Kathford Journal of Engineering and Management,
ISSN: 2661-6106.

https://kathford.edu.np/Journal/
VOL. 4 ISSUE 1 DECEMBER 2024, PP. 59-72

Analysis of Causes for Extension of Time in Construction Projects: A Case Study of Kageshwori Manohara Municipality

Sunil Nepal[*, 1], *Subash Kumar Bhattarai*[2], *Dinesh Sukamani*[1], *Sujan Nepal*[1]

[*, 1]*Center for Post Graduate Studies, Nepal Engineering College (Affiliated to Pokhara University), Prayag Pokhari, Lagankhel, Nepal*
[2]*Lead-Health, Infrastructure and Policy, HERD International, Kathmandu, Nepal*

[*]Corresponding Author: *sunilnepal1069@gmail.com*

ABSTRACT— Extension of Time (EoT) claims are a common occurrence in construction projects worldwide, often leading to disputes due to insufficient attention to delay causes during the contract initiation phase. However, in the context of Kageshwori Manohara Municipality, these challenges are particularly pronounced due to localized factors. This study identifies key causes of EoT through qualitative and quantitative analyses, utilizing Principal Component Analysis (PCA), Kaiser-Meyer-Olkin (KMO) testing, Bartlett's Test of Sphericity, Eigenvalue and variance analysis, and reliability assessments using Cronbach's Alpha. Principal Component Analysis (PCA) helped to categorize twelve major EoT causes into three components: Design and Consultant-Related Issues (Eigenvalue: 13.892, Variance: 55.57%), Project Management and Execution Challenges (Eigenvalue: 1.146, Variance: 4.58%), and External and Unforeseen Conditions (Eigenvalue: 1.000, Variance: 4.00%). Significant causes include inadequate design information, poor project management, and unforeseen challenges like land acquisition disputes. These causes were ranked using the Relative Importance Index (RII) to prioritize their impacts on project time extensions. The authors believe that present findings illuminate the need for improved design and planning processes, along with adaptive project management practices to mitigate EoT claims and enhance project performance within the municipality.

KEYWORDS— ***RI Index, Projects Delay, Multivariate Statistics, Eigenvalues Scaling***

1. INTRODUCTION

The extension of time (EoT) is a justifiable delay that arises when circumstances beyond the contractor's control impede progress. If the contractor fails to meet the project deadline due to reasons within their responsibility, the employer reserves the right to claim Liquidated Damages (LD) to compensate for their losses. Conversely, if the delays are attributable to factors beyond the contractor's control, an extension to the completion period is typically granted, affording the contractor additional time to fulfill their obligations. Contractors can secure a time extension by demonstrating that they are not accountable for the delays (Yusuwan et al., 2021).

Tight deadlines define construction projects, but unforeseen delays—like weather or material shortages—can disrupt schedules. To avoid financial penalties like liquidated damages (LAD), contractors can file an Extension of Time (EoT) claim, formally requesting a deadline extension for delays beyond their control. EoT provisions in standard contracts protect contractors from LAD penalties, fostering fairness and collaboration in managing construction delays (Aryal & Dhakal, 2022).

Delayed completion is a common challenge across various industries worldwide, from construction and aerospace to IT, oil and gas, and rail transport. These delays result from diverse factors like logistical issues, supply chain disruptions, regulatory challenges, and labor or technology shortages. The unique and complex nature of projects—whether skyscrapers, aircraft, or IT systems—adds to these difficulties, as evolving client needs and shifting market conditions further complicate timelines, making on-time completion a constant challenge (Fawzy et al., 2018).

A study revealed that five bus terminals in Nepal, including Office cum Shopping Complex in Byas Municipality, had their Scheduled Performance Index (SPI) values below 1. Specifically, the SPI values were: 0.12, 0.35, 0.69, 0.23, and 0.25. This indicates that six out of ten projects experienced time overruns. As a result, there is a strong need to identify the factors contributing to these delays and develop a process for seeking extensions in these projects to ensure proper assessment (Mishra, Bhandari, & Jha, 2018).

