

Risk Analysis of Change Order on Performance Project Costs on High Rise Construction Building in DKI Jakarta

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ABSTRACT: Implementation of construction projects is often faced with problems during the project period, one of which is the occurrence of a request to implement changes in the construction of a project called Change Order. Change order occurs during the process of project construction work. Change order is also one of the main causes in using and managing cost efficiency in construction. This research uses case study of high-rise building project in DKI Jakarta. Instrument This research consists of among others 7 factors causing change order, 47 independent variables and 1 dependent variable. This research uses qualitative and quantitative methods with statistical study approaches processed with SPSS (Statistical Package for the Social Sciences) program. The required data is a high building construction project in DKI Jakarta experiencing change order. The results of this study were obtained from the results of correlation analysis, linear regression, model test, and R square test. The purpose of this research is to know the factors and variable of change order risk in high building building in DKI Jakarta, to know the result of change order risk analysis to project cost performance in construction process, to know the cause of modeling risk, and give recommendation of the most effective improvement from result of risk analysis change order on high building project in DKI Jakarta.

KEYWORDS: Change Order, Cost Performance, Risk, High Rise Building,

I. INTRODUCTION

Change Order on construction projects often occurs during the process of project construction work and involves stakeholders such as owners and contractors. The occurrence of a change order can have a direct and indirect negative impact both on the contractor and owner. In practice, there are various types of job changes that occur due to reasons such as design errors and inaccuracies, changes in specifications, design changes, changes in conditions for job execution, and methods of implementation of work according to Hardjomuljadi [1]. Change Order has an influence on project construction that is: direct cost, time, and cost of impact according to Sapulette [2]. Strategies that can be taken include avoiding risks, reducing the negative effects of risk, and accommodating some or all of the consequences of certain risks. Identification of risk identification is a process of systematic and continuous risk assessment and uncertainty according to Soeharto [3].

Indonesia as a developing country, has a rapidly growing project, where the growth of these projects is done to build the state economy, improve the quality of life, the welfare of society, and the ease of society. One of the fastest growing projects in Indonesia is the high building construction project. The rapid development of construction projects in Indonesia can be seen in the business center, politics and culture of Indonesia, namely DKI Jakarta.

Based on the phenomenon of building buildings that occur various places abroad and within the country, researchers interested to examine changes in order in improving the cost performance of high-rise building construction projects, especially in Jakarta.

The purpose of this research is to know the factors and risk variables of change order, to know the result of change order risk analysis to the cost performance of the project in the construction process, to know the cause of model

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forming risk, and provide the most effective improvement recommendation from the result of the change order risk analysis on the building project high buildings in DKI Jakarta..

The purpose of this study is to determine the risk change order factors, how far the influence of change order on the cost performance and the cause of the risk of modeling change order influence the cost performance.

II. LITERATURE REVIEW

Risk Management

Risks are things that can never be avoided in any human activity or activity, including construction project activities and construction projects because in every activity, such as construction activities, there must be uncertainties. Project Management Body of Knowledge - PMBOK (2017) [10] defines project risk management as a systematic process consisting of identification, analysis, response, and risk control on the project. The objective of risk management is to maximize the opportunities and consequences of positive events and minimize the opportunities and consequences of negative events on project objectives and targets.

The processes in risk management in Project Management Body of Knowledge - PMBOK (2017) [10] are risk management planning, risk identification, qualitative risk analysis, quantitative risk analysis, and risk response planning.

Referring to the above definition of risk management, it can be concluded that risk management is an uncertain event which, when it happens, will have positive or negative effects on the project objectives can be cost, time, quality, scope of the project. Risk management is also a systematic method step for identifying, analyzing, responding, and controlling risks to projects to minimize the negative impacts of various risk sources faced in order to achieve project objectives optimally as expected

Stages of Construction Project

There are 3 stages of the cycle of a construction project that is the conceptual stage, the definition stage, and the implementation stage according to Soeharto[3]. This period of conceptual stage consists of several activities, namely composing and formulating ideas, analyzing the introduction, and conducting a feasibility study. One of the main activities that are comprehensive, in this stage that try to highlight all aspects about the worth of an idea to be realized, called the feasibility study. Compared to previous assessments, feasibility studies have broader scope and aspects of assessment, encourage positive potential, and pay particular attention to the constraints and limitations. At the definition stage It is mentioned earlier that at the beginning of the project cycle, efforts are aimed at identifying and formulating ideas, developing into alternatives, complete with indications of scope of work, schedule, and cost. Nevertheless, they are still within the conceptual level. This means that the assessment has widened to include aspects that have a close relationship between ideas and available opportunities, but not yet deep enough to be used as a basis for making final decisions about whether to invest or implement projects. The final stage is the implementation stage which consists of: reviewing the scope of work of the project, Planning and controlling aspects of cost, schedule, and quality, closing the project, submitting project results to the owner, and resolving the insurance, claims and project finance.

