ANALYSIS OF THE EFFECT OF CONTRACT CHANGE ORDER FACTORS ON THE PERFORMANCE OF ROAD FACILITY PROJECTS

Dhona Lailatul Qomariah[1*], Budi Susetyo[2]

[1,2] Magister Teknik Sipil, Fakultas Teknik, Universitas Mercu Buana
Jalan Meruya Selatan, Kembangan, Jakarta Barat, DKI Jakarta, 11650, Indonesia
*[1]55721120038@student.mercubuana.ac.id, [2]budi.susetyo@mercubuana.ac.id

Abstract

Road facilities are part of the national transportation system according to Article 25 in Law of the Republic of Indonesia Number 22 of 2009 concerning Road Traffic and Transportation. Road facilities in the form of sidewalks and crossings are crossings for pedestrians. The arrangement of sidewalks by the DKI Jakarta Provincial Government is to improve urban infrastructure, where the percentage of sidewalk arrangements by 2022 will reach 5.58% of the length of roads in Jakarta. This research aims to determine the influence of factors Contract Change Order (CCO) on cost performance and implementation time for sidewalk arrangement activities, using structural equation modeling techniques-partial least squares (SEM-PLS). This research focuses on identifying the main CCO factors that directly influence cost performance, and indirectly influence implementation time performance through cost performance on road facility projects. There are 3 (three) types of research variables used; The independent variables consist of scope of work, planning, policy changes, specification changes, and coordination of related parties, the dependent variable is time performance and the intervening variable is cost performance as a mediating variable of the influence of the CCO factor on time performance. The results showed that the coordination of related parties had a direct and significant positive impact on cost performance by 59%, and an indirect and significant impact on time performance through cost performance as a mediating variable by 37.7%.

Keywords: CCO, Cost Performance and Time Performance, SEM PLS, Road Facilities

Introduction

Article 25 of Law Number 22 of 2009 of the Republic of Indonesia pertaining to Road Traffic and Transportation According to, road infrastructure are a component of the national transportation network. Road facilities are essential to the nation's transportation network because they have to be able to maintain order, safety, security, and smooth traffic flow. Pedestrian crossings are provided by road amenities such as crosswalks and sidewalks (Supriyanto, 2019). The Local Government of Jakarta views the arrangement of sidewalks as a crucial component of its efforts to enhance urban infrastructure. As of 2022, 5.77% of Jakarta's road lengths have sidewalks that are safe, comfortable, and accessible to people with disabilities (BPS, 2022). During construction, contract changes occur, so research is needed to determine the factors that influence these changes to improve the efficiency and effectiveness of construction project implementation (Geraldo & Ariesto, 2022), Contract changes can have a significant impact on project execution costs and timing (Iskandar et al.., 2022). Delays in completing the project and increased costs can be detrimental to all parties involved including government, contractors, and the sidewalk user community (Wirabakti et al.., 2014). Factors causing delays in building construction projects, namely improper schedule planning, improper implementation stages, produce a research value of 52.9% (Pinori et al.., 2015). According to Isfandina (2022) identified that the dominant factor of Change Order (CO), namely the difference between planning and design and actual field of 31.417%, is a factor that affects cost and time performance. On the other hand, inadequate analysis and planning will cause the project to fail. It is recorded that almost 75% of projects in Indonesia experience time overruns and cost overruns caused by various factors (Susanti, 2020). Stating that with a change order, there is an increase in cost of 0.23 and an increase in schedule of 0.3 (Shrestha & Maharjan, 2018). Some of the design changes or specification changes that occurred resulted in changes in project work scheduling and cost overruns (Nurmala & Hardjomuljadi, 2015).

Three factors are crucial for project managers to consider when working on a project: the budget or total amount allotted, the timeline, and the project's quality that needs to be maintained (Fardila & Adawyah, 2021). Project progress reporting is essential to accurately and accountably record project productivity, schedules, plans, and costs (Supriyanto, 2019).

