Scientific Research Publishing

Engineering, 2023, 15, 431-445
https://www.scirp.org/journal/eng
ISSN Online: 1947-394X
ISSN Print: 1947-3931

Perception-Based Assessment of the Factors Causing Delays in Construction Projects

Om Prakash Giri

School of Engineering, Pokhara University, Pokhara, Nepal
Email: omgi5@pu.edu.np

How to cite this paper: Giri, O.P. (2023) Perception-Based Assessment of the Factors Causing Delays in Construction Projects. *Engineering*, **15**, 431-445.
https://doi.org/10.4236/eng.2023.157033

Received: June 21, 2023
Accepted: July 22, 2023
Published: July 25, 2023

Abstract

Construction delay is a widespread issue in the construction industry of developing countries, and Nepal is no exception. These delays extend project durations and lead to cost overruns and disputes among stakeholders. To address this problem, this study aimed to identify and analyze the significant factors that contribute to construction project delays in Nepal. To gather data, a well-structured questionnaire was developed and administered to a sample of 100 participants, including contractors, consultants, and civil engineers. Various statistical tests were conducted to ensure the data's integrity and consistency, such as reliability assessments and factor analyses. The findings of the study highlighted multiple factors contributing to delays in construction projects such as inadequate design, poor communication, and coordination among stakeholders, insufficient experience and planning by contractors, delays in material delivery and testing, labor-related problems including shortages and low qualifications, and external factors like regulatory changes and unforeseen circumstances. By identifying these major causes of construction project delays, this study presented insightful information that can contribute to the analysis and evaluation of project performance.

Keywords

Construction Projects, Construction Industry, Delay Causes, Construction Delays, Project Performance

1. Introduction

Project performance is evaluated based on factors such as time, cost, quality, and customer satisfaction [1]. It is widely acknowledged that a project's timely completion is essential to its success [2]. A delay refers to an occurrence or circumstance that prolongs the project duration beyond the timeframe stipulated in the

contract [3]. In construction projects, particularly in developing nations, unnecessary project delivery delays often serve as a common underlying factor leading to complications [4]. Construction project delays arise when the completion of a project exceeds the designated contractual or agreed-upon timeframe, often attributable to factors associated with the consultant, contractor, or client [5]. Consequently, delays are widely acknowledged as a highly intricate, costly, and prevalent challenge encountered in construction projects, posing a significant concern for all involved stakeholders [6] [7].

The primary causes that significantly contribute to project delays include the slow processing of change orders, unrealistic contract durations, delays in handling variation orders for additional quantities, payment delays for completed work, and inadequate scheduling by contractors [8]. Similarly, the key factors contributing to project delays include the delay in receiving progress payments, insufficient employee training, clients imposing unrealistic schedules, rework due to construction error, a shortage of skilled workforce, delays in obtaining permits from government agencies, and lack of collaborative planning [9]. The other factors contributing to the project delays include inadequate planning, unrealistic estimates, bureaucratic processes, inadequate ground investigation, and a deficient project delivery system [10].

Construction delay is a significant obstacle faced by construction companies [7]. Project execution delays have posed significant challenges to the construction industry in Nepal, with various factors contributing to this issue. Concerns have been raised regarding the insufficient consideration of risks associated with infrastructure development projects by government agencies and other stakeholders, resulting in compromised infrastructure quality and financial losses [11]. In cases where projects experience delays, additional costs are incurred, and disputes may arise among the involved parties [12]. However, construction projects are susceptible to numerous causes such as performance and engagement of project participants, contractual relationships, environmental and site conditions, resource availability, and more [13].

The construction industry holds significant economic and social significance for any country, as it actively contributes to the nation's socio-economic development objectives through infrastructure development and the generation of employment opportunities [14]. However, project delays are frequent in the construction industry, albeit their impacts may be changed depending on the specific project. Stakeholders in the construction industry express concerns about project duration due to factors like increasing interest rates, inflation, and commercial pressures. Delays not only result in wasted resources and increased costs but also give rise to disputes and claims that often lead to arbitration or litigation, ultimately impacting the country's economy. Given the potential of the construction industry to contribute significantly to economic development and growth, effective delay management is vital for its success in Nepal. Numerous construction projects in Nepal have experienced delays or even come to a halt. To mitigate and prevent delays, it is crucial to explore the main causes of these

delays [15]. Gaining a comprehensive understanding and recognizing the primary factors accountable for delays holds the utmost importance in facilitating the smooth functioning of Nepal's construction sector. Therefore, the researcher's goal in this study is to investigate the factors that contribute to project delays in construction projects.

