

Risk Factors Analysis Affecting on Hydrant System Construction Project at Juanda International Airport Terminal-2 Surabaya

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Abstract— *Engineering Procurement Construction (EPC) project is a type of project that is more complex than ordinary construction projects, more in issues and problems, first like mutual dependence between existing activities, overlapping phases between each activity, solving activities to more active work activities. In this research used technique collect data, namely by questionnaires and interviews as an instrument to answer a set of questions or written statements to respondents. The goal is to obtain a complete and deep description. Case study data were obtained from primary and secondary data. Based on research results, F count (18,842) > F table (2.49), meaning that the factors of planning, implementation, management and finishing both simultaneously and partially have a positive and significant effect on the risk of EPC project such as of hydrant system construction project at Juanda International Airport Terminal-2 Surabaya; the results of multiple regression obtained standardized coefficient β of factor 0.765, meaning that the most dominant management factor influences the risk of hydrant system construction projects; the followings strategies used to anticipate the risks in hydrant system construction project at Juanda International Airport Terminal-2 Surabaya, namely, have to carefully calculating in planning and ordering / purchasing related to materials, have to routinely controlling vendors / suppliers and strict supervision of materials quality.*

Keywords — Risk, EPC project, Hydrant system development.

I. INTRODUCTION

Engineering Procurement Construction (EPC) project is a type of project that is more complex than ordinary construction projects, integrated in implementation of science and technology, more in issues and problems, first like mutual dependence between existing activities, overlapping phases between each activity, solving activities to more active the work activities.

Uncertainty project procurement in the cost, quality and time cannot be predicted with certainty beforehand will pose a risk to the project. Therefore a way to reduce the risks that may occur are as small as possible. To reduce the risk is identify the risks that might occur, carefully make plans to overcome them and strictly monitoring to their implementation.

The objectives in this study are: 1. Analyze risk factors affect to the EPC project such as hydrant system construction project at Juanda International Airport Terminal-2 Surabaya; 2. Analyzing most dominant risk factors to the hydrant system construction project at Juanda International Airport Terminal-2 Surabaya; 3. Determine what strategies should be carried out to overcome the risks in the hydrant system construction project at Juanda Internasional Airport Terminal-2 Surabaya

II. THEORETICAL BASIS

A. Project Definition

The project is a temporary effort to produce a unique product or service. The project normally involves several people who are interconnected with their activities.

The construction project is a related of a building and infrastructure that generally involves the main work that is included in the fields of civil and architectural engineering, besides it also involves other fields of science such as Process chemical engineering, Civil engineering, Industrial engineering, Mechanical engineering, Electrical engineering, Instrumentation and control system engineering, Geotechnical engineering and landscape. The characteristics of a project are:

- Has goals and objectives in the form of an end product.
- Projects have a temporary nature, ie clear starting and starting points.
- Costs, time and quality in achieving these goals and objectives have been determined.
- Type and identity of activities change throughout the project, causing the project to be nonrepetitive.

B. Project Management

Project management is a process of planning, organizing, leading and controlling resources to achieve short-term goals that have been determined. Project management grows because of the urge look for a management approach that suits the demands and nature of project activities, an activity is dynamic and different from routine operational activities.

The success of a project requires carefully planning, good coordination and accuracy in supervision of the work, because project is defined as an activity that does not repeat or occur once and its success is determined by a coordination of a number of parties involved both internal or external stake holders.

C. Engineering Procurement Construction (EPC) Project

EPC project is a project where the contractor works on a project with the scope of responsibility for completing work including design engineering, material procurement and construction even including of commissioning work as well as planning of those activities. The EPC project is a project that is quite complex, complex, and rich in problems and problems. Understanding EPC refers to a management system that is able to manage various elements, related to each other, in building an industry. These elements include engineering from various disciplines (process chemical, civil general, mechanical, electrical, instrumentation and control system, material, etc.), in finance (financing, budgeting, cost control, financial management, etc.), in the field of material and equipment procurement from within and abroad, shipping, manpower and others.

D. Risk Identification

Risk identification is a process that is repetitive because new risks are likely to be discovered only when the project is taking place during the project cycle. The frequency of repetition and who the personnel involved in each cycle will vary greatly from case to case. The project team must always be involved in every process so that they can develop and maintain risk responsibilities and action plans for risks that arise.

E. Population and Samples

Population is a collection of all measurements, objects, or individuals that are being studied. While the sample is a part or a subset of a population.

Population is a generation area that consists of subjects that have certain qualities and characteristics determined by researchers to be studied and then conclusions drawn. So the population is not only people, but also objects and other natural objects. The population is also not just the amount that exists on the object/subject studied, but includes all the characteristics/traits that are owned by the subject or studied.

The sampling technique in this study uses a saturated sampling type, this type of sampling technique used if the population is relatively small, or less than 100 people, or researchers who want to make generalizations with very small errors.