The Public Procurement Act (PPA) 2063 and Public Procurement Regulations (PPR) 2064 outline the framework for granting extensions of time (EoT) in public sector construction projects in Nepal. According to Section 56 of the PPA, the conditions for EoT are primarily determined by the procurement contract. However, the competent authority may grant extensions in cases of force majeure, delays caused by the public entity, or other reasonable grounds, upon receiving an application from the contractor (PPA, 2007).

The PPR 2064, under Rule 120, details the process for EoT. Contractors are required to apply at least 21 days before the contract's expiry, providing supporting documents, including a revised schedule and evidence for the delay. EoT may be approved if the delay is due to the public entity's failure to fulfill its obligations, unforeseen disasters, or force majeure. If these conditions are not met, EoT may still be granted with the imposition of liquidated damages. The regulation sets strict deadlines for processing EoT applications and requires higher authorities to monitor and ensure compliance. Contracts that fail to meet the criteria for extension may be terminated, and contractors could face penalties, including blacklisting for deliberate negligence or non-performance. Rule 120(A) introduces special provisions for contracts nearing expiration as of July 2022. Contractors must submit revised schedules and milestones for EoT approval, with extensions allowed up to July 2023 under strict monitoring by the ministry. Contracts where milestones are not met, no application is submitted, or no work has been done for six months are subject to termination, and the contractors involved may be blacklisted. Despite these provisions, many projects with EoT under Rule 120(A) remained incomplete. This led the Government of Nepal to invoke further extensions, often placing the liability on public entities to facilitate project completion (PPR, 2008).

The study on construction delays globally was conducted to provide a comprehensive overview of the causes of construction delays by synthesizing existing data from previous studies. The research methodology involved reviewing literature from various construction industries worldwide and categorizing it based on global location or project type. This included studies on high-rise buildings, grain bin projects, groundwater projects, university construction, and residential projects. The study employed a meta-data analysis approach, using Relative Importance Index (RII) values from influential studies over the last 15 years to identify and rank common delay causes in construction projects. The research aimed to benefit stakeholders in the construction industry by offering a global perspective on the causes of delays, which are given below (Sanni-Anibire, Mohamad Zin, & Olatunji, 2022):

1. **Material-Related Causes**:
   a. Shortage of construction materials or unforeseen material damages.
   b. Slow delivery of materials.
   c. Awaiting approval of shop drawings and material samples.
2. **Manpower-Related Causes**:
   a. Shortage of skilled, semi-skilled, or unskilled labor.
   b. Poor labor productivity.
   c. Labor disputes and strikes.
3. **Equipment-Related Causes**:
   a. Poor equipment productivity due to breakdowns or maintenance issues.
   b. Shortage of equipment.
4. **Contractual Relations-Related Causes**:
   a. Inappropriate construction or contractual management methods.
   b. Slowness in decision-making.
   c. Delay in mobilization.
   d. Excessive bureaucracy or interference by the owner.
   e. Delay in approval of completed work.
   f. Delay in subcontractors' work.
5. **Government-Related Causes**:
   a. Slow permits from municipality or government.
   b. Government regulations.
6. **Financing-Related Causes**:
   a. Contractor's financial difficulties.
   b. Client's cash flow problems or delays in contractor's payment.
   c. Price escalation or fluctuations.
7. **Environmental Factors-Related Causes**:
   a. Weather conditions.
   b. Civil disturbances or hostile political conditions.
8. **Changes-Related Causes**:
   a. Design errors or incompleteness by designers (architects and structural drawings).
   b. Design variations, change orders, or scope increases.
   c. Errors due to lack of experience.
   d. Unanticipated foundation conditions discovered on-site.
   e. Alterations in material types and specifications during construction.
   f. Inaccurate site or soil investigation.
   g. Frequent changes of subcontractors.
9. **Scheduling and Controlling Techniques-Related Causes**:
   a. Subpar site management and coordination among stakeholders.
   b. Inadequate planning of resources and duration estimation.
   c. Insufficient supervision, inspection, and testing procedures.
   d. Accidents during construction due to a lack of safety measures.
   e. Poor communication, documentation, and detailed procedures.
   f. Unrealistic time schedules imposed in contracts.

g. Contractor or consultant qualifications.

h. Architects' or structural engineers' late issuance of instructions.