Change Order

Change order according to Soeharto [3] is a change after the approval and signed contract. Briefly the definition of change order according to Schaufelbeger and Holm [11] as a modification of the original contract. The definition of change order according to the Directorate General of Highways (DGH), Ministry of Public Works [12] is added to the work to adjust the field volume or schedule changes without changing the terms of the contract. So the definition of change order is the form of contract or written approval agreed by the owner of the project with the contractor to change the initial construction contract agreement

Change order is a mechanism for making changes during construction, which is a written document between owner and contractor to change the condition of the original contract document, by adding or reducing the work. This reflects the poor planning and lack of precise efforts to anticipate various technical and commercial factors and problems.

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Although everything has been best done, the project manager notes that change order is inevitable so what should be done is how to manage the change order as well as possible.

Variation Order is a very common way to change the work already written in the original contract document according to Fisk [4]. Variation Order is an agreement between service users and service providers to confirm the changes of plans and the amount of compensation fees to service providers which occurred at the time of construction, after the signing of work between service users and service providers. Change order is a proposed written change between the owner and the contractor to amend some conditions of the original contract document, such as adding, reducing the work, and changing according to Widhiawati [5]. From all opinions or definitions it can be concluded that a change order is a written agreement signed by the owner, contractor, and planner for modification or amendment to the work that has been arranged in the contract document where the change can be considered so as to result in adjustments to the costs and work time. change order consists of two basic changes, namely Direct Change Order (formal change), and Constructive Change order ((informal change) Direct Change Order (informal change) is a proposed change order in written form, proposed to the contractor to change scope of work, execution time, and the costs or other matters which have been stated in the construction contract according to Gilbreath [6] The second type is constructive change (informal change) According to Barrie and Paulson [7] Informal action to order a modification of a contract on the ground that occurs at the request of the planner or contractor owner Constructive Change is also described as a change agreement between the owner and the contractor in terms of cost and time

In reviewing the issue of change order through several references among others :Gumolili [8], Soeharto [3], Hardjomuljadi [1], Sapulette [2], SimhanandiSapulette [2], found on the causes of change orders that can be caused by many factors. The following are the factors causing the change order summarized based on seven parts: Design evaluation, Soil Excavation, Substructure, Upper Structure, MEP, Architech, and Finishing. The following is a grouping of factors and causes change variables.

Table 1: Factors and Variables Causes Change Order

Factors	Variables Cause Change Order
DESIGN EVALUATION	Incompatibility layout between tender drawings and forcon drawings
SOIL EXCAVATION	Incompatibility of the depth of excavation between the tender drawings and the forcon drawings
SUBSTRUCTURE	Incompatibility of the detail, span, and spreading of reinforcement between the tender drawings and the forcon drawings on the raft foundation work, bored pile work, retaining wall work, pile cap work, tie beam work
UPPERSTRUCTURE	Incompatibility of the detail, span, and spreading of reinforcement between the tender drawings and the forcon drawings on the column work, corewall work, beam work, slab work, stairs, work, and ramp work
MEP	Incompatibility of the electrical system, plumbing system, electronic system, fire fighting system, and mechanical ventilation air conditioning (MVAC) system between the tender drawings and the forcon drawings
ARCHITECHT	Incompatibility of the brick wall work, façade work, partition wall work, door window, and external work between the tender drawings and the forcon drawings
FINISHING	Changes in wall finish, floor finish, ceiling fnish, railing, waterproofing specifications in post-design

Based on table 1 shows the factors and variables that cause a change order consisting of 7 factors and 47 variables.

Most change orders have a negative impact on project costs and schedules. As a result of change order to the cost can add the contract value, or it can also decrease the value of the contact. While the effect of change order on time can cause the addition of time so that the completion time of work becomes slower than the contract schedule, or it could be

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with the acceleration of work time. According to Sapulette [2], the effects of change order are divided into three categories: direct cost, time, and cost of impact. Increased change order that occurs in the construction phase can affect the cost performance of the constructor in working on high-rise building construction projects.

