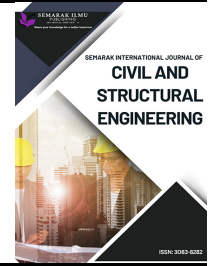




Semarak International Journal of Civil and Structural Engineering

Journal homepage:
<https://semarakilmu.my/index.php/sijcse/index>
ISSN: 3083-8282



Anticipation and Solution of Subcontractor Cost Overruns in Toll Road Construction Projects

Muhammad Nafhan Isfahani¹, Antonius¹, Kartono Wibowo^{1,*}

¹ Department of Civil Engineering, Sultan Agung University (UNISSULA), Semarang, Indonesia

ARTICLE INFO

Article history:

Received 30 December 2025

Received in revised form 19 February 2026

Accepted 26 March 2026

Available online 20 April 2026

Keywords:

sub contractor cost overruns,
Anticipation and Solutions, Toll Roads

ABSTRACT

This paper presents the results of research on anticipation and solutions to subcontractor cost overruns on open system toll road projects in Jabodetabek. The purpose of this study is to determine the anticipation and solutions to handling subcontractor cost overruns. This research was conducted by conducting a survey of 76 respondents consisting of Managers, Consultants and Contractors involved in toll road construction in Jabodetabek which is a coastal area. The survey results were tested for validity, reliability and mean to determine the dominant factors causing cost overrun, then developed anticipation and solutions for handling subcontractor cost overrun by a team of experts. The results showed that there were 22 valid cost overrun causal factors with a coefficient value of 0.245 - 0.670 and 23 reliable cost overrun causal factors with a Cronbach's alpha value above 0.700. The results of this study also show that the anticipation and solution to handling subcontractor cost overruns in the coastal toll road project is a preventive measure to reduce and eliminate the occurrence of cost overruns at the planning stage and at the implementation stage.

1. Introduction

Today's increasingly competitive business competition, especially in the field of toll road construction, demands an increase in the quality of construction service companies. There are several steps that can be taken to improve this quality, for example by taking corrective action in construction project operations. Corrective action at the operational stage can be in the form of a Project Control system, which consists of cost, quality, and time control. Project cost control consists of controlling the cost of materials, equipment, labor, subcontractors, overhead costs and general conditions. In construction project operations, project cost overruns often occur. One of the variables that most affect project cost overruns is subcontractors. Based on research by Plebankiewicz [16], the proposed cost overrun risk prediction model effectively categorizes the risk of cost overruns on construction projects, assisting general contractors in managing the stages of subcontracted work. Frequent delays, incomplete information, slow arrival of materials, improper scheduling, and high

* Corresponding author.

E-mail address: nafhanisfahani@gmail.com

frequency of equipment repairs are the five main factors that cause cost overruns in construction projects [1]. Lack of experience and technical competence in project management.

Toll road development as part of national strategic infrastructure often faces serious challenges in managing project costs. One of the most frequent problems is cost overruns that can affect the overall sustainability and success of the project. Among the various causes of cost overruns, subcontractor performance plays an important role. Subcontractors are responsible for most of the technical work in the field, so delays, lack of resources, or poor planning on their part can cause project costs to balloon. Kaming et al. [19] noted that inefficiencies in time and cost management, especially on the part of subcontractors, are a major cause of cost overruns on large construction projects in Indonesia, including toll road projects.

Factors such as late payments from the main contractor, sudden design changes, and unanticipated fluctuations in material prices also worsen the situation at the subcontractor level [13]. In addition, weak project controls and lack of managerial expertise at the subcontractor level also increase the risk of cost overruns. In the context of highway projects that have tight deadlines and large volumes of work, the failure of subcontractors to meet time and cost targets can have a systemic impact on the entire set of construction works. Therefore, it is important to identify and mitigate cost overrun indicators in subcontractors from the beginning of project implementation to improve the efficiency and accuracy of construction costs.

The topic of this paper is part of the research to provide recommendations for anticipation and solutions to the occurrence of cost overruns in subcontractor management in the operation of coastal highway construction projects.

