{L_p}$$

Description:

Lo = Maximum Likelihood of the reduction model (Reduced Model).

Lp = Maximum Likelihood of the full model (Full Model) or with all independent variables.

This G2 statistic follows a Chi-square distribution with degrees of freedom p so that the hypothesis is rejected if the p-value < , meaning that the independent variable X jointly affects the dependent variable Y.

While the value of the measurement scale for processing SPSS Linear Regression is by entering the results of the assessment in the form of the level of agreement with the statement in accordance with the opinion of the respondent, using the Likert scale method, according to the weight of the value in the table column that has been provided. Description of the weight value given to the section is as follows:
1 = Extremely Disagree (STSS)
2 = Strongly Disagree (STS)
3 = Don't agree (TS)
4 = Agree (S)
5 = Strongly agree (SS)
6 = Extremely agree (SSS)

Furthermore, to obtain/determine priority work items because they have the potential to be the main cause of work delays as a whole is to analyze the most influential factors in the study using the Relative Importance Index (RII) method, which in the calculation can use the following equation:

$$\text{RII Sub Factor} = \frac{\Sigma W}{(A \times N)}$$

Description:
RII = Relative importance index
W = Weight (The score value is multiplied by the weight of each score, namely 1 s.d 5)
A = The highest weight (In this study 5)
N = Total respondents (21)
RII Main Factor = The average value of RII Sub Factor
RII Variabel = Average RII Main Factor nilai

## III. RESULTS AND DISCUSSION

The results of the analysis of the SPSS Logistics Regression/Dichotomy where based on the Model Significance Test shows that there are 10 projects that have a significant effect on Y, while 7 projects are not significant, but although the results say there are 7 projects that have no significant effect together but each variable still has an effect on overall work delays. Meanwhile, the results of the SPSS Linear Regression analysis are described in table 3 where the factor that occupies the highest level is the number of workers with a value of 5.43,

while the quality of the material and the condition of the equipment ranks second and third with the same value,

| No | Variable | Sub Faktor | | Mean |
|---|---|---|---|---|
| 1 | Labor (x2) | Total Labor | X1-1 | 5.43 |
| 2 | Material (x2) | Material Quality | X2-3 | 5.38 |
| 3 | Equipment (x3) | Equipment condition | X3-1 | 5.38 |
| 4 | Equipment (x3) | Equipment Specification | X3-3 | 5.33 |
| 5 | Material (x2) | *Stock* material | X2-2 | 5.29 |
| 6 | Labor (x2) | Skill | X1-2 | 5.24 |
| 7 | Equipment (x3) | Equipment selection | X3-2 | 5.19 |
| 8 | Material (x2) | Material mobilization | X2-1 | 5.14 |
| 9 | Labor (x2) | Experience | X1-3 | 5.05 |

Tabel 3: Mean and Ranking

namely 5.38.

The relationship between the independent variable and the dependent variable, in this case the delay, is explained as follows:

Simple Correlation (Bivariate correlation).

- The correlation between two variables is known as simple correlation (linear and non-linear).
- Simple linear correlation structural model:

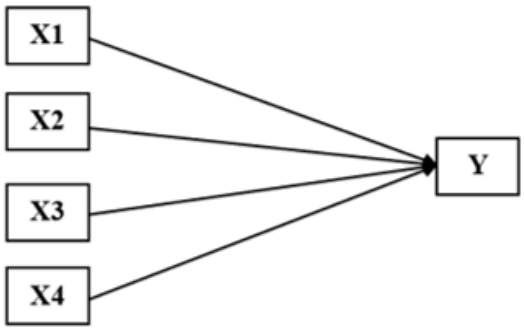


Fig. 1: The relationship between the independent and dependent variables

Where the Independent Variables:
X1 (Labor)
X2 (Equipment)
X3 (Materials)
X4 (Weather),
Bound Variables:
Y (Time Performance).