2. MATERIALS AND METHODS

The study population consisted of 123 engineers representing all three contractual stakeholders: clients (16 respondents), consultants (48 respondents), and contractors (59 respondents). These individuals were selected from 19 construction projects in Kageshwori Manohara Municipality, ensuring they had sufficient knowledge of extension of time (EoT) and its causes. The study was based on both primary and secondary data to identify the causes of extension of time in Kageshwori Manohara Municipality.

2.1 Primary Data collection

Primary data are the base of the research. The more accurate the figures collected from primary data, the more precise the study will be. The following methods were used for collecting primary data:

(a) Questionnaires— Different sets of questions were prepared for engineers/technical persons and contractors regarding the extension of time for data collection. All respondents were asked to rate the causes on a 5-point Likert scale. The rating details are as below:

1 = Strongly Disagree
2 = Disagree
3 = Neutral
4 = Agree
5 = Strongly Agree

(b) KII (Key Informant Interview) — Key Informant Interviews were also conducted for data collection. Five informants were used for this type of data collection in the study, including experienced engineers working in the Gokarneshwor Municipality.

2.2 Secondary Data Collection

Secondary data were collected from the Kageshwori Manohara Municipality. Published journals, reports, and internet/websites related to the extension of time were other sources of data involved in this research.

(a) Literatures— Key documents from Kageshwori Manohara Municipality were utilized, including Municipal decision, Council decision, EoT files which provided detailed insights into local policies, budget allocations, and project management strategies. Additionally, these references were taken as secondary data sources for this study. Singh (2018) was referenced for identifying critical delay factors in Nepal, such as disputes and contractor incompetence. Zidane and Andersen (2018) provided insights on delays in Norway through surveys and clustering analysis. Arantes and Ferreira (2020) were cited for their use of RII and factor analysis to study planning and site management issues in Portugal. Owolabi James et al. (2014) highlighted financial and decision-making delays in Nigeria. Sanni-Anibire et al. (2022) contributed global rankings of delay causes using RII data. Salunkhe and Patil (2014) analyzed Indian project delays, while Ahmad et al. (2020) examined delay factors in Jordan's public infrastructure projects. These sources were reviewed to gather comparative insights from both national and international perspectives. Journal data offered global insights into construction delays, highlighting common trends, while municipal data from Kageshwori Manohara Municipality provided localized details on policies, budgets, and management. Municipal data was more directly relevant, while journal data was valuable for broader comparisons.

(b) Regulations and guidelines related to Extension of time like Public Procurement Act 2063, Public Procurement Regulation 2064 were used.

3. RESULT AND DISCUSSIONS

3.1 Assessment of the Suitability of the Data for Causes of EoT

To evaluate the appropriateness of data for factor analysis, the Kaiser-Meyer-Olkin (KMO) measure is employed to gauge the adequacy of the data. Additionally, Bartlett's test of sphericity, the correlation matrix, and the determinant score are utilized to ascertain the suitability of the data for performing factor analysis (Mehmedinović, 2017).

The Kaiser-Meyer-Olkin (KMO) test is used to assess the appropriateness of data for factor analysis by measuring sample adequacy. Along with Bartlett's Test of Sphericity, these tests evaluate the validity of Principal Component Analysis (PCA). KMO values in the range of 0.8 to 1.0 indicate that the sampling is adequate, while values from 0.7 to 0.79 suggest a middling adequacy, and values from 0.6 to 0.69 imply a mediocre adequacy. If KMO values are below 0.6, it suggests the sample is inadequate and remedial actions are needed. Bartlett's Test of Sphericity, which is highly significant when $p<0.001$, indicates significant correlations among at least some of the variables in the correlation matrix (Prajapati, 2022).

