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Quantitative Analysis of Contract Variations Impact on Infrastructure Project Performance

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Abstract : Infrastructure projects often encounter contract variations that can significantly deviate from the original tender estimates, leading to cost overruns, schedule delays, and financial implications. This research aims to quantitatively assess the impact of changes in contract variations on project performance by conducting an in-depth analysis of a comprehensive dataset from the Regional Airport Car Park project. The dataset includes tender budget, contract quantities, rates, claims, and revenue data, providing a unique opportunity to investigate the effects of variations on project outcomes. The study focuses on 21 specific variations identified in the dataset, which represent changes or additions to the project scope. The research methodology involves establishing a baseline for the project's planned cost and scope by examining the tender budget and contract quantities. Each variation is then analyzed in detail, comparing the actual quantities and rates against the tender estimates to determine their impact on project cost and schedule. The claims data is utilized to track the progress of work and identify deviations from the planned schedule. The study employs statistical analysis using R to examine the dataset, including tender budget, contract quantities, rates, claims, and revenue data. Time series analysis is applied to the claims data to track progress and detect variations from the planned schedule. Regression analysis is utilized to investigate the relationship between variations and project performance indicators, such as cost overruns and schedule delays. The research findings highlight the significance of effective variation management in construction projects. The analysis reveals that variations can have a substantial impact on project cost, schedule, and financial outcomes. The study identifies specific variations that had the most significant influence on the Regional Airport Car Park project's performance, such as PV03 (additional fill, road base gravel, spray seal, and asphalt), PV06 (extension to the commercial car park), and PV07 (additional box out and general fill). These variations contributed to increased costs, schedule delays, and changes in the project's revenue profile. The study also examines the effectiveness of project management practices in managing variations and mitigating their impact. The research suggests that proactive risk management, thorough scope definition, and effective communication among project stakeholders can help minimize the negative consequences of variations. The findings emphasize the importance of establishing clear procedures for identifying, assessing, and managing variations throughout the project lifecycle. The outcomes of this research contribute to the body of knowledge in construction project management by demonstrating the value of analyzing tender, contract, claims, and revenue data in variation impact assessment. However, the research acknowledges the limitations imposed by the dataset, particularly the absence of detailed contract and tender documents. This constraint restricts the depth of analysis possible in investigating the root causes and full extent of variations' impact on the project. Future research could build upon this study by incorporating more comprehensive data sources to further explore the dynamics of variations in construction projects.

Keywords : contract variation impact, quantitative analysis, project performance, claims analysis
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