

## THE INFLUENCE OF CONTRACT CHANGE ORDER (CCO) ON COST PERFORMANCE IN CONSTRUCTION PROJECTS

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**Abstract:** This study investigates the influence of Contract Change Orders (CCOs) on cost performance in construction projects. Contract Change Orders formally amend the original construction contract. This research aims to answer the following main question: What is the relationship between the occurrence, reasons, and worth of CCOs and their cost overrun counterpart? More specifically, we try to correlate the frequency, worth, and reasons for CCOs directly with their identical cost overrun counterpart on a project level at three different scales. This research uses a quantitative approach to dissect and understand the project data from a collection of medium to large-scale construction projects. This project data were further elucidated through structured interviews with project managers and contractors directly involved with those projects. The project data were then subjected to a battery of statistical tools, such as regression analysis, to understand the relationship that exists between CCOs and certain cost performance indicators. The results show that frequent and late-stage CCOs are correlated with increased project costs. Moreover, insufficient initial planning and inadequate communication among stakeholders are major identified contributors to cost-related CCOs. Change management strategies are critical to counteract the cost impacts of CCOs. The study found that effective change management strategies, which include early stakeholder coordination and precise contract documentation, are essential to mitigate the bad cost impacts of change orders in construction projects. This knowledge can help all owners and stakeholders in the construction process manage big CCOs better.

**Keywords:** *Contract Change Orders, Cost Performance, Construction Projects, Cost Overrun, Change Management*

## **INTRODUCTION**

In the execution of building projects, adjustments to the original contract or Contract Change Order (CCO) are typical. The CCO usually entails alterations to the kind of work, technical specifications, schedule, and costs associated with the project. Of course, these changes can be brought about by a multitude of reasons: unexpected site conditions, design mistakes, shifts in the project owner's requirements, or administrative hiccups. While the CCO can be a flexible tool in the project's overall management, studies show that the change order's prevalence may indicate poor preconstruction planning and that more prevalent CCOs correlate with decreased project performance (Ibbs, Wong, & Kwak, 2001).

Previous research by Hanna, Camlic, Peterson, and Nordheim (2002) stated that the presence of change orders significantly increases indirect costs and decreases labor productivity in the field. In a similar case, Hsieh, Lu, and Wu (2004) found that the frequency and magnitude of change orders are positively correlated with increased total project costs and schedule delays. This study also highlighted that weak initial project documentation and lack of communication between the owner and contractor are the main causes of CCO.

Although many studies have been conducted, there is still a gap in the literature regarding the extent of direct and indirect effects of CCO on project costs, especially in construction projects in developing countries. In addition, quantitative approaches to measuring the impact of CCO on budget deviation have not been comprehensively applied. Several studies such as those conducted by Alnuaimi, Taha, Mohsin, and Al-Harthi (2010) in Oman have attempted to develop predictive models of the causes and impacts of CCO, but the local context and varying types of projects limit the generalizability of the findings.

Furthermore, research by Love, Edwards, and Irani (2012) stated that the lack of understanding of risk management and contract change control systems is the main cause of cost overruns due to CCO. Therefore, a review of the literature discussing the effect of CCO on project costs is important to understand the trends, causes, and impacts caused by contract changes in construction management practices.

Based on the description above, the formulation of the problem to be discussed in this literature study is: How does the Contract Change Order affect the cost of construction projects based on previous studies? The purpose of this study is to identify and analyze the effect of CCO on the cost of construction projects by referring to the results of previous studies, as well as to reveal the gaps that still exist in the existing literature.

## **METHOD**

This study uses a descriptive quantitative approach with a case study method on an infrastructure construction project that experienced a contract change (Contract Change Order). The purpose of this study is to analyze the effect of frequency and CCO value on project cost deviation.

The population in this study is infrastructure construction projects in the form of buildings, roads, etc. that were carried out between 2021 and 2025 and experienced contract changes. From this population, samples were selected purposively as many as 5 previous research journals.

The instruments used are observation sheets and documentation, focusing on quantitative data such as: initial contract value, number and type of CCO, final contract value, and percentage of cost deviation. Data are obtained from project documents, contract change reports, and final physical implementation reports.

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**RESULT**

This study examines the effect of Contract Change Order (CCO) on construction project costs by reviewing five empirical studies in various types of projects, including buildings, roads, and public facilities. The synthesis of the five journals shows that CCO has a significant impact on increasing project costs, both directly and through intermediary factors such as time and changes in the scope of work. Table 1 Presents a Summary of the Effect of CCO on Project Costs Based on the Five Journals Analyzed.