Table 1. KMO and Bartlett's test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		0.935
Bartlett's Test of Sphericity	Approx. Chi-Square	2338.862
	df	300
	Sig.	0.000

In this instance, the factor number was determined with a Kaiser-Meyer-Olkin (KMO) value of 0.935, which is well above the threshold of 0.6. Additionally, Bartlett's test produced a chi-square ($\chi2$) value of 2338.862 with 300 degrees of freedom (df), and a significance level of 0.000, which is less than 0.001. These results indicate that the sampling is adequate.

3.2 Factor Extraction for Causes of EoT

In this study, two techniques were employed to assist in determining the number of factors to retain: Kaiser's Criterion (Eigenvalues) and the Scree Test. For this purpose, 25 causes of extension of time were included in the Principal Component Analysis (PCA). The Eigenvalue technique was used to determine the number of factors to extract, retaining only three factors with Eigenvalues of 1.0 or higher. Varimax rotation was applied for normalization to simplify the factors and maximize the variance explained by the model.

In multivariate statistics, a scree plot is a graphical representation of the Eigenvalues of factors or principal components. It is used to determine the number of factors to retain in exploratory factor analysis (FA) or the number of principal components to keep in PCA. As illustrated in Figure 4.3 of the scree plot, three variables were identified with Eigenvalues greater than 1. The scree plot is important for identifying the key factors contributing to Extensions of Time (EOT) by showing significant components, while eigenvalues greater than 1 help prioritize critical delay causes.

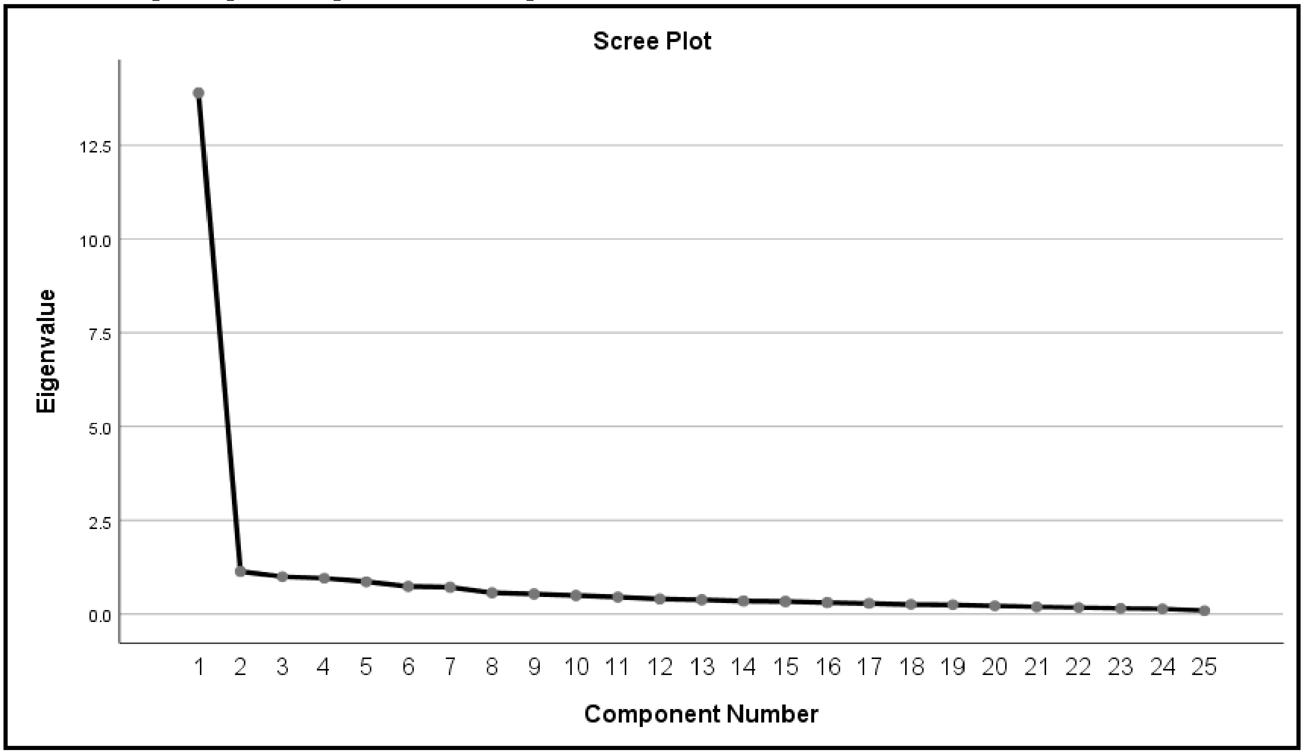

Figure 1. Scree plot for causes of extension of time.