2. Literature Review

In construction projects, a project consists of multiple activities, and the delay in completing one activity can lead to delays in subsequent activities, ultimately impacting the overall project completion time. This interdependency of activities makes delays a prevalent and intricate challenge in construction projects, as they can be costly and pose risks to the project's success [16]. Hence, delays are widely recognized as a significant and multifaceted issue in the construction industry.

A study was undertaken to examine the factors contributing to delays in construction projects and identified the top five factors based on a meta-analysis. These factors include financial difficulties faced by contractors, poor planning in terms of resource management, and scheduling, slow material deliveries, poor site organization, and poor coordination between various parties [17]. Inadequate communication between parties, problems with subcontractors, a lack of design team experience, and frequent change orders by clients are the main factors contributing to construction delays in grain construction projects in China [18]. Similarly, research in Iran identified various factors contributing to construction delays. These factors include a lack of commitment, complicated heritage and legal requirements, ineffective site management, a lack of skilled labor, poor communication between parties, poor planning, and contractual ambiguity [19]. Likewise, factors such as delays in receiving progress payments, change orders during construction, financial challenges encountered by contractors, delays in reviewing and approving design documents, complications with subcontractors, ineffective project planning and scheduling by contractors, inaccuracies and inconsistencies in design documents, and adverse weather conditions were identified as primary reasons for project delays [20].

Based on a research study conducted in Malaysia, the primary factors leading to project delays can be attributed to insufficient planning, ineffective management at the construction site, limited contractor experience, inadequate financing from clients and delayed payments for completed work, challenges with subcontractors, material shortages, difficulties in labor supply, equipment availability, and malfunctions, communication gaps between involved parties, and construction errors [21]. Similarly, the main factors leading to project delays were identified in Malaysia as the delay in preparing design documents, inadequate schedule management and time control, lack of understanding of various execution techniques, changes in the scope of work, delays in the delivery of materials to the construction site, and shortages of labor and materials in the market [22]. Several key factors contributing to delays in India include insuffi-

cient availability of materials at the construction site, unexpected ground conditions, inadequate planning for procurement, difficulties in site accessibility, rework, unfavorable weather conditions, insufficient modern equipment, and skilled workforce, and equipment malfunctions identified as contributing factors to project delays [23]. Other factors identified in India include delays in design review, material shortages, ineffective contract management, conflicts among stakeholders, rework due to non-compliance with quality standards or poor workmanship, and inadequate site management and supervision [24]. In Oman, poor contract management and a lack of experienced workers were found to be common causes of contractor-related project delays [25]. Similarly, in Saudi Arabia, a lack of experience and construction materials were identified as the main causes of construction delays [26].

Project delays can arise from various factors, including challenges in claim resolution, contractor financial hardships, delays in payment for additional work or variations, late payments from contractors to suppliers or subcontractors, owner-initiated variation orders, and owner-made design modifications [27]. Owners can contribute to delays through unrealistic project duration, excessive provisional sums and prime cost items, issues with subcontractor and supplier nomination, irregular payment practices, and variations [28]. The main reasons for construction project delays include inadequate communication, adverse weather conditions, coordination problems, stakeholder conflicts, ineffective planning, material shortages, financial difficulties, payment delays, limited equipment availability, lacking of experience or qualifications among project stakeholders, labor shortages, and poor site management techniques [29]. Additionally, project delays have been linked to several significant factors, including poor site management, unrealistic project scheduling, a lack of skilled labor, worker absenteeism, design changes or rework brought on by construction mistakes, and accidents brought on by insufficient site safety management [22] [30].

The completion of projects can be significantly influenced by several factors. These include giving priority to financial analysis and selecting the lowest bidder, assigning projects to contractors who may lack the necessary financial and technical capabilities, choosing contractors with a history of struggling on previous projects, and lack of commitment from ministries towards the growth of the engineering sector, delayed allocation of financial rights to contractors by government entities, inadequate financial and technical capabilities of certain contractors [4] [31]. Other factors include delays in the owner paying contractors, design changes made during construction by the owner or consultant, partial payments made during the construction phase, labor and equipment shortages, errors in design and documentation, modifications to the material specifications, and a lack of quick decision-making [32] [33]. Additional factors that can cause delays include inadequate monitoring and control, high capital expenses, and political insecurity and instability [34].

An examination of factors contributing to project delays highlights that five

crucial managerial capabilities significantly influence schedule delays in construction projects. These capabilities encompass the effective management of competencies, communication, coordination, financial management, risk management, and site management. These findings offer valuable insights for the practical implementation of critical reflection in the planning and management of production within the construction industry [35]. The primary factors related to clients that cause delays include cost overruns and changes in the project scope. In developing countries, delays in construction projects are primarily attributed to owner-initiated design changes during construction, lack of experience, inadequate supervision, delays in delivery and coordination, weather conditions, and slow mobilization [36].