From the results of the correlation table between the independent variable and the dependent variable in the form of time performance, it can be explained that:

- Correlation of Independent Variables consisting of Labor (X1-1, X1-2, X1-3), Materials (X2-1, X2-2, X2-3) and Equipment (X3-1, X3-2, X3-3 ) on the dependent variable, namely Time Performance, has a correlation value for Time Performance r count > 0.4329 so that the correlation between X and Y variables is declared valid, while for the Independent Variable in the form of Weather (X4-1, X4-2) on the Time Performance variable with a value correlation of 0.297 and 0.362 (< 0.4329) so that the Weather variable is declared invalid
- Correlation of Independent Variables consisting of Labor (X1-1, X1-2, X1-3), Materials (X2-1, X2-2, X2-3) and Equipment (X3-1, X3-2, X3-3 ) on the dependent variable, namely Time Performance, has a value of sig.(2-tailed)/(signification) < 0.05 so that the correlation between variables X and Y is declared valid, while for the Independent Variable in the form of Weather (X4-1, X4-2) against Time Performance variables with values of 0.190 and 0.107 (> 0.005) were declared invalid Weather variables.

The results of the calculation of the Relative Importance Index (RII) value to find the ranking of work items that have the potential to cause delays in dock construction work are presented in the image below:

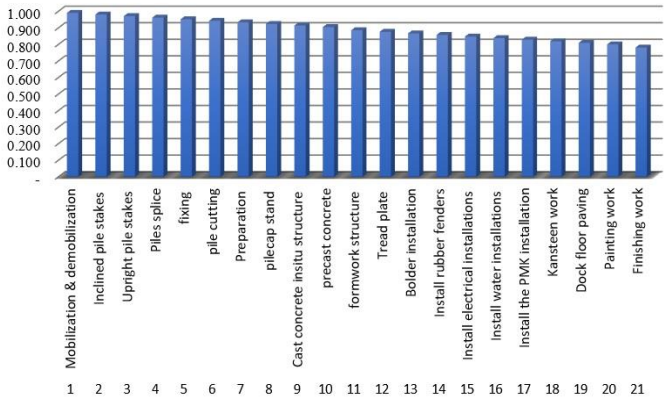


Fig. 2: Ranking order of work items that are potential causes of delays

The calculation results show that the work item that occupies the first level is the mobilization and demobilization work with a value of 0.990, the second is the erection of the pier sloping pile foundation with a value of 0.981, the third is the erection of the erect pier foundation with a value of 0.971 and the fourth rank is the connection of piles with a value of 0.962.

Based on the results of the t-test (partial), then the discussion of the results of data analysis is obtained, as follows:

- This study shows that the X1 (Labor) variable, namely X1-1 (Number of Workers) on Y has a significant effect. Previous research explains, the results of the analysis have identified seven risks including Human Resources where the source of risk and the causes are human error, incompetence, ignorance, fatigue, communication skills, culture of working at night. The final result of the study shows that HR does not include a high level of risk [4]. In

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this study, the variable X1-1 is the number of workers occupying the highest level where in dock work the number of workers is very decisive, especially experts in the field of piling and dock structures.

- This study shows that the X2 (Material) variable, namely X2-3 (Material Quality) on Y has a significant effect. Previous research stated that the material was in accordance with the requirements of the availability of materials, there was no delay in the mobilization of materials, the quality of the materials according to specifications, the existence of material control, and the use of appropriate materials, but the performance of the quality of the reinforced concrete structure work that was not in accordance with the requirements was an aspect density. In the aspect of density, there is a construction defect, namely porous concrete on the surface of the reinforced concrete structure [5]. This study explains that material quality is one of the factors that has the highest level of risk where if the quality of the material does not match the technical specifications it will result in being rejected by the owner so that the installed material is automatically dismantled and reworked and these activities have an impact on work delays (time performance). ) as a whole, whereas previous studies focused more on the details of the quality of the material so that it had more influence on Quality Performance.
- Variable X3 (Equipment), namely X3-1 (Condition of Equipment) on Y has a significant effect. Previous research is more focused on the alternative of choosing the right piling tool according to the soil layer conditions of the piling location, the selection of the piling tool uses Export Choice (EC) software [6]. Both studies have the same variable, namely Equipment, where the equipment variable is different in its sub-factors but has a linkage in the implementation of its functions, namely if the selection of the right tool and supported by good equipment conditions will both have a significant influence on the implementation of the work and vice versa. if one of them can not be met it will affect the delay in work.
- This study shows that the X4 (Weather) variable on Y has no significant effect because the X4 variable is declared invalid and abnormal in the validity test and normality test (Kolmogorov Smirnov). Previous research explained that there were 7 highest risks that resulted in delays, including the weather factor. In risk response research that needs to be addressed regarding weather is the mitigation process that coordinates with BMKG related parties regarding weather conditions. In a different study, it was shown that the weather (heavy rain/flooded location) was ranked at the top with the analysis. This item was considered an influence by the respondents because in the implementation of this bridge work it could not be carried out because it was strongly influenced by good weather conditions [7]. In principle, weather conditions are natural phenomena that can be handled well by choosing the right time to start/carry out work that affects the weather when the weather conditions are good.

