Quantitative Economics and Management Studies (QEMS) *ISSN: 2722-6247 (online)*
Vol. 2 No. 4 (2021)
https://doi.org/10.35877/454RI.qems323

Risk and Change Order Impact Analysis of Costs in Tamansari Iswara Bekasi Project

Ali Sunandar* & Kuncoro Bili Aszhari

Mercu Buana University, Bekasi, Indonesia

Abstract

In every construction project, there is always a change or what is commonly called a change order (CO). CO greatly affects the effectiveness of project work where its sustainability depends on three interrelated components namely quality, time and cost. The purpose of this study is to determine the causes, risks, impact of CO and risk management on costs. This research was conducted in the Bekasi area at the Tamansari Iswara project. This study uses descriptive analysis methods and direct interviews with the experts concerned by distributing questionnaires to 85 respondents and producing data for analysis. With the help of statistical analysis software that is SPSS researchers use several tests such as validity test, reliability test, descriptive analysis test, regression analysis, and risk analysis to determine the dominant variables and risk management. From the results of the analysis conducted there are 6 dominant variables namely X18, X19, X15, X28, X21, X9, X25, and the highest risk is found in variables X1 and X21.

Keywords: Risk analysis; damp analysis; contract change order; contractor.

1. Introduction

Understanding the construction industry, in general, is all activities or businesses related to land preparation and construction processes, changes, improvements to buildings, structures, and other related facilities. While the definition of construction work according to Article 1 Paragraph 3 of Law no. 2 of 2017 concerning Construction Services is the whole or part of activities which include construction, operation, maintenance, demolition, and rebuilding of a building. Simply stated, there are 3 (three) important criteria that are the focus of construction projects, namely: cost, quality, and time. These three criteria will continue to be considered throughout the stages of the construction project cycle (Hansen, 2017). During the construction of change order construction can occur from the owner, the contractor, and also due to field conditions that do not allow it to proceed in the process of implementing the construction project. Change orders which include less added work, changing work schedule, and changing technical specifications of work that affect the performance of a construction project will have a direct or indirect negative impact on both the owner and the contractor himself, (Beatrix, et. al., 2013). The development of the Tamansari Iswara project uses a joint contract, namely: a Lump Sum Contract and a Unit Price Contract. However, in the implementation of the Tamansari Iswara project development many experienced obstacles in the field so that it affected the development implementation process. The existing constraints caused several changes to the employment contract. The number of issuance of addendum changes to the Bill of Quantity (BOQ) and the contract value by the service provider, is the cause for analyzing the main causes of changes in the contract of work (Contract Change order). As a result of frequent changes in orders (changes in work) where the administrative process is not carried out according to procedures, there are often disputes between the owner and the contractor that ends in arbitration (court). From this, it will be examined what are the main causes of change orders (job changes), and their impact on costs in the Tamansari Iswara project.

* Corresponding author.
E-mail address: ali.sunandar@gmail.com (Ali Sunandar)

While the purpose of this research is:

a) Knowing the dominant variable causing contract change order
b) Knowing the risk management strategy in the Tamansari Iswara Bekasi project

2. Literature Review

2.1. Understanding Order Changer

Change Order is a written agreement to modify, add, or other changes to the work that has been set in the contract at the time of bid opening, provided that the change is still within the scope of the initial project (Khan, 2016). Change orders can include changes in contract prices, payment schedules, project completion schedules, or changes in drawings and specifications. Change orders can arise due to various reasons, some of which are: flawed or incomplete designs, changes in demand, unknown field conditions, unclear contract language, and acceleration orders (Osman, et.al., 2009).

2.2. Purpose of Change Order

According to Fisk & Reinolds (2006) and Khan (2016), the objectives of the change order are:

- To change the contract plan with a special method of payment
- To change job specifications
- For the approval of additional new jobs
- For administrative purposes
- To follow the adjustment to the contract unit price
- For submission of cost reduction proposal incentives
- To adjust the project schedule due to change
- To avoid disputes between the contractor and the owner

2.3. Factors That Cause Order Changer

No	The causal factors and the impact of the contract change order on cost performance in the Tamansari Iswara project
Planing and design factors	
X1	design blindness
X2	design changes by consultant planners
X3	Less detailed planner design
X4	Completeness in contract documents
X5	the mismatch between the picture and the state of the field
Natural Conditions	
X6	very bad weather
X7	flooding
X8	Land subsidence
Owner Influence Factors	
X9	Termination of work at the request of the owner
X10	acceleration of work execution time due to the owner's request to quickly finish
X11	delay in execution of work due to the owner's request
X12	a request for material change by the owner
X13	changes in technical specifications of work items