Delays in construction projects are a significant issue due to their complex, costly, and risky nature. Numerous factors contribute to these delays. Client- related causes include unrealistic project duration, payment irregularities, and changes in project requirements. Consultants can also impact project timelines through delays in drawings, quality control, and test approvals. Material-related delays stem from scarcity and late deliveries. Labor factors include productivity issues, skill shortages, and insufficient training. External causes such as weather conditions and government tendering systems selecting the lowest bidder also play a role. Poor project planning and management, including site management, contractor experience, and communication problems, contribute to delays. Country-specific challenges like lack of experience, construction materials, and project financing difficulties also affect timelines. Design changes, rework, equipment failure, and scope variations further compound delays. It is essential to address these causes comprehensively to ensure timely project completion and mitigate the negative impacts on revenue, productivity, and client satisfaction.

3. Methodology

The data for this study was obtained through a survey conducted via questionnaires, while the secondary data was derived from a reliable journal database. The study's target population consisted of professionals working in the construction industry, specifically civil engineers, consultants, and contractors who had a minimum of three years of experience. The sample size was determined using a stratified random sampling technique. The main tool for gathering data was the questionnaire. It was created after a thorough review of the available literature [12] [19] [37]. Seven different groups of design, client, consultant, contractor, material, labor, and external factors totaled 42 delay factors, which were then divided into those categories. A Likert-type scale with five possible ratings1 for "strongly disagree" and 5 for "strongly agree" was used to rate these variables.

The R software was employed to perform Confirmatory Factor Analysis (CFA) and assess the reliability of the scales used in the study. Various indicators

were analyzed to determine the appropriateness and fit of the CFA model. CFA is a powerful statistical tool that helps validate the proposed model, identify underlying constructs, and establish relationships between observed variables. It confirms whether the chosen factors (inadequate design, poor communication, inadequate planning, material delays, labor-related issues, and external factors) indeed represent the underlying constructs causing construction project delays. It contributes to the scientific understanding of construction project delays and provides practical insights for better project management and performance evaluation. By understanding the significant factors affecting project delays, stakeholders can implement targeted interventions and strategies to address these issues effectively.

4. Result and Discussion

Data analysis was performed using the R statistical software, and the collected data was quantitatively analyzed. The sample and observations were summarized using descriptive statistics. Confirmatory Factor Analysis (CFA) was also performed to create a model for determining the main reasons for delays.

Reliability & Importance of Factors

Table 1 presents the reliability values for each factor in the CFA model, along with the impact of removing variables on factor reliability. The first factor has an alpha (raw-alpha) value of 0.49, indicating that it falls below the standard threshold. Similarly, the second factor has an alpha value of 0.44, also below the standard. On the other hand, the third factor exhibits a good alpha value of 0.77, indicating a well-defined factor. Additionally, removing a component of this factor influences the alpha value positively or negatively, suggesting its clarity. The fourth factor also demonstrates a good alpha value of 0.82, and its internal consistency is maintained even when one of its items is removed. The reliability coefficients (alpha values) for factors 5, 6, and 7 are 0.80, 0.77, and 0.69, respectively. Removing items from these factors affects the alpha values, indicating that all variables contribute positively to the internal consistency of their respective factors. In conclusion, it can be inferred that all variables in these factors are well-defined.

The findings, presented in Table 2, demonstrate that the chi-square to degrees of freedom ratio (χ^2/df) was <5.0, the root mean square error of approximation (RMSEA) was ≤0.08, and both the comparative fit index (CFI) and Tucker Lewis Index (TLI) exceeded 0.9. Furthermore, the p-value of the chi-square test was greater than 0.05. These findings collectively suggest a good fit for the constructed model. The validity of the construct was confirmed by standardized factor loadings exceeding 0.5 and p-values below 0.05, indicating a close connection between items and their corresponding factors. Additionally, the composite reliability of the domains, which was calculated to be 0.7 or higher, was considered acceptable.

Table 1. Reliability & importance of each factor.

Factors	Number of Items	α	Variables	$\alpha 1$
Design Related	5	0.47	Insufficient and ambiguous information in drawings and specifications.	0.36
			Delayed delivery of drawings/designs.	0.40
			Rework caused by design changes or variation orders.	0.55
			The designer carried out inadequate research and analysis in the design phase.	0.36
			Insufficient exchange of information between the owner and designer in the design phase.	0.40
Consultant Related	6	0.82	Delayed approval of contractor submissions by the consultant.	0.79
			Inadequate qualifications of the engineer's staff assigned to the project.	0.79
			Delayed response from the consultant to contractor inquiries.	0.86
			Poor coordination by the consultant with other project stakeholders.	0.75
			Delays in inspection, performance, and testing by the consultant.	0.77
			Delays in rectifying errors in the contract document.	0.78
Client Related	5	0.44	Client's delays in making progress payments.	0.38
			Owner's delays in providing and delivering the site to the contractor.	0.47
			Owner's slow decision-making process.	0.36
			Client's limitation of site supervisor's authority.	0.28
			Excessive administrative bureaucracy within the owner's organization.	0.40
Contractor Related	9	0.73	Inefficient project scheduling and planning.	0.71
			Ineffective quality control.	0.70
			Improper implementation of construction techniques.	0.71
			Delays in mobilizing resources to the construction site.	0.75
			Inadequate contractor experience.	0.70
			Lack of contractor motivation to achieve early project completion.	0.71