Based on the results of the f test (simultaneous), then the discussion of the results of data analysis is obtained, namely:

The results of the f test indicate that there is a simultaneous effect on the variable X/independent variable on the dependent variable/time performance in the form of delays in the work of the dock construction project. From the results obtained that the fulfillment of the number of workers, especially those who are competent in the field of wharf construction, improving the quality of materials in accordance with the technical specifications in the contract and maintaining the condition of the equipment properly according to procedures simultaneously that can be implemented by the Contractor from the time the work starts until the completion of the work, then the process of completing the construction of the wharf construction becomes more effective and efficient, it also supports previous research if the results of the study conclude the need for the application of risk management in the implementation of project development so that the risks and obstacles encountered in the implementation of project development can be anticipated earlier before the project is implemented. The study also concluded that one of the highest risks, namely heavy equipment damage, can be anticipated by performing periodic maintenance supported by mechanics who are always on standby in the field [4].

Based on the results of calculations in this study using the Relative Importance Index (RII) method by analyzing all work items in the construction of the wharf, the results of the Reliability Test and Validity Test on 21 correspondents from experts (Project Manager, Site Manager and Supervisory Consultant) are Reliable and valid results and ranking of work items that have the potential to cause delays in work time has been obtained. The jobs that occupy the four highest ranks that have great potential in contributing to delays in a dock construction work are mobilization and demobilization work (equipment, materials, labor), erecting inclined pile foundations, erecting erect pile foundations and connecting dock piles. When viewed from the weight value in the overall work schedule, the four work items have the greatest weight in a dock construction contract so that if the work item experiences problems, it can significantly affect the value of the delay weight in the field. Mobilization and demobilization work (equipment, material, labor) has always used shipping facilities by sea so that if you encounter obstacles on the way, the work in the field cannot indirectly begin, as well as for the work of piling the pier foundation if you experience technical problems. in the field, it will affect further work that cannot be carried out if the erection work experiences problems, both technical and delivery problems.

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## IV. CONCLUSION

Based on the results of the research that has been done, it can be concluded that the results of the Research Question are as follows:

- The factors that have the most dominant influence on the cause of delays in work on the wharf construction project are 3 variables with the highest level, namely the Number of Labor Factors with a value of 5.43, Material Quality and Equipment Conditions with the same value, namely 5.38. Meanwhile, in previous studies, weather factors include factors that have a large / high impact on the delay in the construction of the pier. However, the analysis using Linear Regression SPSS version 2.60 with processed data derived from expert questionnaires (Project Manager, Site Manager and Supervisory Consultant) showed the results that the weather was declared invalid and was not among the highest factors of work delays. This is because the wharf construction projects studied have been largely anticipated in advance, such as in making a schedule for the implementation plan of the work looking at local BMKG data, tidal data so that work items related to weather can be anticipated in advance, so the work that comes first is work that is not affected by weather such as concrete structure work mostly using precast concrete where it can be done in the workshop and also the work is done by adjustment on each2 structure. Then there are also jobs where on the job site the weather is mostly quite good, especially on weather-related jobs.
- The relationship between the independent variable and delay (the dependent variable) on the wharf construction project shows that the correlation of Labor, Materials, Tools is declared valid while the Weather variable has a Correlation value for Time Performance of r count, namely 0.297 and 0.362 (< 0.4329) and sig.(2-tailed)/(signification) values of 0.190 and 0.107 (> 0.005) so that the weather variable is declared invalid. These results indicate that the weather variable has no effect or has a relationship with delays in the work of the dock construction project. Technically, in the field application, natural weather factors/natural cycles cannot be controlled/avoided, but can be circumvented, such as in setting a schedule for the physical work implementation by looking at data from the local BMKG so that the timing of the work that has an impact due to bad weather can be adjusted appropriately.
- The jobs that occupy the four highest ranks that have great potential in contributing to delays in a dock construction work are mobilization and demobilization work (equipment, materials, labor) with a value of 0.990, piling pile foundation erection with a value of 0.981, pile foundation erection upright with a value of 0.971 and the work of connecting the pier piles with a value of 0.952.

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