No	The causal factors and the impact of the contract change order on cost performance in the Tamansari Iswara project
X14	being late in approving drawings (shop drawing)
Contractor Influence Factors	
X15	lack of control by the contractor in the implementation of construction
X16	the discrepancy between contractor and subcontractor schedules
X17	replacement of the foreman carried out by the contractor because the work did not match the contract
X18	poor material control
X19	lack of contractor teamwork in carrying out the work
X20	lack of communication between field implementers and supervisory consultants
X21	errors and omissions in calculating volume estimates
X22	less quick decision making by the contractor
Other Influencing Factors	
X23	disputes between workers, be it consultants, contractors or owners
X24	lack of management related to the security and scheduling of project personnel equipment materials
X25	damage to equipment by irresponsible parties
X26	land acquisition issues
X27	material delivery by suppliers does not match the specifications & schedule
X28	inadequate equipment needs environmental & social impacts due to adjacent residential areas
X29	inadequate equipment needs environmental & social impacts due to adjacent residential areas
The Impact of a Terms of Cost	
X30	Increased Overhead Costs
X31	Increased equipment and material costs
Impact of Time	
X32	Extension of time for work duration
X33	Added time for additional work, rework / redesign
X34	Procurement of equipment and materials
Impact in terms of quality	
X35	A decrease in quality
X36	Rework and disassembly occurred
X37	there is a defect in the product

2.4. Risk Management

According to PMBOK Guide-Sixth Edition (2017), Risk Management is the process of defining how to carry out risk management activities for a project. The main benefit of this process is ensuring that the degree, type, and visibility of risk management are proportionate to the risks and importance of the project for the organization and other stakeholders. This process is carried out once or at a predetermined point in the project.

3. Methods

The method used in this research is data collection through a questionnaire distributed to several respondents. The analytical method used is descriptive quantitative. A quantitative approach is a research that focuses on testing hypotheses, the data used must be measurable, and produce conclusions that can be generalized. This approach uses inferential statistical (analytical tool) methods.

The flowchart of the study in this study is as follows in fig. 1.