Amendment orders, also known as a contract change order (CCO) can be implemented in the case of projects organized by the government (Susila, 2019), based on Article 87 and Paragraph 1 of Presidential Regulation No. 54 of 2010, "Contract Change", When field conditions deviate from the technical requirements or drawings in the contract documents during construction, the PPK works with the construction service provider to carry out the following: Changes to the implementation schedule that apply to work using Unit Price Contracts or to the parts of the work that use unit prices from Combined Lumps Sum and Unit Price Contracts include: a) adding or removing types of work; b) expanding or contracting the scope of work as specified; and c) making adjustments to the schedule.

Research Methodology

This research will use a quantitative descriptive approach by conducting a survey(Aziza, 2023). Research with survey method (Wardhana, 2022). This study was conducted to investigate what factors cause change orders (CCO) and how these factors affect project performance in terms of construction cost and time on pavement projects. At the research stage of the field study, data collection is carried out directly to the object of research (Ahmad & Laha, 2020). The survey results will be disseminated by distributing questionnaires to relevant parties through the questions in the questionnaire, namely service providers (contractors), service users/owners, planning consultants and supervision consultants for sidewalk project work in the Jakarta area. The questions have been verified by experts (Puspitasari & Febrinita, 2021) who understand the essence of CCO (Contract Change Order) for sidewalk works in DKI Jakarta Province.

The research place is the Sidewalk Development Activity in DKI Jakarta Province in the 2023 Budget year organized by the DKI Jakarta Provincial Government. The following Figure 1 is the research stages.
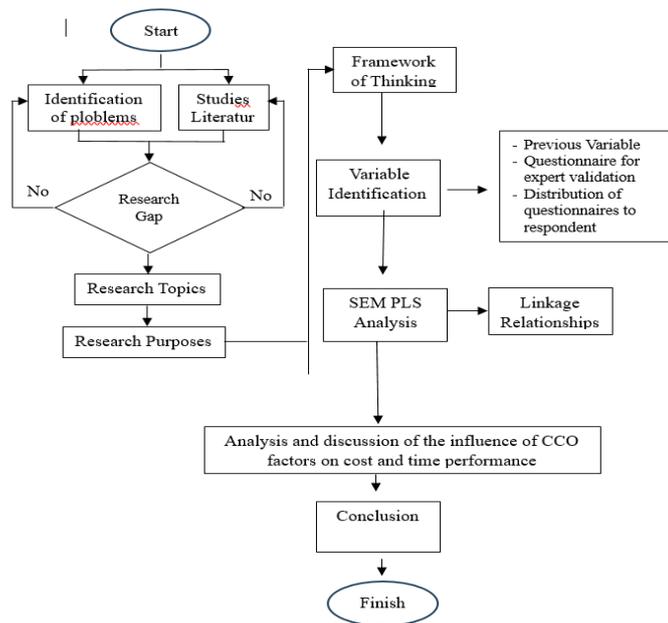
Figure 1.   Research flow chart

There are three variables resulting in Contract Change Order (CCO) that affect the performance of pavement construction projects (Rahadi & Farid, 2021) namely : a) The dependent variable is cost and time performance, b) Independent variables include ; Scope of Work, Planning, Changes in specifications, Policy changes, and Coordination with related parties, and c) The Intervention variable in this study is cost performance (Hamid & Anwar, 2019). The research model can be seen in Figure 2.