Continued

			An insufficient technical study during the bidding stage.	0.68
			Inadequate communication with other project stakeholders.	0.70
			Frequent subcontractor changes due to their inefficient work and inadequate screening processes.	0.70
Labor Related	5	0.77	Inadequate labor productivity.	0.78
			Shortage of manpower.	0.71
			Lack of skilled labor.	0.72
			Workforce strikes by the contractor.	0.72
			Low qualifications of the contractor's technical personnel assigned to the project.	0.73
External Factors	7	0.69	Modifications in government regulations, political interference.	0.62
			Impacts of underground conditions.	0.71
			Delays in obtaining permits from various government offices.	0.66
			Adverse weather conditions at the construction site.	0.65
			Unforeseen circumstances.	0.63
			Influence of cultural and social factors.	0.61
			Government procurement system favoring the lowest bidder.	0.68
Material Related	5	0.80	Delays in material delivery and late ordering.	0.77
			Lack of skilled labor.	0.72
			Inadequate labor productivity.	0.78
			Workforce strikes by the contractor.	0.72
			Low qualifications of the contractor's technical personnel assigned to the project.	0.73

α = Reliability factor, $\alpha 1$ = Reliability of a factor if an item is dropped.

Table 2. CFA test result.

SN	Indicators	Tested-value	Result
1	Degree of freedom (df)	44	
2	Test statistics	64.88	
3	(χ^2/df)	1.47	Between 1 to 2, is a good value
4	P-value	0.02	Less than 0.05, is a good value
5	CFI	0.95	Above 0.095, excellent value
6	TLI	0.92	Between 0.9 to 0.95 is a good value

Continued

7	RMSEA	0.07	Between 0.05 to 0.08, is a good value
8	SRMR	0.05	Between 0.05 to 0.08, is a good value

Validity and Reliability Testing

1) Convergent Validity

Table 3 displays the values of Construct Reliability (CR) and Average Variance Extracted (AVE), which are used to access validity. In this study, the CR values are greater than the AVE values, and the AVE values greater than 0.5. These results confirm the presence of convergent validity within the study.

2) Discriminant Validity

The correlations between factors and the square root of the Average Variance Extracted (AVE) were examined. The diagonal values are observed to be higher than the correlations between the analyzed constructs, indicating the presence of discriminant validity in the model. Moreover, confirmatory factor analysis was conducted to assess the correlations between factors, and the findings demonstrated statistical significance for the factors included in the model.

3) Contractor's Related Factors

The key factors that significantly impact construction projects include financial difficulties faced by contractors, delays in the approval process for completed work, slow delivery of materials, inadequate site organization and coordination among multiple parties, and poor resource allocation and project duration estimation [17]. Contractors often fail to provide comprehensive technical studies and effective work plans during the initial planning stage due to inadequate communication with other involved parties. Effective communication among project stakeholders is crucial for successful project execution, as any communication issues can lead to misunderstandings and subsequent project delays. The frequent change of subcontractors is often due to the contractor's lack of experience with the specific project and inadequate screening of subcontractors. Contractors lacking experience may struggle with project planning and management, resulting in unfavorable outcomes [38]. Another study by [39] highlighted that inadequate information and communication among construction project stakeholders significantly contribute to delays. Effective communication during project implementation plays a crucial role in ensuring that construction projects are finished well and on schedule [40].

4) Consultant Related Factors

The primary factors causing delays related to consultants in construction projects are ineffective coordination with other stakeholders and delays in inspection and testing procedures. Changes in drawings, consultant inefficiency, poor contract management, inadequate site investigation, and slow inspection [13], "incomplete drawings, delays in document approval, incomplete contract documents, changes in drawings/specifications, and lengthy inspection procedures are significant contributors to construction project delays caused by consultants" [28].

Table 3. Validity and reliability of test.