In Figure 1, the Scree Test is represented by a graph where the Eigenvalues are plotted on the y-axis and the component numbers are plotted on the x-axis in the order of their extraction. The initial components extracted have larger Eigenvalues, indicating that they account for a significant amount of the variance in the data. These are followed by components with smaller Eigenvalues. The purpose of the scree plot is to help determine the number of factors to retain. In this case, the plot reveals that there are three factors with Eigenvalues greater than one, which together account for most of the total variability in the data. The remaining factors, with much smaller Eigenvalues, contribute to a minor proportion of the variability and are therefore considered less important (Prajapati, 2022). In this study, smaller eigenvalues (Components 4 to 25, each less than 1) contribute minimally to delay variability and have limited influence on project outcomes. Key efforts should focus on larger eigenvalues (Components 1, 2, and 3), as they account for a significant portion of project delay variance, ensuring effective identification of critical causes.

Table 2. Eigen Value and Total Variance Explained Extraction Method: Principal component Analysis for Causes of Extension of Time.

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	13.892	55.569	55.569	13.892	55.569	55.569	6.166	24.663	24.663
2	1.146	4.583	60.152	1.146	4.583	60.152	4.986	19.943	44.606
3	1.000	4.001	64.153	1.000	4.001	64.153	4.887	19.547	64.153
4	0.959	3.838	67.991						
5	0.863	3.450	71.441						
6	0.738	2.953	74.394						
7	0.718	2.872	77.266						
8	0.571	2.283	79.549						
9	0.541	2.162	81.711						
10	0.502	2.007	83.718						
11	0.459	1.837	85.555						
12	0.409	1.636	87.191						
13	0.387	1.548	88.739						
14	0.356	1.423	90.162						
15	0.344	1.375	91.537						
16	0.314	1.256	92.793						
17	0.290	1.160	93.953						
18	0.263	1.052	95.005						
19	0.254	1.015	96.021						
20	0.223	0.891	96.912						
21	0.197	0.787	97.699						
22	0.177	0.709	98.408						
23	0.157	0.628	99.036						
24	0.144	0.577	99.613						
25	0.097	0.387	100.00						

Kathford Journal of Engineering and Management,
ISSN: 2661-6106.

https://kathford.edu.np/Journal/
VOL. 4 ISSUE 1 DECEMBER 2024, PP. 59-72

Table 2 provides a detailed summary of the Eigenvalues and the total variance explained in the study, where principal component analysis (PCA) was utilized as the method for factor analysis. Initially, 25 linear components were identified within the dataset. Following extraction and rotation, three distinct linear components were found to have Eigenvalues greater than 1, accounting for a combined total of 64.153% of the variance. According to standard recommendations, the proportion of total variance explained by the retained factors should exceed 50% to be considered adequate.

The results demonstrate that these three factors collectively explain 64.153% of the common variance shared among the 25 variables. This substantial proportion of explained variance aligns with a Kaiser-Meyer-Olkin (KMO) value of 0.935, which is indicative of good sample adequacy and supports the appropriateness of factor analysis for the dataset.

In the scope of this study, it was determined that three factors have Eigenvalues greater than 1. The first factor explains a significant portion of the variance, 55.569%, with an Eigenvalue of 13.892. The second factor accounts for 4.583% of the variance with an Eigenvalue of 1.146. The third factor explains 4.001% of the variance with an Eigenvalue of 1.000. These findings highlighted that the retained factors, including Design and Consultant-Related Issues, Project Management and Execution Challenges, and External and Unforeseen Conditions, collectively accounted for a significant portion of the variance in the dataset, as they were found to play a vital role in causing delays in construction projects within Kageshwori-Manohara Municipality.