1.1 Subcontractor Cost Control

Controlling cost overruns caused by variable subcontractors on toll road projects requires a structured and proactive managerial approach. One of the main strategies is the implementation of a regular monitoring and evaluation system of subcontractor performance. According to Doloi et al. [13], performance tracking of subcontractors' schedule, cost, and quality through Key Performance Indicators (KPIs) allows the main contractor to detect potential cost overruns early and take timely corrective actions. In addition, selecting subcontractors that have a good track record in cost and time management is an important first step in preventing project budget wastage.

Another effective strategy is the implementation of performance-based contracts that provide incentives for target achievement and penalties for delays or cost overruns. This approach encourages subcontractors to work more efficiently and responsibly in the use of resources. In addition, improved communication between the main contractor and subcontractors and the involvement of subcontractors in the early planning stages of the project can also minimize unexpected changes to the scope of work. The combination of rigorous selection, performance-based contracting, and a consistent monitoring system is the key to controlling cost overruns in toll road projects.

2. Research Methods

This research consists of 23 indicators of the causes of cost overruns in Subcontractor management. Determination of indicator variables by conducting literature review studies from several internationally reputable journals which resulted in 23 indicator factors that are in accordance with the research. In collecting data, this research uses 2 methods, namely by distributing

questionnaires and interviews. At the questionnaire stage, 80 respondents were distributed to experts in the toll road sector and 76 respondents returned, this data was representative based on the slovin sampling technique. From the first stage data is then processed to find valid and reliable indicators, then carried out to the interview stage. At the interview stage with experts or specialists who have experience in toll road construction projects in the Jabodetabek area, to get anticipatory actions and solutions to the occurrence of cost overruns on subcontractor factors at the planning and implementation stages of toll road construction projects.

The questionnaire is compiled based on indicators that have been determined from literature studies and uses a five-point Likert scale to measure the level of respondents' perceptions or assessments of each statement item. Before being widely used, the questionnaire was tested first to ensure its validity and reliability. The validity test was carried out using the Pearson Product Moment correlation technique, where an item is declared valid if the correlation coefficient value is greater than the r-table value at a certain level of significance. Furthermore, the reliability test was carried out using the Cronbach's Alpha coefficient, with the criterion that an instrument is said to be reliable if the α value is ≥ 0.7 . After being declared valid and reliable, the questionnaire was distributed to respondents according to the specified sample criteria. The data obtained was then analyzed using the Relative Importance Index (RII) method to determine the relative importance of each factor or item. Relative Importance Index (RII) is a quantitative method used in research to determine the ranking or level of importance of various factors based on respondents' assessments. This method is often applied in survey data analysis to identify the most influential factors in a particular context. The RII calculation is done with the following formula:

$$RII (\%) = \frac{6(n_6) + 5(n_5) + 4(n_4) + 3(n_3) + 2(n_2) + n_1}{W \times (n_6 + n_5 + n_4 + n_3 + n_2 + n_1)}$$

with RII = Relative Importance Index of each factor, n_6 = total or number of respondents who filled out scale 6, n_5 = total or number of respondents who filled out scale 5, n_4 = total or number of respondents who filled out scale 4, n_3 = total or number of respondents who filled out scale 3, n_2 = total or number of respondents who filled out scale 2, n_1 = total or number of respondents who filled out scale 1, W = the largest Likert scale used.

Table 1
 Range of importance levels of RII values

RII Value Range	Level of Importance
$0.8 \leq RII \leq 1$	High (H)
$0.6 \leq RII \leq 0.8$	High-Medium (H-M)
$0.4 \leq RII \leq 0.6$	Medium (M)
$0.2 \leq RII \leq 0.4$	Medium-Low (M-L)
$0 \leq RII \leq 0.2$	Low (L)

3. Research Results

The results of the validity test of the factors causing subcontractor cost overruns in toll road construction projects consist of 23 factors. There is 1 invalid question item at number 10 (Slow flow of information between parties) because the validity value is <0.300 . So that there are 10 valid indicators with a coefficient value of 0.245 - 0.670. The results of the validity test of the subcontractor variable are presented in table 2.