III. RESEARCH METHODOLOGY

A. Research Type

This study uses quantitative research methods by capturing the opinions, experiences and attitudes of respondents to obtain primary data through a questionnaire as a means of collecting data from populations that are used as samples that have been determined in number. Quantitative research

method is defined as a research method based on the philosophy of positivism, used to examine a population or a specific sample, collecting data using research instruments, quantitative / statistical data analysis, with the aim to test a predetermined hypothesis.

To determine the number of research samples, use the slovin formula:

$$n = \frac{N}{1 + Ne^2} \tag{1}$$

with:

- n = number of samples
- N = total population
- d = precision value

B. Research Objects

The object of the project is the engineering procurement construction for hydrant system construction project at Juanda International Airport Terminal-2 Surabaya, the facility includes a Jet Fuel hydrant pipeline to the apron, valve chamber / header pit and hydrant pit valves installation on the new apron terminal-2, accompanied by the addition of a new Jet fuel hydrant pump to accommodate charging wide body & narrow body air planes simultaneously.

C. Questionnaire Validity Results

To test the validity of the questionnaire using equations:

$$r = \frac{n(\sum XY - \sum X \cdot \sum Y)}{\sqrt{[n \cdot \sum X^2 - (\sum X)^2] \cdot [n \cdot \sum Y^2 - (\sum Y)^2]}} \tag{2}$$

with:

- r = Correlation coefficient between items and totals
- X = Question item scores
- Y = Total score
- n = Number of respondents

The following results of the questionnaire data validity test can be seen in the following table:

TABLE I. Questionnaire Validity Results X₁

Item-Total Statistics				
	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
X1.1	6.65	.723	.650	.600
X1.2	6.19	.694	.637	.615
X1.3	8.51	.653	.606	.633
X1.4	8.43	.642	.610	.642
X1.5	6.59	.622	.616	.652
X1.6	7.89	.688	.608	.631
X1.7	8.76	.689	.612	.650
X1.8	8.05	.650	.606	.633
X1.9	6.68	.695	.642	.610
X1.10	6.54	.642	.601	.638
X1.11	6.59	.630	.608	.646
X1.12	8.14	.676	.617	.625
X1.13	6.86	.634	.601	.640
X1.14	8.08	.647	.603	.635
X1.15	8.08	.647	.603	.602
X1.16	6.46	.620	.629	.615
X1.17	5.92	.624	.608	.646
X1.18	6.08	.674	.622	.621

TABLE II. Questionnaire Validity Results X₂

Item-Total Statistics				
	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
X2.1	6.85	.675	.761	.603
X2.2	6.24	.619	.761	.601
X2.3	6.19	.607	.761	.610
X2.4	6.11	.693	.762	.610
X2.5	6.59	.637	.761	.613
X2.6	7.03	.642	.762	.626
X2.7	8.16	.658	.761	.615
X2.8	6.68	.667	.760	.607
X2.9	6.89	.682	.761	.606
X2.10	8.11	.688	.761	.607

TABLE III. Questionnaire Validity Results X₃

Item-Total Statistics				
	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
X3.1	6.08	.641	.604	.591
X3.2	6.68	.667	.619	.618
X3.3	6.16	.620	.613	.601
X3.4	6.62	.652	.606	.610
X3.5	7.08	.630	.603	.606
X3.6	6.05	.616	.612	.604
X3.7	6.70	.644	.603	.609
X3.8	6.05	.633	.601	.607
X3.9	6.97	.636	.602	.609
X3.10	6.92	.608	.618	.605
X3.11	6.27	.626	.608	.602

TABLE IV. Questionnaire Validity Results X₄

Item-Total Statistics				
	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
X4.1	7.24	.719	.724	.714
X4.2	7.46	.726	.724	.714

D. Reliability Results

Reliability test to determine the consistency of the measuring instrument or research questionnaire, the consistency in question is if the measuring instrument is distributed more than once then the data obtained will remain the same, and the equation in testing the reliability of the questionnaire data, namely:

$$S_r^2 = \frac{\sum S_i^2}{n} - \frac{(\sum S_i)^2}{n^2}, \text{ dan } S_r^2 = \frac{JK_i}{n} - \frac{JK_s}{n} \quad (3)$$

with:

- $\sum Xt$ = Total score of respondents
- JKi = Sum of the squares of all item scores
- JKs = Number of subjects squared

$$r_i = \left(\frac{k}{k-1} \right) \left(1 - \frac{\sum S_i^2}{S_t^2} \right) \quad (4)$$

with:

- r_i = Realibilitas instrument (Cronbach's Alpha)
- k = Mean squares between subjects
- S_t² = Mean squared error
- S_t² = Marias total

The results of the questionnaire data reliability test can be seen in the following table:

TABLE V. Questionnaire Reliability Results

Variabel	Cronbach Alpha	Keterangan
Planning	0,737	Reliabel
Implementation	0,838	Reliabel
Management	0,771	Reliabel
Finishing	0,778	Reliabel

E. Regression Analysis Results

To answer the purpose of the problem, namely to find out whether the variables Planning (X1), Implementation (X2), Management (X3), Finishing (X4) simultaneously and partially have a significant effect and what risk factors are the most dominant affecting the project construction engineering procurement construction hydrant system at Juanda Internasional Airport Terminal-2 Surabaya.