Data analysis in this study used Partial Least Square (PLS) where this type of analysis is an alternative method based on the Structural Equation Modeling (SEM PLS) method type (Rahadi, 2023). Primary data processing is measured using Smart PLS software. In the data analysis process, this stage has several stages of data analysis (Rahadi, 2023) The following are the stages in the Data Instrument Test process which consists of outer model analysis and inner model analysis. Outer model analysis can be seen from several types of indicators as follows : a) Convergent validity, the value in this measurement is more than 0.70; b) Discriminant validity, done by comparing the value of the intended construction must be greater than the value of other constructions; c) Composite reliability, has a composite reliability value of more than 0.70; and d) Average Variance Extracted (AVE) The resulting AVE is at least 0.50; e) Cronbach's Alfa, the resulting value for all constructs must be greater than 0.60. Inner Model (Structural Model) which describes the link between latent variabels and is based on substantive theory, this analysis involves multiple computations: a) Coefficient of determination (R^2), the value of R square is 0.67, it is declared strong, the value of 0.33 is declared moderate and the value of 0.19 is declared weak; b) Effect size (F^2) obtained a value of 0.02, the effect of exogenous latent variables is said to be weak, with a value of 0.15, the effect of exogenous latent variables is declared moderate, and the effect of exogenous latent variables is declared strong, with a value of 0.35; and c) Goodness of Fit Index (GoF), to get a suitable model, the indicator must meet a value, namely SRMS < 0.08; NFI> 0.90 ; RMS_theta is close to zero. Lastly, hypothesis testing that the relationship between variables is significant if the T_Statistic p_value is less than the 5% significance level (Rahmad Salling Hamid, S.E, 2019).
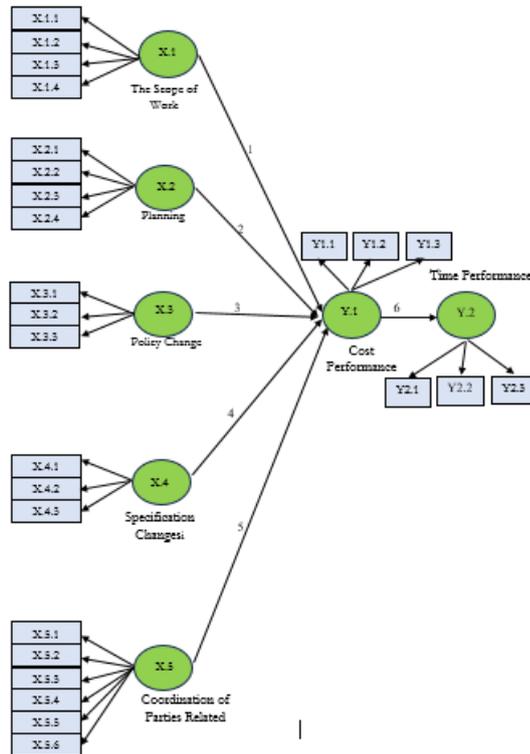
Figure 2. Research model

Research Results and Discussion

Table 1 contans questions to respondents.

Table 1. Research variables and indicators

No	Variables		Indicator
1	X1. Scope of work	X.1.1	Change in volume of sidewalk work with K-250 Decorative/stamp Concrete (Full Depth Pigment)
		X.1.2	Change in volume of sidewalk work with precast concrete stone / andesite stone
		X.1.3	Change in volume of sidewalk work with decorative K-350 concrete/stamp concrete (Full Depth Pigment)
		X.1.4	Volume changes to manhole cover work with finishing plate iron material on sidewalk pekjerjaan
2	X2. Planning	X2.1	Errors in planning (Perwitasari et al., 2019)
		X2.2	Errors and omissions in determining volume estimates (Khalim Abdul, 2021)
		X2.3	Discrepancy between design drawings and real conditions (Arnandha et al., 2023)
		X2.4	Design changes (Wibowo et al., 2023)
3	X3. Policy Changes	X.3.1	There are commands to change drawings or specifications. (Kamaludin et al.., 2023)
		X.3.2	Postponement of work due to certain reasons (Kanniappan, 2022)
		X.3.3	Delays in granting permits, approvals and decisions (Fashina et al.., 2021)
4	X4. Specification Changes	X.4.1	Drawing or design errors from the planning consultant (Dosumu & Aigbavboa, 2017)