Table 2
 Subcontractor Validity Test Results

Sub Contractor				
1	Inexperienced contractors	0.656	0.300	VALID
2	Contracts that do not favor contractors	0.628	0.300	VALID
3	Poor supervision of construction projects	0.670	0.300	VALID
4	Errors in predicting field conditions	0.438	0.300	VALID
5	Low subcontractor productivity	0.396	0.300	VALID
6	Lack of contractor competence	0.438	0.300	VALID
7	Lack of coordination (contractor)	0.280	0.300	NOT VALID
8	Delay in payment for work completed	0.556	0.300	VALID
9	Poor contract management	0.599	0.300	VALID
10	Slow flow of information between parties	0.245	0.300	NOT VALID
11	Poor project management assistance	0.347	0.300	VALID
12	Financial difficulties of subcontractors	0.419	0.300	VALID
13	Barriers from the government	0.321	0.300	VALID
14	Lack of skilled labor	0.400	0.300	VALID
15	Incomplete image design	0.582	0.300	VALID
16	There is additional work / rework	0.366	0.300	VALID
17	Obsolete or inappropriate construction methods	0.600	0.300	VALID
18	Poor scheduling in project execution	0.542	0.300	VALID
19	Delays in decision making	0.555	0.300	VALID
20	Design error	0.506	0.300	VALID
21	Project management effectiveness	0.580	0.300	VALID
22	Poor project management	0.605	0.300	VALID
23	Poor project supervision	0.599	0.300	VALID

The results of the reliability test using the Cronbach's alpha method , the factors causing cost overrun of subcontractor costs on toll road construction projects consist of 23 factors, all reliable indicators have a coefficient value above 0.700, presented in table 2 below.

Table 2
 Reliability Test Results of Subcontractor Factors

Sub Contractor				
1	Inexperienced contractors	0.769	0.700	RELIABLE
2	Contracts that do not favor contractors	0.814	0.700	RELIABLE
3	Poor supervision of construction projects	0.85	0.700	RELIABLE
4	Errors in predicting field conditions	0.837	0.700	RELIABLE
5	Low subcontractor productivity	0.832	0.700	RELIABLE
6	Lack of contractor competence	0.813	0.700	RELIABLE
7	Lack of coordination (contractor)	0.861	0.700	RELIABLE
8	Delay in payment for work completed	0.759	0.700	RELIABLE
9	Poor contract management	0.796	0.700	RELIABLE
10	Slow flow of information between parties	0.864	0.700	RELIABLE
11	Poor project management assistance	0.741	0.700	RELIABLE
12	Financial difficulties of subcontractors	0.821	0.700	RELIABLE
13	Barriers from the government	0.738	0.700	RELIABLE
14	Lack of skilled labor	0.729	0.700	RELIABLE
15	Incomplete image design	0.771	0.700	RELIABLE
16	There is additional work / rework	0.731	0.700	RELIABLE
17	Outdated or inappropriate construction methods	0.877	0.700	RELIABLE
18	Poor scheduling in project execution	0.854	0.700	RELIABLE
19	Delays in decision making	0.801	0.700	RELIABLE
20	Design error	0.808	0.700	RELIABLE
21	Project management effectiveness	0.820	0.700	RELIABLE
22	Poor project management	0.872	0.700	RELIABLE
23	Poor project supervision	0.841	0.700	RELIABLE

Furthermore, the development of cost overrun anticipation measures for subcontractor variables in toll road projects is valid and reliable. In this development, it is carried out with a team of experts to get recommendations for anticipation and solutions when there is a cost overrun on the Toll Road Project presented in table 3 and the implementation stage is presented in table 4.