3.3 Factor Rotation and Interpretation for Causes of EoT

The rotation method employed was Varimax with Kaiser normalization. The Varimax rotation method with Kaiser normalization was employed to simplify the factor structure, ensuring a clearer identification of significant delay factors in construction projects by maximizing the variance of factor loadings. This method was considered highly relevant as it enhanced the interpretability of the results, allowing stakeholders to pinpoint critical contributors to Extensions of Time (EOT). It was a commonly applied technique in factor analysis across disciplines, including project management and construction research. By providing a more meaningful factor structure, better strategic planning and decision-making were facilitated to address the primary causes of project delays.

Table 3. Rotated Component Matrix for Causes of Extension of Time.

Causes of Extension of Time	Component		
	Design and Consultant-Related Issues	Project Management and Execution Challenges	External and Unforeseen Conditions

Insufficient information exchange in design phase	0.740		
Inadequate engineer qualifications	0.735		
Insufficient information in drawings/specifications	0.726		
Limited site supervisor authority	0.651		
Delayed consultant response	0.607		
Delays in rectifying contract errors			
Delayed delivery of designs			
Poor consultant coordination			
Rework due to design changes			
Delayed approval of submissions			
Delays in inspections/testing			
Delays in resource mobilization			
Ineffective quality control		0.839	
Inadequate design research/analysis		0.714	
Improper construction techniques		0.672	
Inefficient project scheduling		0.666	
Excessive administrative bureaucracy			
Slow decision-making by owner			
Delays in progress payments			
Land acquisitions: citizens refuse compensation for their land use or demolition of their homes.			0.776

Kathford Journal of Engineering and Management,
ISSN: 2661-6106.

https://kathford.edu.np/Journal/
VOL. 4 ISSUE 1 DECEMBER 2024, PP. 59-72

Different and unforeseen ground conditions.	0.768
Changes in government policies and macroeconomic context including rise in material price and instructions in payloads.	0.682
Shortage in material	
Delays in site delivery	
Accidents during construction.	

Table 3 identifies the key factors contributing to Extensions of Time (EOT) in construction projects, categorized into design and consultant issues, project management challenges, and external conditions. Strongly correlated components, such as insufficient information exchange (0.740), poor quality control (0.839), land acquisition problems (0.776), and unforeseen ground conditions (0.768), highlight the critical areas requiring attention.

Summary of PCA

1. Design and Consultant-Related Issues (Variance 55.569 % and Eigen Value 13.892)
   a. Insufficient information exchange in design phase
   b. Inadequate engineer qualifications
   c. Insufficient information in drawings/specifications
   d. Limited site supervisor authority
   e. Delayed consultant response
2. Project Management and Execution Challenges (Variance 4.583 % and Eigen Value 1.146)
   a. Ineffective quality control
   b. Inadequate design research/analysis
   c. Improper construction techniques
   d. Inefficient project scheduling
3. External and Unforeseen Conditions (Variance 4.001 % and Eigen Value 1.000)
   a. Land acquisitions: citizens refuse compensation for their land use or demolition of their homes.
   b. Different and unforeseen ground conditions.
   c. Changes in government policies and macroeconomic context including rise in material price and instructions in payloads.

Table 4. Cornbach's Alpha for Component Analysis of Causes of EoT

SN	Component	Cornbach's Alpha	Number of items
1	Design and Consultant-Related Issues	0.865	5
2	Project Management and Execution Challenges	0.895	4

3	External and Unforeseen Conditions	0.819	3

The internal consistency of the components was analyzed using Cronbach's alpha, and the results were evaluated against the standard values. The component Design and Consultant-Related Issues had a Cronbach's alpha of 0.865 with 5 items, indicating a good level of internal consistency as it fell within the range of 0.8 to 0.9. Similarly, the component Project Management and Execution Challenges demonstrated a Cronbach's alpha of 0.895 with 4 items, also signifying a good level of internal consistency. Lastly, the component External and Unforeseen Conditions had a Cronbach's alpha of 0.819 with 3 items, which again indicated a good level of internal consistency. Therefore, all three components were found to have good internal consistency according to their respective Cronbach's alpha values.