No	Variables		Indicator
		X.4.2	Significant difference in results between drawings, field conditions and bill of quantities (Tenno & Suroso, 2021)
		X.4.3	Incomplete or unclear preliminary tender drawings or plan drawings (Yuni et al., 2017)
5	X5. Related Party Coordination	X5.1	Errors and omissions in design (Hansen & Nindartin, 2022)
		X5.2	Lack of coordination (Junius & Waty, 2020)
		X5.3	Errors in the execution of work (Geraldo & Ariesto, 2022)
		X5.4	Insufficient detail of working drawings (Mohammad et al., 2017)
		X5.5	Lack of data required by the consultant (Mishra & Aithal, 2022)
		X5.6	Recalculation on the miscalculation of the volume of work items adjusted to the plan drawings with field conditions during MC0 (initial mutual check) by the work executor (Abdullah, 2023) (Abdullah, 2023)
6	Y.1. Cost Performance	Y.1.1	As per contract documents and agreements (Prianto et al., 2014)
		Y.1.2	The assignor signs the contract and pays for the work until completion (Susanti, 2020)
		Y1.3	All parties involved in the project implementation are satisfied (Brahmantariguna et al., 2016)
7	Y.2. Time performance	Y2.1	As per contract documents and agreements
		Y2.2	The assignor signs the contract and pays for the work until completion.
		Y2.3	All parties involved in the project implementation are satisfied

The results of the path coefficient will get t-values to assess the significance of the prediction model (Latumeten et al.., 2018), the following is a display of the bootstrapping output.

Table 2. Direct effect of variable P value

	Original Sample (O)	Sample Average (M)	Standard Deviation (STDEV)	T Statistic (IO/STDEV I)	P Value	Conclusion
X1 Scope of work →Y1 Cost Performance	-0.130	-0.066	0.108	1.199	0.231	Rejected
X2 Planning →Y1 Cost Performance	0.206	0.178	0.141	1.465	0.143	Rejected
X3 Policy Changes → Y1 Cost Performance	-0.176	-0.137	0.154	1.142	0.253	Rejected
X4 Specification Changes → Y1 Cost Performance	-0.004	0.003	0.155	0.027	0.978	Rejected
X5 Related Party Coordination → Y1 Cost Performance	0.590	0.559	0.183	3.218	0.001	Accepted
Y1 Cost Performance → Y2 Time Performance	0.640	0.645	0.055	11.570	0.000	Accepted

Structure equation from Table 2.

Cost Performance = (-0.130). Scope of work + (0.206). Planning + (-0.176). Policy Changes + (-0.044). Specification Changes + (0.590). Related Party Coordination + e

Or Y1   = (-0.130) X1 + (0.206).X2 + (-0.176).X3 + (-0.044).X4 +(0.590).X4 + e

Time Performance = 0.640. Cost Performance + e

Or Y2   = 0.640 Y1

From Table 2, the results of the direct influence hypothesis between variables. Scope of Work has a negative and insignificant effect on Cost Performance. Planning has a positive and insignificant effect on Cost Performance. Policy Changes have a negative and insignificant effect on Cost Performance. Changes in Specifications have a positive and insignificant effect on Cost Performance. Coordination with related parties has a positive and significant effect on cost performance, if the coordination of related parties increases by 1 unit, cost performance will increase by 59%. Cost performance has a positive and significant effect on time performance, if cost performance increases by 1 unit, time performance will increase by 59%.

Table 3. P-Value indirect effect of variables (through mediating variables)

	O (Original Sample)	M (Sample Average)	(STDEV) Standard Deviation	(IO/STDEV I) T Statistic	P (Value)	Conclusion
X1 Scope of Work →Y1 Cost performance → Y2 time performance	-0.083	-0.044	0.071	1.176	0.240	Rejected
X2 Planning →Y1 Cost performance → Y2 time performance	0.132	0.115	0.091	1.446	0.145	Rejected
X3 Policy Changes → Y1 Cost performance → Y2 time performance	-0.112	-0.089	0.100	1.129	0.259	Rejected
X4 Changes in Specifications → Y1 Cost performance → Y2 time performance	-0.003	0.001	0.100	0.027	0.979	Rejected
X5 Coordination with related parties → Y1 Cost performance → Y2 time performance	0.377	0.364	0.131	2.879	0.004	Accepted