Table 3
 Test Results of Subcontractor Factors

No.	Risk Factor	Value
1	Inexperienced contractors	0.693
2	Contracts that are unfavorable to the contractor	0.688
3	Poor supervision of construction projects	0.685
4	Error in predicting field conditions	0.658

No.	Risk Factor	Value
5	Low subcontractor productivity	0.713
6	Lack of competent contractors	0.715
7	Lack of coordination (contractor)	0.660
8	Slow payment for completed work	0.685
9	Poor contract management	0.713
10	Slow flow of information between parties	0.678
11	Poor project management assistance	0.750
12	Subcontractor financial difficulties	0.658
13	Obstacles from the government	0.625
14	Shortage of experts	0.685
15	Incomplete image design	0.698
16	Additional work / rework	0.680
17	Obsolete or inappropriate construction methods	0.688
18	Poor scheduling of the project implementation	0.670
19	Delays in decision-making	0.670
20	Design error	0.695
21	Women's management effectiveness	0.653
22	Poor management of Women's projects	0.673
23	Poor project supervision	0.695

From table 3 above, the results show that the highest with the RII method is the subcon cost overrun factor. In the subcon variable, the highest indicator is in terms of project management assistance with an RII test result of 0.750. The second indicator is the lack of competence of the contractor with an RII test result of 0.715. The third indicator is low subcon productivity with an RII test result of 0.713. The fourth indicator of poor contract management with a RII test result of 0.713. Fifth indicator of incomplete drawing design with a RII test result of 0.698.

The sixth indicator of design errors with an RII test result of 0.695. The seventh indicator of lack of contractor experience with an RII test result of 0.693.

4. Anticipation and solutions for cost overruns

Some ways to anticipate and overcome the occurrence of cost overruns due to subcontractor factors based on previous literature, to reduce the occurrence of cost overruns are shown in tables 4 and 5 below;

Table 4
 Anticipation for Toll Road Project Subcontractors

No.	Method / Subcontractor	Anticipate	Reference
1	Inexperienced contractors	Selection of contractors based on experience and performance history. Rigorous technical prequalification assessment.	[33]
2	Poor supervision of construction projects	Implementation of technology-based project management system.	[18]
3	Low subcontractor productivity	Performance-based Subcontract Agreement.	
4	Lack of coordination (contractor)	Regular coordination meetings with various stakeholders. Use of digital project management system.	[18]
5	Poor contract management	Prepare detailed contract documents that include the scope of work, schedule, responsibilities and payment terms. Avoid conflicts due to multiple interpretations or gaps in the documents.	
6	There is additional work / rework	Organize all additional work or changes to be made through formal documents such as change orders or variation orders, with estimated costs and schedule impacts. Avoid additional work being performed without authorization.	[35]
7	Incomplete design image	Adopt BIM to detect design flaws and conflicts before implementation.	[18]
8	Outdated or inappropriate construction methods	Implementing more efficient construction technology.	[18]
9	Delays in decision making	Establish a clear decision-making structure and hierarchy.	[36]
10	Project management effectiveness	Adopt a digital-based Project Management Information System (PMIS) for project planning, reporting, and control.	[38]

No.	Method / Subcontractor	Anticipate	Reference
11	Poor project supervision	Use assistive technology tools to monitor progress visually and in real time.	[18]
12	Slow flow of information between parties	Implementation of centralized and digital communication systems.	[18]
13	Lack of coordination (contractor)	Schedule weekly coordination meetings involving the main contractor, subcontractors, consultants, and project owner.	[36]
14	Poor project management assistance	Project managers have professional certifications such as PMP and relevant experience in large infrastructure projects.	[13]
15	Delays in decision making	Implement a Project Management Information System (PMIS) or digital document approval system that can be accessed online.	[18]
16	Poor scheduling in project execution	Implement project scheduling software that is able to adapt to dynamic changes and provide real-time updates.	[19]
17	Project management effectiveness	Use a Project Management Information System (PMIS) to manage project documents, schedules, costs, and communications in an integrated manner.	[41]

Table 5
 Solution for Toll Road Project Subcontractors

No.	Method / Subcontractor	Solution	Reference
1	Inexperienced contractors	Implement a contractor performance appraisal system.	
2	Poor supervision of construction projects	Use technology-based surveillance systems such as BIM or drones. Improve surveillance quality through training and audits.	
3	Low subcontractor productivity	Evaluate subcontractor performance on a regular basis.	
4	Lack of coordination (contractor)	Conduct regular coordination meetings (weekly coordination meetings). Use a digital project collaboration platform.	
5	Poor contract management	Implement a digital system for contract management, which enables tracking of contract changes.	