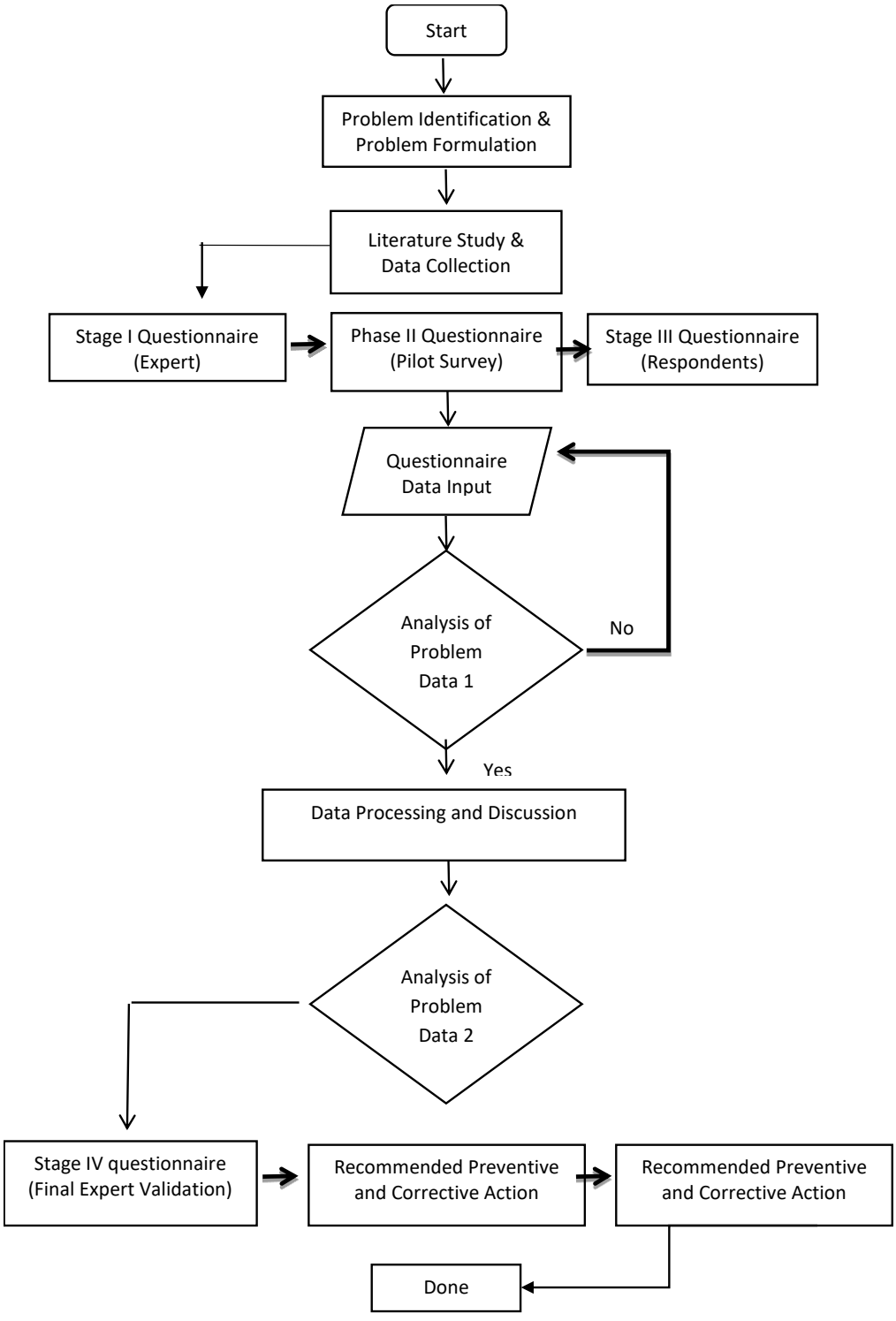

Fig. 1. Flowchart of Study

4. Result and Discussions

Data collection consisted of four stages which began with the distribution of questionnaires to 3 experts, followed by the distribution of pilot survey questionnaires, then the distribution of questionnaires to respondents and finally the validation of the final stage of experts to find out risk management. From 37 variables validated by experts, filtered to 31 variables to be analyzed. The filtered variables are X4, X5, X7, X8, X20, and X37.

4.1. Validity and Reliability Results

For reliability testing, Cronbach's alpha method is used where the value must be greater than 0.6 for each variable and 0.8 for the entire variable to be considered reliable. Based on the reliability test results obtained show that all items of the variables in the study can be declared reliable and have a high level of reliability.

Table 1. Result of reliability test

Cronbach's Alpha	N of Items
0.864	31

4.2. Spearman Rank Correlation Results

The Spearman Rank Test is used to see whether the relationship is significant or not, by referring to the column correlation coefficient (r count) compared to the r table value. The table value is 0.213. for statistical decision making is a variable that has a correlation coefficient> 0.213.

Table 2. Result of Spearman Rank Test

Variabel	N	*Correlation Coefficient*	Sig. (2-tailed)
X6	85	0.211	0.052
X9	85	0.559**	0.000
X10	85	0.459**	0.000
X11	85	0.437**	0.000
X12	85	0.062	0.574
X13	85	0.451**	0.000
X15	85	0.371**	0.000
X16	85	0.408**	0.000
X17	85	0.494**	0.000
X18	85	0.608**	0.000
X19	85	0.580**	0.000
X21	85	0.589**	0.000
X22	85	0.436**	0.000
X23	85	0.273*	0.011
X24	85	0.367**	0.001
X25	85	0.452**	0.000
X26	85	0.328**	0.002

Variabel	N	*Correlation Coefficient*	Sig. (2-tailed)
X27	85	0.490**	0.000
X28	85	0.490**	0.000
X29	85	0.458**	0.000
X30	85	0.220*	0.043
X31	85	0.241*	0.026
X32	85	0.376**	0.000
X33	85	0.235*	0.031
X34	85	0.385**	0.000
X35	85	0.344**	0.001
X36	85	0.215*	0.048

From the above table, it can be concluded that the variables that are stated to have significant correlation levels are X9, X10, X11, X13, X15, X16, X17, X18, X19, X21, X22, X23, X24, X25, X26, X27, X28, X29, X30, X31, X32, X33, X34, X25 and X36.

4.3. Regression Analysis Results

The relationship model between pineapple variables (CCO factors) to the dependent variable (Cost Performance) was studied by regression analysis using the help of a statistical processing program. The input for this regression analysis is the dominant variable in determining the factors that cause change order. The outputs of the regression analysis can be seen in Table 3.