Factors	Loading	SL	AVE	Errors	SoE	SSL	CR
Consultant	0.92	0.85	0.74	0.18	0.51	2.99	0.85
	0.81	0.66		0.33			
Contractor	0.57	0.32	0.67	0.68	1.62	4.08	0.72
	0.76	0.58		0.42			
	0.69	0.48		0.52			
Material	0.73	0.53	0.76	0.42	0.84	2.50	0.77
	0.80	0.64		0.42			
External	0.51	0.26	0.56	0.71	2.04	2.86	0.58
	0.56	0.31		0.74			
	0.62	0.38		0.59			
Labor	0.76	0.58	0.79	0.42	0.74	2.99	0.80
	0.82	0.67		0.32			
	0.56	0.31		0.74			
	0.62	0.38		0.59			

SL = Square Loading, SoE = Sum of Error, SSL = The Sum of Square Loadings.

5) Labor-Related Factors Causing Delay

The primary factors that contribute to delays related to labor in construction projects are the inadequate qualification of the contractor's technical personnel and work stoppages due to strikes by the contractor's workforce. Challenges such as labor shortages, the presence of unskilled workers, dependence on foreign labor, low labor productivity, and personal conflicts among laborers are prevalent factors leading to project delays. The scarcity of labor is a substantial obstacle encountered by construction industries globally [41].

6) Material Related Factors

Delays in construction schedules can be substantially influenced by factors such as the consultant's examination, utilization, and testing of materials, along with delayed delivery and procurement of materials. Factors contributing to material delay are the shortage of on-site materials and delayed delivery of materials are considered to be significant contributors to project delays [23].

7) External Factors

Significant external factors that contribute to project delays include governmental rules and laws, political interference, delays in obtaining permits from government agencies, extreme weather, unforeseen circumstances, the influence of cultural and social factors, and the government's tendering system that favors the lowest bidder. Extreme weather has been shown in numerous studies to significantly affect construction project delays [42]. Along the same line, unexpected site conditions, regulatory changes, and weather are identified as the three main outside factors contributing to project delays in the Saudi construction industry [43].

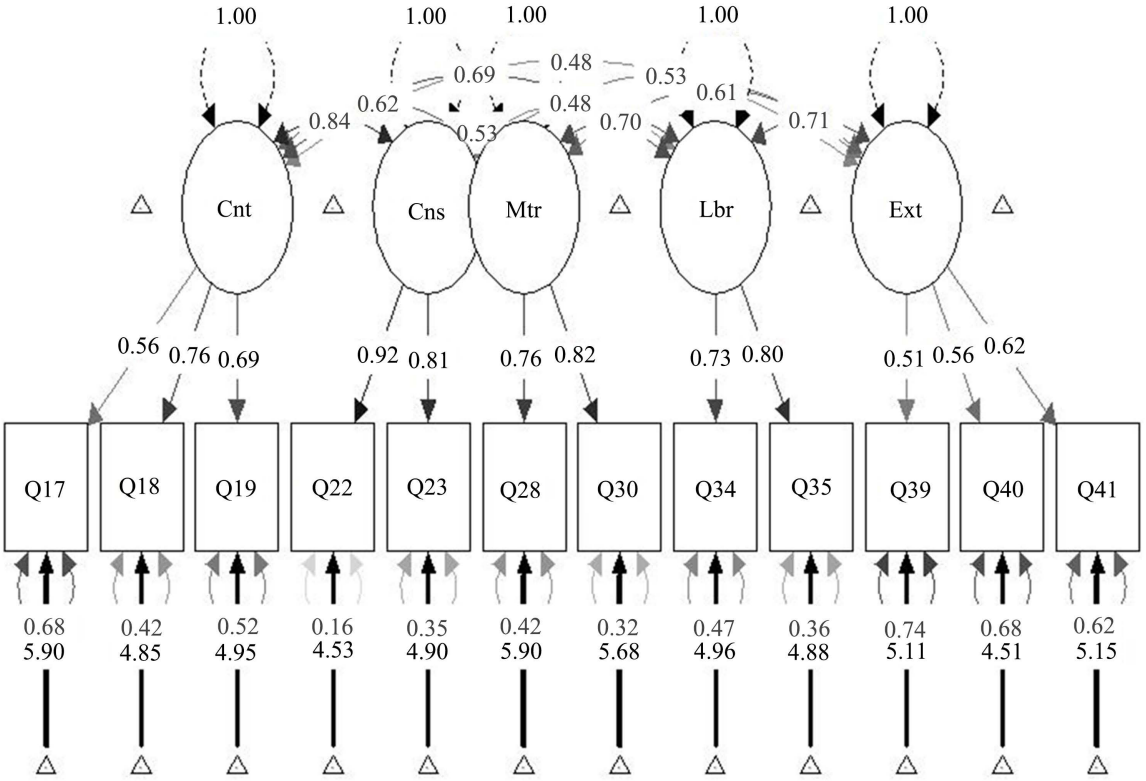

Figure 1. Final developed model for outlining the primary factors responsible for construction project delays. Cons = Consultant, Cnt = Contractor, Mtr = Material, Lbr = Labour, and Ext = External related factors.