No.	Method / Subcontractor	Solution	Reference
6	There is additional work / rework	Involve the technical design team in on-site decision-making.	
7	Incomplete design image	Validating design drawings through multi-disciplinary review. Using BIM technology for design integration.	[16]
8	Outdated or inappropriate construction methods	Establish a technical supervision team that conducts periodic evaluations of the effectiveness of construction methods and recommends changes when necessary.	
9	Delays in decision making	Develop a real-time data-driven Decision Support System (DSS), which integrates physical progress, costs, risks and technical constraints to support fast and accurate decision-making.	
10	Project management effectiveness	Establish a Project Management Office (PMO) as a centralized unit. Implement PMBOK. Technical and financial audits on a regular basis.	
11	Poor supervision project	Use assistive technology tools to monitor progress visually and in real time.	[18]
12	Slow flow of information between parties	Implement an application-based real-time communication system.	
13	Poor project management assistance	Conduct periodic audits of management performance.	
14	Delay in decision making	Implement a Project Management Information System (PMIS) or digital document approval system that can be accessed online.	[18]
15	Poor scheduling in project execution	Conduct regular evaluation of the basic schedule with field progress.	
16	Project management effectiveness	Use a Project Management Information System (PMIS) to manage project documents, schedules, costs, and communications in an integrated manner.	[41]

5. Conclusions

From the results of the study it can be concluded:

- 1) There are 22 valid factors causing cost overruns with a coefficient value of 0.245 - 0.670 and there are 23 reliable factors causing cost overruns with Cronbach's

- alpha values above 0.700.
- 2) The results showed that the anticipation and solution of handling variable subcontractor cost overruns on toll road projects is a preventive measure to reduce and eliminate the occurrence of cost overruns at the planning stage and implementation stage.
 - 3) From the results of the study, it was found that the most influential factor was poor project management assistance, and the solution was to conduct regular audits of management performance.