Table 3. Model Summary of Regression Analysis

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.620[a]	0.384	0.377	0.440
2	.743[b]	0.551	0.540	0.378
3	.804[c]	0.646	0.633	0.337
4	.841[d]	0.707	0.692	0.309
5	.871[e]	0.759	0.744	0.282
6	.881[f]	0.776	0.759	0.274
7	.889[g]	0.790	0.771	0.267

a. Predictors: (Constant), X18
b. Predictors: (Constant), X18, X19
c. Predictors: (Constant), X18, X19, X15
d. Predictors: (Constant), X18, X19, X15, X28
e. Predictors: (Constant), X18, X19, X15, X28, X21
f. Predictors: (Constant), X18, X19, X15, X28, X21, X9
g. Predictors: (Constant), X18, X19, X15, X28, X21, X9, X25

The model which has the highest R square value is model 7. The correlation/relationship value (R) is equal to .889 and the magnitude of the influence of the independent variable on the dependent variable is called the coefficient of determination (R2) of .790, meaning the effect of the variable free to the dependent variable is 79%, while the rest is influenced by other variables.

Table 4. Coefficients of T test

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	2.649	0.153		17.320	0.000
	X18	0.330	0.046	0.620	7.192	0.000
2	(Constant)	2.000	0.176		11.352	0.000
	X18	0.251	0.042	0.471	5.981	0.000
	X19	0.248	0.045	0.435	5.531	0.000
3	(Constant)	1.331	0.213		6.255	0.000
	X18	0.241	0.038	0.451	6.406	0.000
	X19	0.242	0.040	0.424	6.032	0.000
	X15	0.191	0.041	0.309	4.666	0.000
4	(Constant)	1.060	0.206		5.141	0.000
	X18	0.214	0.035	0.402	6.129	0.000
	X19	0.205	0.038	0.358	5.391	0.000
	X15	0.186	0.038	0.301	4.945	0.000
	X28	0.144	0.036	0.264	4.062	0.000
5	(Constant)	0.828	0.196		4.222	0.000
	X18	0.177	0.033	0.333	5.351	0.000
	X19	0.139	0.038	0.243	3.638	0.000
	X15	0.194	0.034	0.313	5.644	0.000
	X28	0.137	0.032	0.251	4.234	0.000
	X21	0.164	0.040	0.278	4.143	0.000
6	(Constant)	0.763	0.192		3.971	0.000
	X18	0.141	0.036	0.264	3.959	0.000
	X19	0.125	0.037	0.220	3.354	0.001
	X15	0.191	0.033	0.309	5.724	0.000
	X28	0.131	0.032	0.240	4.161	0.000
	X21	0.154	0.039	0.261	3.987	0.000
	X9	0.085	0.035	0.160	2.418	0.018
7	(Constant)	0.664	0.192		3.452	0.001
	X18	0.129	0.035	0.242	3.689	0.000
	X19	0.106	0.037	0.186	2.829	0.006

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
X15	0.194	0.033	0.314	5.968	0.000
X28	0.112	0.032	0.206	3.524	0.001
X21	0.152	0.038	0.259	4.045	0.000
X9	0.084	0.034	0.160	2.478	0.015
X25	0.077	0.034	0.136	2.261	0.027

So, the equation can be written as follows:

$$Y = 0.664 + 0.129X18 + 0.106X19 + 0.194X15 + 0.112X28 + 0.152X21 + 0.084X9 + 0.077X25$$

Description:

Y = Cost Performance
X18 = Inadequate Material Control Variable
X19 = Contractor Team Work Variable in Work Implementation
X15 = Variable Lack of Control By the Contractor in the Implementation of Construction
X28 = Inadequate Equipment Requirement Variable
X21 = Variable Errors and Omissions in Volume Estimation Calculations
X9 = Job Termination Variable at Owner Request
X25 = Variable Occurrence of Equipment Damage by Irresponsible Parties

Hypothesis: from the results of the output of table 4, we can know the significance value of 0.000 < 0.05, then H0 is rejected and H1 is accepted. Statement H0 is that if there is no risk and CCO impact analysis on cost performance, then the project cost performance management will not be controlled. Whereas H1 statement is: If an analysis of risk identification and the impact of CCO on cost performance is carried out, then project cost management will be controlled, which means there is a significant (significant) influence on variables (X18, X19, X15, X28, X21, X9, and X25) on variable Y.