As shown in **Figure 1**, the contractor, consultant, labor, materials, and external factors are among the main causes of delays in construction projects. Contractor-related factors include inadequate technical studies, poor communication, and frequent changes of subcontractors. Consultant-related factors involve poor coordination and delays in inspection and testing. Labor-related delays stem from the low qualification of personnel and strikes. Material-related factors include shortages and delays in delivery. External factors include changes in regulations, weather conditions, and unforeseen circumstances. These results underline the significance of efficient communication, careful planning, and resource management in preventing delays in construction projects.

5. Conclusion

This study aims to pinpoint the primary factors responsible for causing delays in construction projects. It investigates the impact of various stakeholders, including contractors, clients/owners, consultants, materials, labor, equipment, and external factors on project delays. The research incorporates 42 variables obtained from existing literature to determine the causes behind delays. The study utilizes the CFA method and a goodness-of-fit test to determine the most significant factors and their distribution significance. The questionnaire survey involved 100 respondents selected from the Kaski district, including civil engineers, contractors, and consultants. The findings from the CFA indicate that

significant delays related to contractors include insufficient technical study during the bidding phase, inadequate communication with project stakeholders, and frequent changes of sub-contractors due to their inefficiency and inadequate screening processes. Consultant-related delays are attributed to ineffective dialogue with other parties in the project and delays in examination and testing. Material-related delays stem from shortages, delivery delays, and late ordering of construction materials. Delays related to labor are primarily attributed to the strikes started by the contractor workforce and insufficiently qualified contractors assigned to the project. Furthermore, external factors, including challenging weather conditions, and unforeseen circumstances, have a substantial impact on causing project delays. The results of the goodness-of-fit test support the findings obtained from the confirmatory factor analysis. The study's findings can inform the development of policies and strategies to minimize delays in construction projects in Nepal. By addressing these identified factors, the concerned authority can formulate policy to mitigate delays and improve project efficiency and timely completion.

6. Recommendation

This study investigates primary factors causing construction project delays in the Kaski district of Nepal using CFA and highlights issues related to contractors, consultants, materials, labor, and external factors. The study emphasizes the need for policies and strategies to mitigate delays and enhance project efficiency and timely completion. Further research could explore multiple regions, interactions between factors, and the effectiveness of intervention strategies.

Acknowledgements

The author would like to express heartfelt appreciation to the Pokhara University Research Center, Nepal.

Conflicts of Interest

The author states that there are no conflicts of interest concerning the publication of this paper.

References

[1] Giri, O.P. (2019) Study the Role of the Project Manager in İmproving the Project Performance. *Technical Journal*, **1**, 133-139. https://doi.org/10.3126/tj.v1i1.27711

[2] Chan, D.W.M. and Kumaraswamy, M.M. (1997) A Comparative Study of Causes of Time Overruns in Hong Kong Construction Projects. *International Journal of Project Management*, **15**, 55-63. https://doi.org/10.1016/S0263-7863(96)00039-7

[3] Kassem, M.A., Khoiry, M.A. and Hamzah, N. (2019) Risk Factors in Oil and Gas Construction Projects in Developing Countries: A Case Study. *International Journal of Energy Sector Management*, **13**, 846-861. https://doi.org/10.1108/IJESM-11-2018-0002

[4] Alsuliman, J.A. (2019) Causes of Delay in Saudi Public Construction Projects.

Alexandria Engineering Journal, **58**, 801-808.
https://doi.org/10.1016/j.aej.2019.07.002

[5] Afshari, H., Khosravi, S., Ghorbanali, A., Borzabadi, M. and Valipour, M. (2010) Identification of Causes of Non-Excusable Delays of Construction Projects. *Proceedigs of the International Conference on E-Business*, *Management and Economics*, Hong Kong, 28-30 December 2010, 42-46.

[6] Hossain, M.A., Raiymbekov, D., Nadeem, A. and Kim, J.R. (2022) Delay Causes in Kazakhstan's Construction Projects and Remedial Measures. *International Journal of Construction Management*, **22**, 801-819.
https://doi.org/10.1080/15623599.2019.1647635

[7] Assaf, S.A. and Al-Hejji, S. (2006) Causes of Delay in Large Construction Projects. *International Journal of Project Management*, **24**, 349-357.
https://doi.org/10.1016/j.ijproman.2005.11.010

[8] Rachid, Z., Toufik, B. and Mohammed, B. (2019) Causes of Schedule Delays in Construction Projects in Algeria. *International Journal of Construction Management*, **19**, 371-381. https://doi.org/10.1080/15623599.2018.1435234