Reference

- [1] Magdalena, S., and Z. Citra. 2025. "Factors Affecting the Occurrence of Cost Overrun Based on Relative Importance Index (RII) on Toll Road Projects." *Civil Engineering*. <https://doi.org/10.21776/ub.tekniksipil.2025.019.01.14>.
- [2] Okonkwo, C., U. Evans, and S. Ekung. 2022. "Exploring Direct and Indirect Material Waste Related Factors Underlying Cost Overruns in Construction Projects." *International Journal of Construction Management* 23: 2298–2304. <https://doi.org/10.1080/15623599.2022.2052431>.
- [3] Uvarova, S., S. Belyaeva, A. Orlov, and V. Kankhva. 2023. "Forecasting the Cost of Building Materials under Conditions of Uncertainty: Methodology and Practice." *Buildings*. <https://doi.org/10.3390/buildings13092371>.
- [4] Sepasgozar, S., A. Costin, R. Karimi, S. Shirowzhan, E. Abbasian, and J. Li. 2022. "BIM and Digital Tools for Advanced Construction Cost Management." *Buildings*. <https://doi.org/10.3390/buildings12040396>.
- [5] R., Y., and B. Susetyo. 2019. "Factors Affecting the Cost Overrun of the Jabodebek RC-PIER LRT Project: Case Study of Cawang, Indonesia." *International Journal of Engineering Research and Advanced Technology*. <https://doi.org/10.31695/ijerat.2019.3436>.
- [6] Więcek, D., D. Wiecek, and Ł. Dulina. 2020. "Material Requirements Planning Using Activity Based Costing." *Production Engineering Management Systems* 28: 3–8. <https://doi.org/10.2478/mspe-2020-0001>.
- [7] Awati, M., N. Dita, P. Putra, and M. Oktrify. 2024. "Analysis of Material Planning with Material Requirement Planning Method in High Rise Building Project." *Journal of Sustainable Civil Building Management and Engineering*. <https://doi.org/10.47134/scbmej.v1i3.2438>.
- [8] Asare, S., G. Fobiri, and F. Bondinuba. 2024. "Improving Fairness, Transparency and Accountability During Tendering under Ghana's Procurement System: A Systematic Review." *Built Environment and Asset Management Project*. <https://doi.org/10.1108/bepam-04-2024-0107>.
- [9] Chen, Q., B. Adey, C. Haas, and D. Hall. 2020. "Using Foresight Plans to Improve Material Flow Processes on Construction Projects When Using BIM and RFID Technologies." *Construction Innovation*. <https://doi.org/10.1108/ci-11-2019-0133>.
- [10] Noori-Daryan, M., A. Taleizadeh, and F. Jolai. 2017. "Analyzing Pricing, Promised Delivery Lead Time, Supplier Selection, and Ordering Decisions of a Multi-National Supply Chain under Uncertain Environment." *International Journal of Production Economics*. <https://doi.org/10.1016/J.IJPE.2017.12.019>.
- [11] Sweis, G., R. Sweis, A. Abu Hammad, and A. Shboul. 2008. "Delays in Construction Projects: The Case of Jordan." *International Journal of Project Management*.
- [12] Doloi, H., A. Sawhney, K. C. Iyer, and S. Rentala. 2012. "Analyzing Factors Affecting Delays in Construction Projects in India." *International Journal of Project Management*.
- [13] Assaf, S. A., and S. Al-Hejji. 2006. "Causes of Delays in Large Construction Projects." *International Journal of Project Management*.
- [14] Kusumanugraha, Y. 2018. "Evaluation of Foreman Competency Conformity to Consumer Complaints." *Journal of Civil Engineering and Planning*. <https://doi.org/10.15294/JTSP.V20I2.16172>.
- [15] Putri, R. D. 2020. "Analysis of Factors Causing Delay in the Cibitung-Cilincing Toll Road Project." Politeknik Negeri Jakarta.
- [16] Widodo, T. 2021. "Analysis of Overtime Policy on Construction Project: Cost vs. Benefit." *Scientific Journal of Civil Engineering*.
- [17] Azhar, S. 2011. "Building Information Modeling (BIM): Trends, Benefits, Risks, and Challenges for the AEC Industry." *Engineering Leadership and Management* 11: 241–252.
- [18] Kaming, P. F., P. Olomolaiye, G. D. Holt, and F. C. Harris. 1997. "Factors Affecting Construction Time and Cost Overruns on High-Rise Building Projects in Indonesia." *Construction Management and Economics* 15: 83–94.
- [19] Navon, R. 2005. "Automated Project Performance Control in Construction Projects." *Automation in Construction*.