III. RESEARCH METHODOLOGY

Research Process

Research is a long and thorough process that begins with an interest in knowing a particular phenomenon. This idea is intended to examine more deeply the occurrence of change orders during the construction process takes place on the project cost performance. The framework of this research process is from the initial stage, literature review, analysis, and discussion. The initial phase is the first stage in the study used to determine the tools needed to achieve the research objectives. This section consists of problems after the problem formation.

The purpose of this research is to know the factors and variable of change order risk in high building building in DKI Jakarta, to know the result of change order risk analysis to project cost performance in construction process, to know the cause of modeling risk, and give recommendation of the most effective improvement from result of risk analysis change order on high building project in DKI Jakarta. In this journal will be discussed the first problem and the second problem.

The literature review comes from a construction management guide book that can help in this research. In addition, there are also relevant local and international journals in the last 10 years with the aim of identifying the effect of change order in improving cost performance in high buildings in Jakarta to answer the first problem. Next to the second problem, the stage of analysis is the stage to collect data consisting of primary and secondary data, followed by analyzing the two data that will be continued to be used in evaluating and providing recommendation improvement on the effect of change order in improving the cost performance of building construction projects high in DKI Jakarta

Research Respondents

Research respondent is person or agency that will become source of information and answer questions of research questionnaire. Respondent in this research is staff or assignee working in specialist contractor in high rise building with minimum age 23 years old, minimum education level of bacheor, minimum 2 years experience especially in high building project, has reputation both in construction projects, have knowledge of change order, and the minimum positions that fill out this questionnaire are field implementers. In this research there ara 30 respondents who fill this questionnaire.

Research Instruments

In this research is divided into 2 data to be used, namely: Primary Data and secondary data. Primary data in this study was obtained by distributing questionnaires to contractors. Questionnaires were made based on research variables. These variables are converted into questions that direct respondents to determine the factors and risk variables of change order on project cost performance in high rise buildings in DKI Jakarta. The questions are arranged in simple language and lead to the goals to be achieved so as to facilitate the respondent to answer. This questionnaire will be assessed using a Likert scale, which is a scale to measure attitudes, opinions and perceptions of a person against a particular object. Secondary data is data published or used by non-processing organization, ie data obtained from journals and other literature related to this research. Secondary data is data obtained in the form of finished, that is processed and presented by other parties. The researcher obtained the ready-made data obtained from the literature related to the risk of change order to the cost performance of the project in high rise building in DKI Jakarta.

Research Methods

In this study the researchers conducted a case study on high-rise project in DKI Jakarta. In order to get the results of research in accordance with the expected hence required the appropriate research methods. Research methods need to consider three things, namely the types of questions used, the constraints on the events studied, and the focus of ongoing events or just completed. According to Sudarmanto[9], The statistical calculation based on the questionnaire answers will be processed by validity test, reliability test, correlation and intercorrelation analysis, factor analysis,

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determinant variable analysis, regression analysis, and model test. Using the tools of SPSS (Statistical Package for the Social Sciences).

IV. ANALYSIS AND RESULTS

The discussion of the first problem can be seen based on the table of factors and variable causes of change order is design evaluation factor (1 variables), soil excavation factors (1 variables), substructure factor (10 variables), upperstructure factor (13 variables), MEP factor (5 variables), architect factor (9 variables), finishing factor (8 variables). Then from the table and variable change order above will be analyzed for discussion of the second research problem. Factor and variable change order will be tested the validity where the correlation value of Pearson r fulfilled the requirement greater than r table and continued for intercorrelation test and get valid data result consist of 9 variables those are Incompatibility of the detail of reinforcement between the tender drawings and the forcon drawings on pile cap work (X8), Incompatibility of the brick wall work between the tender drawings and the forcon drawings (X31), Incompatibility of the partition wall work between the tender drawings and the forcon drawings (X33), Incompatibility of the external work between the tender drawings and the forcon drawings (X39), Changes in internal wall finish specifications in post-design (X40), Changes in floor finish specifications in post-design (X41), Changes in external wall finish specifications in post-design (X42), Changes in ceiling finish specifications in post-design (X43), Changes in skirting finish specifications in post-design (X44).

Multiple Linear Regression Analysis

After that, based on the calculation results using SPSS program can be seen in the Coefficients that the regression model obtained is: $Y = 0.49 + 0.526 X_{40} + 0.194 X_{33} + 0.244 X_{41}$. From the existing regression equation, the constant value B obtained by all positive value variables which means the more frequent occurrence of causes of change order, it will further decrease the cost performance of high-rise building construction project in DKI Jakarta.