[9] Bajjou, M.S. and Chafi, A. (2020) An Empirical Study of Schedule Delay in Moroccan Construction Projects. *International Journal of Construction Management*, **20**, 783-800. https://doi.org/10.1080/15623599.2018.1484859

[10] McDermot, E., Agdas, D., Rodríguez Díaz, C.R., Rose, T. and Forcael, E. (2022) Improving the Performance of Infrastructure Projects in Developing Countries: An Ecuadorian Case Study. *International Journal of Construction Management*, **22**, 2469-2483. https://doi.org/10.1080/15623599.2020.1797985

[11] Koirala, M. (2017) Contribution of Risk Factors for Infrastructure Development of Nepal. *American Journal of Civil Engineering*, **5**, 124-131.
https://doi.org/10.11648/j.ajce.20170503.11

[12] Shahsavand, P. (2018) Causes of Delays in the Construction Industry and Comparative Delay Analysis Techniques with SCL Protocol. *Engineering*, *Construction and Architectural Management*, **25**, 497-533.
https://doi.org/10.1108/ECAM-10-2016-0220

[13] Afshari, H., Khosravi, S., Ghorbanali, A., Borzabadi, M. and Valipour, M. (2010) Identification of Causes of Non-Excusable Delays of Construction Projects. In *International conference on e-business management and economics*, Hong Kong, 28-30 December 2010, 42-46.

[14] Giri, O.P. (2020) Factors Causing Health and Safety Hazards at Construction Sites. *Technical Journal*, **2**, 68-74. https://doi.org/10.3126/tj.v2i1.32841

[15] N Alenezi, T.A. (2020) COVID-19 Causes of Delays in Construction Projects in Kuwait. *International Journal of Engineering Research and General Science*, **8**, 35-39. https://www.ijergs.org/

[16] Indhu, B. and Ajai, P. (2014) Study of Delay Management in a Construction Project: A Case Study. *International Journal of Emerging Technology and Advanced Engineering*, **4**, 2-7.

[17] Sanni-Anibire, M.O., Mohamad Zin, R. and Olatunji, S.O. (2022) Causes of Delay in the Global Construction Industry: A Meta-Analytical Review. *International Journal of Construction Management*, **22**, 1395-1407.
https://doi.org/10.1080/15623599.2020.1716132

[18] Chen, G.-X., Shan, M., Chan, A.P.C., Liu, X. and Zhao, Y.-Q. (2019) Investigating the Causes of Delay in Grain Bin Construction Projects: The Case of China. *International Journal of Construction Management*, **19**, 1-14.

https://doi.org/10.1080/15623599.2017.1354514

[19] Rafieizonooz, M., Salim, M.R., Khankhaje, E., Warid Hussin, M., Zarebidaki, A. and Salmiati. (2015) Determining the Causes of Delay by Using Factor Analysis in Tehran's Construction Projects. *Applied Mechanics and Materials*, **735**, 109-116. https://doi.org/10.4028/www.scientific.net/AMM.735.109

[20] Pourrostam, T. and Ismail, A. (2012) Causes and Effects of Delay in Iranian Construction Projects. *International Journal of Engineering and Technology*, **4**, 5-8. https://doi.org/10.7763/IJET.2012.V4.441

[21] Sambasivan, M. and Soon, Y.W. (2007) Causes and Effects of Delays in the Malaysian Construction Industry. *International Journal of Project Management*, **25**, 517-526. https://doi.org/10.1016/j.ijproman.2006.11.007

[22] Tahir, M.M., Haron, N.A., Alias, A.H. and Diugwu, I.A. (2019) Causes of Delay and Cost Overrun in the Malaysian Construction Industry. In: Pradhan, B., Ed., *GCEC* 2017: *Proceedings of the* 1*st Global Civil Engineering Conference*, Springer, Singapore. https://doi.org/10.1007/978-981-10-8016-6

[23] Singh, S., Bala, A. and Varshney, D. (2018) Critical Analysis of Causes of Delay in Residential Construction Projects. *International Journal of Civil Engineering and Technology*, **9**, 330-345.

[24] Shrivas, A. and Singla, H.K. (2022) Analysis of Interaction among the Factors Affecting Delay in Construction Projects Using an Interpretive Structural Modeling Approach. *International Journal of Construction Management*, **22**, 1455-1463. https://doi.org/10.1080/15623599.2020.1728486

[25] Al, T. and Marey-Pérez, M. (2020) Towards a Sustainable Construction Industry: Delays and Cost Overrun Causes in Construction Projects of Oman. *Journal of Project Management*, **5**, 87-102. https://doi.org/10.5267/j.jpm.2020.1.001

[26] Al-Kharashi, A., Skitmore, M., Al-kharashi, A. and Skitmore, M. (2009) Causes of Delays in Saudi Arabian Public Sector Construction Projects. *Journal of Construction Management and Economics*, **27**, 37-41. https://doi.org/10.1080/01446190802541457

[27] Prasad, K.V., Vasugi, V., Venkatesan, R. and Bhat, N. (2019) Analysis of Causes of Delay in Indian Construction Projects and Mitigation Measures. *Journal of Financial Management of Property and Construction*, **24**, 58-78. https://doi.org/10.1108/JFMPC-04-2018-0020

[28] Ren, Z., Atout, M. and Jones, J. (2008) Root Causes of Construction Project Delays in Dubai. *Proceedings of the* 24*th Annual ARCOM Conference*, Cardiff, 1-3 September 2008, 749-757.