4.4. Analys Risk

The variables of the results of the data collection of respondents who have been reduced from the results of the validity and reliability tests are input from this stage of the analysis, namely many 31 variables. Risk ranking analysis is performed on the results of calculation of the average value of frequency and impact of risk.

The range for determining risk is as follows:

• Low risk: 0.01 - 0.05

• Moderate risk: 0.06 - 0.25

• High risk: 0.25 - 0.72

The following risk values and risk categories are shown in the table 5.

Table 5. Value Table and Risk Category

Variabel	Impact (D)	Frekuensi (F)	Risk (D X F)	Category Risk
X1	0.52	56.1	29.11	High
X2	0.44	51.5	22.84	Medium
X3	0.38	54.9	21.12	Medium
X6	0.35	45.5	16.14	Medium
X9	0.36	46.7	16.98	Medium
X10	0.43	51.9	22.10	Medium
X11	0.40	55.5	22.46	Medium
X12	0.38	49.5	19.04	Medium
X13	0.42	52.7	22.01	Medium
X14	0.36	49.5	17.94	Medium
X15	0.38	51.7	19.40	Medium
X16	0.29	38.5	11.23	Medium
X17	0.38	47.9	18.26	Medium
X18	0.36	50.7	18.43	Medium
X19	0.36	46.7	16.81	Medium
X21	0.47	56.7	26.75	High
X22	0.35	47.9	16.57	Medium
X23	0.34	43.7	14.91	Medium
X24	0.31	50.3	15.74	Medium
X25	0.34	49.7	16.87	Medium
X26	0.37	42.7	15.62	Medium
X27	0.38	51.1	19.24	Medium
X28	0.44	48.3	21.31	Medium
X29	0.36	43.3	15.69	Medium
X30	0.34	50.7	17.42	Medium
X31	0.41	56.9	23.36	Medium
X32	0.38	51.1	19.36	Medium
X33	0.37	50.1	18.39	Medium
X34	0.39	49.9	19.43	Medium
X35	0.40	52.7	21.27	Medium
X36	0.33	47.3	15.61	Medium

Source: Researcher's Processed Data, 2020

The highest risk from the table of values and risk categories can be seen as follows:

X1: Design invasion
X21: errors and omissions in calculating volume estimates

5. Conclusions

Based on the analysis and discussion that has been presented in the previous chapter, it can be concluded that several dominant variables cause the contract change order in the Tamansari Iswara Apartment project, namely:

Variable	The causative factor of CCO
X9	Termination of work at the request of the owner
X15	lack of control by the contractor in the implementation of construction
X18	poor material control
X19	lack of contractor teamwork in carrying out the work
X21	errors and omissions in calculating volume estimates
X25	damage to equipment by irresponsible parties
X28	inadequate equipment needs

After obtaining the risks that have a high correlation with cost performance, a strategy or solution can be made to overcome these risks which are explained below:

Variable	Statement	Solution
X1	Agree	Compile a picture that is not appropriate/problematic and immediately inform the owner and construction management so that it is immediately forwarded to the consultant to immediately be repaired
X21	Agree	Submitting changes in design/items / job specifications so that there is no significant change in costs from the initial contract File VO changes in accordance with errors with adjusted unit prices

Recommendations:

a. This study specifically reviews the risks and impacts of contract change orders on the cost performance of the Tamansari Isawara Apartment project. Future studies can identify at the control stage.
b. This research specifically reviews the risk and impact of the contract change order on the Tamansari Iswara Apartment project which is seen from the perspective of the service user, so that it can then be examined from the perspective of the service provider.

References

Beatrix, M., & Wiguna, I. P. A. (2013). Analisa Pengaruh Change Order Terhadap Biaya, Waktu dan Mutu Proyek Konstruksi di Surabaya. *Prosiding Seminar Nasional Manajemen Teknologi XX*. 1-7.

Fisk, E.R. & Reynolds, W. D. (2006). *Construction project administration*. New Jersey: Prentice Hall.

Hansen, S. (2017). *Quantity Surveying: Pengantar Manajemen Biaya dan Kontrak Konstruksi*. Gramedia Pustaka Utama.

Khan, O. H. (2016). Effective framework for change order management in construction industry. *Professional Masters project, Qatar university*.

Osman, Z., Omran, A., & Foo, C. K. (2009). The potential effects of variation orders in construction projects, *Journal of Engineering*, **7**, 141–152.

PMBOK Guide-Sixth Edition. (2017). Project Management Institution. Retrieved from: *https://www.pmi.org/pmbok-guide-standards/foundational/pmbok*