TABLE VI. Regression Analysis Results

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.	
	B	Std. Error	Beta			
1	(Constant)	25.420	22.537		31,082	.000
	Perencanaan	2.674	2.813	.489	.576	.000
	Pelaksanaan	2.710	3.487	.557	.722	.000
	Pengelolaan	4.991	3.243	.765	.869	.000
	Finishing	2.589	2.772	.432	.530	.000

a. Dependent Variable: Resiko_EPC

Regression coefficient is 25,420 which means that the risk of the project construction engineering procurement for hydrant system construction project at Juanda Internasional Airport Terminal-2 Surabaya is affected by the planning, implementation, management and finishing of 25,420. While the regression coefficients of some independent variables positive signification means that the implementation and management factors have a positive relationship with the risk of engineering procurement construction for hydrant system construction projects at Juanda Internasional Airport Terminal-2 Surabaya, meaning that they have a direct relationship or in other words the implementation and management factors will be followed by high risk of engineering procurement construction for hydrant system construction projects at Juanda Internasional Airport Terminal-2 Surabaya.

F. Simultaneous Analysis Results

The equation to research test hypothesis with the F test is:

$$\text{Nilai } F_{hitung} = \frac{R^2(n-k-1)}{k(1-R^2)} \quad (6)$$

with:

- R² = The coefficient of multiple determination
- n = Sample size
- k = The total number of samples

Results of the following hypothesis testing use the simultaneous significance test or Fisher's exact test (F test) with the Fcount test results contained in the following table:

TABLE VII. Simultaneous Analysis Result

ANOVA ^a						
Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	37.770	4	37.770	18.842	.001 ^b
	Residual	18.842	32	1.884		
	Total	56.612	36			

a. Dependent Variable: Resiko_EPC

b. Predictors: (Constant), Finishing, Perencanaan, Pengelolaan, Pelaksanaan

From the table, the calculated F value is 18.842, with a significance of 0.000, while the F table at the 95% confidence level or $\alpha = 0.05$ is 2.49. By comparing the value of F arithmetic with F table, then F arithmetic (18.842) is greater than F table (2.49). Thus the factors of planning, implementation, management and finishing simultaneously have a positive and significant effect on the risk of engineering procurement construction for hydrant system construction projects at Juanda International Airport Terminal-2 Surabaya.

G. Partial Analysis Results

To test the effect of planning, implementation, management and finishing on the risk of engineering procurement construction for hydrant system construction projects at Juanda International Airport Terminal-2 Surabaya, the statistical t test (t test) was used.

TABLE VIII. Partial Analysis Results

Coefficients ^a						
Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	25.420	22.537		35.082	.000
	Perencanaan	2.674	2.813	.489	.576	.000
	Pelaksanaan	2.710	3.487	.557	.722	.000
	Pengelolaan	4.991	3.243	.765	.869	.000
	Finishing	2.589	2.772	.432	.530	.000

a. Dependent Variable: Resiko_EPC

Based on the analysis results obtained t value of each independent variable and if t arithmetic of each independent variable will be compared with the value of t table using a 95% confidence level or $\alpha = 0.05$, then the value of t table is 2.056.

The results of the t-test explain that each factor (planning, implementation, management and finishing) has a significant (dominant) effect on the risk of engineering procurement construction for hydrant system construction projects at Juanda International Airport Terminal-2 Surabaya.

IV. CONCLUSIONS AND SUGGESTIONS

A. Conclusions

From the results of data analysis, it can be concluded:

1. Based on the calculation results obtained F count (18,842) > F table (2.49), that meaning the factors of planning, implementation, management and finishing both simultaneously and partially have a positive and significant effect on the risk of engineering procurement construction for hydrant system

construction projects in Juanda International Airport Terminal-2 Surabaya.

2. Based on the results of multiple regressions, the standardized coefficient β of the management factor is 0.765, that meaning the most dominant on the management factor influences the risk of the engineering procurement construction for hydrant system project at Juanda International Airport Terminal-2 Surabaya.
3. The strategy to anticipate risks in the engineering procurement construction for hydrant system construction project at Juanda International Airport Terminal-2 Surabaya, namely, have to carefully calculating in planning and ordering / purchasing related to the material, have to routinely controlling the vendor / supplier and strict supervision of the material quality.

B. Suggestions

1. Should pay attention to the problem of planning, implementing, managing and finishing.
2. For further research is expected to examine by adding another variables not examined in this study, the population or with different objects/places.

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