Hypothesis Testing

Hypothesis in this research are:

H_0 = the causes of change order factor does not significantly affect cost performance.

H_a = the factors causing the change order significantly influence the cost performance.

Based on the above hypothesis will be continued analysis of test models are T, F and D.

T Test

From T test, the value of t in SPSS program is found in the t test result table below. The value of t table is $t = 1.703$ and seen from the existing significant level, obtained the result of hypothesis: Reject H_0 and take H_a , the factors causing the change order significantly influence the cost performance of high-rise building construction project in DKI Jakarta.

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Table 2: Results of T Test
Coefficients^a

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Collinearity Statistics	
		B	Std. Error	Beta			Tolerance	VIF
1	(Constant)	1.554	.441		3.522	.001		
	40	.684	.097	.799	7.031	.000	1.000	1.000
2	(Constant)	1.354	.359		3.775	.001		
	40	.530	.087	.618	6.072	.000	.806	1.240
	33	.226	.056	.410	4.030	.000	.806	1.240
3	(Constant)	.490	.480		1.021	.317		
	40	.526	.080	.614	6.577	.000	.806	1.241
	33	.194	.053	.352	3.652	.001	.758	1.320
	41	.244	.099	.216	2.474	.020	.921	1.085

a. Dependent Variable: 48

Based on table 2 shows the results of analysis of SPSS software to get the value of T test.

F Test

By using SPSS program can be seen the results of F arithmetic = 6.967 and F table = 2.96 with significant results 0.000. so it can be seen that F arithmetic > F table then Ho rejected means Ha accepted. Furthermore it can be seen that significant < 0.05 mahaHo rejected means Ha accepted.

Table 3: Results F Test

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	4.447	1	4.447	49.429	.000 ^b
	Residual	2.519	28	.090		
	Total	6.967	29			
2	Regression	5.394	2	2.697	46.285	.000 ^c
	Residual	1.573	27	.058		
	Total	6.967	29			
3	Regression	5.693	3	1.898	38.750	.000 ^d
	Residual	1.273	26	.049		
	Total	6.967	29			

Based on table 3 shows the results of analysis of SPSS software to get the value of F test.

Determination Coefficient Test

To determine the coefficient of determination of independent variables in a regression model can be done by looking at the value of R square or adjusted R square values contained in the summary model table results of regression analysis. Based on the result of using SPSS program the value of R square is 0.817, which means the variables X40, 33, X41 are simultaneously able to explain Y (cost performance) of 81.7%, while the remaining 18.3% is explained by factors outside the independent variables.

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Table 4: Model Summary Result of Regression Analysis

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics					Durbin-Watson
					R Square Change	F Change	df1	df2	Sig. F Change	
1	.799 ^a	.638	.625	.300	.638	49.429	1	28	.000	
2	.880 ^b	.774	.757	.241	.136	16.239	1	27	.000	
3	.904 ^c	.817	.796	.221	.043	6.121	1	26	.020	2.231

a. Predictors: (Constant), 40

b. Predictors: (Constant), 40, 33

c. Predictors: (Constant), 40, 33, 41

d. Dependent Variable: 48

Based on table 4 shows the results of analysis of SPSS software to get the summary result of regression analysis.

V. CONCLUSION

Conclusion in this research are:

1. the factors causing the change order are Incompatibility of the detail of reinforcement between the tender drawings and the forcon drawings on pile cap work(X8), Incompatibility of the brick wall work between the tender drawings and the forcon drawings(X31), Incompatibility of the partition wall work between the tender drawings and the forcon drawings (X33), Incompatibility of the external work between the tender drawings and the forcon drawings (X39), Changes in internal wall finish specifications in post-design (X40),Changes in floor finish specifications in post-design (X41), Changes in external wall finish specifications in post-design (X42), Changes in ceiling finish specifications in post-design (X43), Changes in skirting finish specifications in post-design (X44).
2. The amount of contribution or influence of these factors on the cost performance of high-rise building construction project in Jakarta is 81.7% consisting of Changes in internal wall finish specifications in post-design (X40) is 63.8%,Incompatibility of the partition wall work between the tender drawings and the forcon drawings (X33) is 13.6%,and Changes in floor finish specifications in post-design (X41)is 4.3%. While the remaining of 18.3% is associated with other factors or variables not examined in this study.

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