[29] Durdyev, S. and Hosseini, M.R. (2020) Causes of Delays on Construction Projects: A Comprehensive List. *International Journal of Managing Projects in Business*, **13**, 20-46. https://doi.org/10.1108/IJMPB-09-2018-0178

[30] Mbala, M., Aigbavboa, C. and Aliu, J. (2019) Causes of Delay in Various Construction Projects : A Literature Review. In: Charytonowicz, J. and Falcão, C., Eds., *Advances in Human Factors*, *Sustainable Urban Planning and Infrastructure*. *AHFE* 2018. *Advances in Intelligent Systems and Computing*, Vol. 788, Springer, Cham, 489-495. https://doi.org/10.1007/978-3-319-94199-8_47

[31] Mohammed, A.M. and Seifu, N. (2019) Causes of Delay in Public Building Construction Projects: A Case of Addis Abeba Administration, Ethiopia. *Asian Journal of Managerial Science*, **8**, 4-9. https://doi.org/10.51983/ajms-2019.8.2.1560

[32] Viles, E., Rudeli, N.C. and Santilli, A. (2020) Causes of Delay in Construction

Projects: A Quantitative Analysis. *Engineering, Construction, and Architectural Management*, **27**, 917-935. https://doi.org/10.1108/ECAM-01-2019-0024

[33] Bekr, G.A. (2018) Study and Assessment of Causes and Effects of Delay in Large Public Construction Projects in Jordan. *International Journal of Applied Engineering Research*, **13**, 6204-6210.

[34] Apolot, R. and Tindiwensi, D. (2013) Investigation into the Causes of Delays and Cost Overruns in Uganda's Public Sector Construction Projects. *Journal of Construction in Developing Countries*, **18**, 33-47.

[35] Yap, J.B.H., Goay, P.L., Woon, Y.B. and Skitmore, M. (2021) Revisiting Critical Delay Factors for Construction: Analysing Projects in Malaysia. *Alexandria Engineering Journal*, **60**, 1717-1729. https://doi.org/10.1016/j.aej.2020.11.021

[36] Sivaprakasam, S. and Jayashree, S.D.J. (2017) A Review on Causes of Delay in Construction Projects. *International Journal for Scientific Research & Development*, **5**, 1108-1110.

[37] Varghese, A.R., Varghese, S. and Engineering, S. (2015) Analysis of Delays in Construction Projects. *International Journal of Engineering Research and General Science*, **3**, 108-112.

[38] Ghenbasha, M.R.R., Sabki, W.M. and Ayob, A. (2016) Causes of Construction Delay in Developing Countries: A Theoretical Review. *The 1st International Conference on Invention & Design* (*ICID*) 2016, Kuala, 13-14 May 2016.

[39] Odeh, A.M. and Battaineh, H.T. (2002) Causes of Construction Delay: Traditional Contracts. *International Journal of Project Management*, **20**, 67-73. https://doi.org/10.1016/S0263-7863(00)00037-5

[40] Owalabi, J.D., Amusan, L.M., Oloke, C.O., Olusanya, O., Tunji-Olayeni, P., OwolabiDele and PeterJoy, O. (2014) Causes and Effects of Delay on Project Construction Delivery Time. *International Journal of Education and Research*, **2**, 197-208.

[41] Kikwasi, G.J. (2008) Causes and Effects of Delays and Disruptions in Construction Projects in Tanzania. *Australasian Journal of Construction Economics and Building*, **1**, 52-59. https://doi.org/10.5130/ajceb-cs.v1i2.3166

[42] Awari, S.G., Jamgade, M. and Patil, U. (2016) Identifying the Cause of Delay in the Construction Industry in the Mumbai Region. *International Journal of Modern Trends in Engineering and Research*, **2**, 541-543.

[43] Frimpong, Y., Oluwoye, J. and Crawford, L. (2003) Causes of Delay and Cost Overruns in Construction of Groundwater Projects in Developing Countries; Ghana as a Case Study. *International Journal of Project Management*, **21**, 321-326. https://doi.org/10.1016/S0263-7863(02)00055-8