- [20] Cheng et al. 2005. "Title Not Provided." *Automation in Construction*. <https://doi.org/10.1016/j.autcon.2005.01.002>.
- [21] Elazouni, A., and M. Abou Zeid. 2003. "Resource Scheduling Using Combined Simulation and Genetic Algorithm." *Automation in Construction* 12 (3): 329–343. [https://doi.org/10.1016/S0926-5805\(03\)00003-6](https://doi.org/10.1016/S0926-5805(03)00003-6).
- [22] Hegazy, T., and A. Ayed. 1998. "Neural Network Models for Parametric Cost Estimation of Highway Projects." *Journal of Construction Engineering and Management* 124 (5): 357–363. [https://doi.org/10.1061/\(ASCE\)0733-9364\(1998\)124:5\(357\)](https://doi.org/10.1061/(ASCE)0733-9364(1998)124:5(357)).
- [23] Creedy, G. D., M. Skitmore, and J. K. W. Wong. 2010. "Evaluation of Risk Factors Leading to Cost Overruns in Highway Construction Project Delivery." *Journal of Construction Engineering and Management* 136 (5): 528–537. [https://doi.org/10.1061/\(ASCE\)CO.1943-7862.0000150](https://doi.org/10.1061/(ASCE)CO.1943-7862.0000150).
- [24] Al-Najjar, B. 2007. "Lack of Maintenance and No Maintenance Cost: A Model to Describe and Measure the Impact of Vibration-Based Maintenance on a Firm's Business." *International Journal of Production Economics* 107 (1): 260–273. <https://doi.org/10.1016/j.ijpe.2006.09.005>.
- [25] Musa, R. A., M. R. Abdul-Kadir, and M. S. Jaafar. 2005. "Delays and Cost Overruns in the Construction of Public Projects in Malaysia." *International Journal of Project Management* 23 (4): 283–295. <https://doi.org/10.1016/j.ijproman.2004.10.003>.
- [26] Chan, D. W. M., and M. M. Kumaraswamy. 2002. "Compressing Construction Duration: Lessons Learned from Building Projects in Hong Kong." *International Journal of Project Management* 20 (1): 23–35. [https://doi.org/10.1016/S0263-7863\(00\)00032-6](https://doi.org/10.1016/S0263-7863(00)00032-6).
- [27] Gransberg, D. D., and K. R. Molenaar. 2008. "Life Cycle Cost Analysis for Construction Equipment Procurement." *Journal of Construction Engineering and Management* 134 (10): 800–808. [https://doi.org/10.1061/\(ASCE\)0733-9364\(2008\)134:10\(800\)](https://doi.org/10.1061/(ASCE)0733-9364(2008)134:10(800)).
- [28] Elazouni, A., and S. AbouRizk. 2001. "Integrating Construction Planning Simulation and Optimization." *Journal of Construction Engineering and Management* 127 (2): 132–141. [https://doi.org/10.1061/\(ASCE\)0733-9364\(2001\)127:2\(132\)](https://doi.org/10.1061/(ASCE)0733-9364(2001)127:2(132)).
- [29] Enshassi, A., S. Mohamed, and S. Abushaban. 2009. "Factors Affecting Construction Project Performance in the Gaza Strip." *Journal of Civil Engineering and Management* 15 (3): 269–280. <https://doi.org/10.3846/1392-3730.2009.15.269-280>.
- [30] Olawale, Y. A., and M. Sun. 2010. "Cost and Time Control of Construction Projects: Constraining Factors and Mitigating Measures in Practice." *Construction Management and Economics* 28 (5): 509–526. <https://doi.org/10.1080/01446190903521510>.
- [31] Assaf, S. A., and S. Al-Hejji. 2006. "Causes of Delays in Large Construction Projects." *International Journal of Project Management* 24 (4): 349–357. <https://doi.org/10.1016/j.ijproman.2005.11.010>.
- [32] Alaghbari, W., M. R. Kadir, A. Salim, and Ernawati. 2007. "Important Factors Causing Delays in Building Construction Projects in Malaysia." *Engineering, Construction and Architecture Management* 14 (2): 192–206. <https://doi.org/10.1108/09699980710731308>.
- [33] Kaming, P. F., P. O. Olomolaiye, G. D. Holt, and F. C. Harris. 1997. "Factors Affecting Construction Time and Cost Overruns on High-Rise Building Projects in Indonesia." *Construction Management and Economics* 15 (1): 83–94. <https://doi.org/10.1080/014461997373132>.
- [34] Zwikael, O. 2009. "Critical Planning Process in Construction Projects." *Construction Innovation* 9 (4): 372–387. <https://doi.org/10.1108/14714170910995951>.
- [35] Hidayat, B., and C. Egbu. 2010. "Literature Review on Issues and Challenges of Public-Private Partnership (PPP) Projects in Indonesia." RICS COBRA Conference, 1–10. https://www.arcom.ac.uk/-docs/proceedings/ar2010-915-924_Hidayat_Egbu.pdf.