From Table 3, the results of the indirect effect hypothesis between variables. Scope of Work has a negative and insignificant effect on time performance through cost performance as a mediating variable. Cost performance as a mediating variable shows that planning has a positive and insignificant effect on time performance and insignificant effect on time performance. Policy changes have a negative and insignificant effect on time performance through cost performance as a mediating variable. Changes in specifications have a negative and insignificant effect on time performance through cost performance as a mediating variable. Coordination of related parties has a positive and significant effect on time performance through cost performance as a mediating variable,If the coordination of related parties increases by 1 unit, the time performance through cost performance will increase by 37.7%.

From Tables 2 and 3, The results showed that the coordination of related parties had a direct and significant positive impact on cost performance by 59%, and an indirect and significant impact on time performance through cost performance as a mediating variable by 37.7%. The influence of factors Contract Change Order (CCO) on cost performance and implementation time for sidewalk arrangement activities is related party coordination variable, namely Errors and omissions in design supported by Reseach (Putri & Waty, 2021; Widhiawati & Wiranata, 2016) Most of the building construction development experienced change orders due to design changes with a calculated statistical value of 90.777> 12.592 table statistics and a probability of 0.000 <0.05 and the value of Kendall W = 0.473. Research by Immanuel & Yuwono (2020) shows immature

shopdrawing resulted in rework in high-rise building construction projects by 26.958%. Indicators of coordination of related parties also affect time performance and the most influential factors are: a. Errors and omissions in design, b. Lack of coordination and c. Lack of data required by consultants. Supported by research from E. Kuswandari (2019) The factor that often occurs when a CCO (Contract Change Order) is held is the occurrence of repeated coordination with the owner when carrying out work. The results of the analysis using the SEM-PLS method show that the highest performance indicator is quantity with a mean value of 3.87, while the timeliness indicator is the lowest with a mean value of 3.71. This shows that the CCO (Contract Change Order) on the Ngablak Bridge rehabilitation work is caused by inaccuracy in time. CCO (Contract Change Order) affects contractor performance by 67.4%, so it can be concluded that when this CCO (Contract Change Order) is carried out, the contractor experiences a decrease in performance.

Conclusion

Related party coordination is the dominant factor of Contract Change Order in road facility construction activities. Based on SEM PLS data analysis, the coordination of related parties had a direct and significant positive impact on cost performance by 59%, and an indirect and significant impact on time performance through cost performance as a mediating variable by 37.7%.Activities that can be carried out to minimize the impact of Contact Change Order on cost performance and time performance for Sidewalk Construction activities in DKI Jakarta Province are by improving coordination of related parties consisting of activity owners, planning consultants, construction service providers at the Planning Stage and at the Construction Stage.

Errors and omissions in the design of sidewalk construction activities that are different from the field conditions at the time of implementation, namely in the division of road space, determination of the width of access in and out of the building (inrit), resulting in the volume contained in the Bill of Quantity in the Contract Documents found to have a difference of more or less. Lack of coordination between Service Users, Service Providers and Consultancy Services results in differences in perceptions in using work methods at the location of activities so that the results of the work completed are not in accordance with the provisions of the applicable specifications, that the more careful the coordination of related parties, the more it will reduce cost changes and changes in implementation time through cost performance.

To minimize the impact of CCO, innovative methods of continuous monitoring and evaluation of the work results of the ongoing construction of road facilities are needed. This can help detect changes or problems that require early attention so that corrective actions can be taken quickly, Selecting Implementers and Supervisory Consultants who have experts in implementing the stages of pavement construction implementation and are able to identify any design changes early to then be properly coordinated among the parties appropriately, and competently. Further research must be conducted to gain more comprehensive insight. Further research coverage can be carried out in other objects such as MRT and LRT Jakarta Phase 2 to determine other factors that affect the occurrence of Contract Change Orders.

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