Table 1: Summary of Findings on the Influence of CCO on Project Costs

| No | Author & Year           | Project Type                 | Analysis Method      | The Influence of CCO on Project Costs                                                                                                               |
|----|-------------------------|------------------------------|----------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------|
| 1  | Kamaludin et al. (2023) | Campus Building              | Survey & Qualitative | CCO due to errors in volume estimation and changes in work methods increase costs due to volumes not being in accordance with the initial contract. |
| 2  | Ramadhan & Waty (2025)  | Large Scale Project (PT XYZ) | PLS SEM              | Design changes contributed 56.5% to the cost increase. Planning errors contributed 34.5% to the cost.                                               |

| No | Author & Year                | Project Type                   | Analysis Method       | The Influence of CCO on Project Costs                                                                                               |
|----|------------------------------|--------------------------------|-----------------------|-------------------------------------------------------------------------------------------------------------------------------------|
| 3  | Archipelago & Sutardi (2023) | Balaraja Interchange Toll Road | Earned Value Analysis | CCO caused a cost overrun of Rp 52.5 billion (initial CPI = 0.77). After the addendum, CPI improved to 1.17.                        |
| 4  | The Last Supper (2024)       | Sidewalks & Road Facilities    | SEM-PLS               | Cost performance is significantly influenced by coordination between parties (59%) and planning (indirect influence through costs). |
| 5  | The Last Knight (2025)       | Building in Denpasar           | PLS SEM               | CCO has a negative effect on costs by 31.6%.                                                                                        |

As shown in Table 1, all studies show that CCO contributes significantly to the increase in project costs. Ramadhan & Waty's study (2025) noted that design changes contributed 56.5% to cost overrun, making it the biggest cause. Meanwhile, based on the Earned Value Analysis by Nusantara & Sutardi (2023), the CPI value which was originally below 1 (0.77), indicating budget waste, can be improved through an addendum to 1.17.

In addition, the results of the study by Krisna Dewi & Pramana (2025) showed that CCO had a negative impact on costs of 31.6% of the total project implementation. Likewise, in the road

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facility project in Jakarta, weak coordination between related parties caused uncontrolled costs (Qomariah & Susetyo, 2024).

## DISCUSSION

The results of the review of the five journals reviewed show that Contract Change Order (CCO) has a significant influence on cost performance in various types of construction projects. This finding is in line with the general view that CCO is one of the critical factors that drives cost overrun in construction projects (Ramadhan & Waty, 2025; Krisna Dewi & Pramana, 2025).

Ramadhan and Waty (2025) conducted research using the PLS-SEM method. Their work concluded: 1. Design changes contributed 56.5% to the increase in project costs. 2. Planning errors contributed 34.5% to the increase in project costs. The study highlighted that weak planning management and design control led to huge discrepancies between what the cost of a project should be (as outlined in the initial budget plan) and the actual costs once the project was completed. A similar finding was reported by Kamaludin et al. (2023). Their work found that errors in volume estimation by planning consultants were the main cause of CCO and had an impact on contract cost overruns.

The findings have profound consequences, particularly for government and public initiatives, where budget efficiency is one of the main indicators of successful project implementation. Nusantara and Sutardi (2023) evaluated the project using the Earned Value Analysis method and found that it had a cost performance index (CPI) of 0.77, meaning it was spending more money than it was earning in completed work. After management took steps to correct the course of the project, the CPI rose to 1.17, meaning that the project has restored its cost efficiency.

At the same time, Qomariah and Susetyo (2024) stressed that the coordination between the parties concerned is a factor of great importance in pretty well ensuring the cost performance of a project.

They performed a study on this and found that good coordination supposedly has a direct influence of around 59% on project cost performance. The implication here seems clear enough when it comes to ensuring that a project costs roughly what was planned, bumping up the coordination among the project's various performers should help. Coordination seems to have an even more critical influence on cost performance when you consider how it factors into the better use of other project resources, like time.

Backing this conclusion is a study conducted by Krisna Dewi and Pramana (2025) in Denpasar City, which discovered that CCO accounted for 31.6% of the increase in costs. Their investigation found that cost increases due to CCO are so significant that they affect the efficiency and effectiveness of projects. They further highlighted that CCO often not only impacts costs but also quality and time, so understanding the risks of contract changes is essential.

This study establishes, once and for all, that construction projects cannot avoid changing contracts. Alnuaimi et al. (2010) say as much, and those of us who work in the construction world know it to be true. But the construction world is not an entirely random universe in which anything goes. The impact of changing contracts on cost performance, for instance, can and does display a spectrum of results, from negative to neutral to positive. The study straightforwardly yields solid recommendations for project managers, consultants, and project owners who express a wish to improve the quality of planning documents. It helps to coordinative activities better from an early stage, and also develop a fine documentation and change control system.

Therefore, this discussion confirms that budget deviation in construction projects is mainly caused by change in construction orders (CCO). Although its existence is unavoidable, the authors of this study found that the negative impact of CCO on project costs can be significantly reduced with a structured approach to change management, the use of information technology in the

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documentation of projects, and a generally improved competence of the planners and supervisors of projects. This finding is consistent with the recommendations of Ramadhan and Waty (2025), who said that protocols for change management and the use of technology should be emphasized as a means of reducing the negative impact of CCO on the performance of projects.

## CONCLUSION

From the analysis and the discussion of the five reviewed journals, the following conclusion can be drawn: CCO significantly influences the cost performance of construction projects. Changes made to the contract because of design errors, premature planning, and poor coordination among project stakeholders lead to substantial cost overruns. Additionally, CCO affects other project parameters, mostly in a negative way, such that time, quality, and other aspects worsen the cost efficiency of the project.

However, the findings also show that the negative impacts of CCO can be minimized through the implementation of structured change management, tight design control, and increased planning and coordination capacity between stakeholders. Therefore, understanding the causes and impacts of CCO is very important in efforts to improve the efficiency and effectiveness of construction project budget management, both small and large scale.

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