The research findings indicate that among the twenty-five causes of Extension of Time initially considered in projects of Kageshwori Manohara Municipality, only twelve were identified as significant. These twelve measures were categorized into three distinct components.

Component 1: Design and Consultant-Related Issues

The first component, named "Design and Consultant-Related Issues," included factors related to the initial stages of project planning and design. The design and consultant-related issues included factors with loading values greater than 0.6, such as insufficient information exchange in the design phase, inadequate engineer qualifications, insufficient information in drawings and specifications, limited site supervisor authority, and delayed consultant response, highlighting critical areas that impact project delays. The analysis revealed that insufficient information exchange in the design phase had a significant impact, with a loading factor of 0.740. Inadequate engineer qualifications also played a crucial role, indicated by a loading factor of 0.735. The lack of sufficient information in drawings and specifications was another critical factor, with a loading of 0.726. Additionally, limited site supervisor authority contributed to delays, with a loading factor of 0.651, and delayed consultant response further exacerbated the problem, showing a loading of 0.607. These factors collectively highlighted the importance of thorough and effective communication, competent engineering, and detailed documentation in the design and planning stages to prevent project delays.

Component 2: Project Management and Execution Challenges

The second component, named "Project Management and Execution Challenges," encompassed issues related to the management and execution phases of the project. Ineffective quality control emerged as a major concern, with a high loading factor of 0.839. Inadequate design research and analysis were also significant, with a loading of 0.714, indicating that insufficient preliminary studies and assessments could lead to delays. Improper construction techniques were identified as another critical factor, with a loading of 0.672, underscoring the importance of adhering to proper methods and standards. Furthermore, inefficient project scheduling contributed to time extensions, as indicated by a loading factor of 0.666. These findings underscored the necessity for robust project management practices, comprehensive research, adherence to quality standards, and efficient scheduling to minimize delays.

Component 3: External and Unforeseen Conditions

The third component, named "External and Unforeseen Conditions," included factors beyond the direct control of the project team, often related to external circumstances and conditions. Land acquisitions, where citizens refused compensation for their land use or demolition of their homes, had a significant loading factor of 0.776, indicating the substantial impact of such social issues on project timelines. Different and unforeseen ground conditions also posed challenges, with a loading of 0.768, highlighting the unpredictability of the natural environment. Changes in government policies and the macroeconomic context, including rises in material prices and new instructions in payloads, further complicated project execution, with a loading of 0.682. These results emphasized the critical need for contingency planning and flexibility to address external and unforeseen factors that could delay project progress.

Each of these components illustrated distinct sets of challenges contributing to the extension of project timelines, underscoring the multifaceted nature of delays in construction projects. The findings suggested that addressing these issues required a comprehensive approach encompassing better design and planning, enhanced project management practices, and adaptive strategies to cope with external conditions.

Component 1 comprising insufficient information exchange in the design phase, inadequate engineer qualifications, insufficient information in drawings and specifications, limited site supervisor authority, and delayed consultant responses, was ranked first due to its critical impact on construction delays. This component had the highest eigenvalue (13.892) and explained 55.569% of the total variance, accounting for more than half of the overall variance in the data. Component 2 comprising ineffective quality control, inadequate design research and analysis, improper construction techniques, and inefficient project scheduling was ranked second as it had the next highest eigenvalue (1.146) and explained the second-largest percentage of variance (4.583%), contributing the next most significant portion of the remaining variance after Component 1. Similarly, Component 3 comprising land acquisitions, where citizens refuse compensation for the use of their land or the demolition of their homes, different and unforeseen ground conditions that complicate site work, and changes in government policies along with macroeconomic factors was ranked third with an eigenvalue of 1.000 and explained 4.001% of the variance, accounting for the next most significant portion after Components 1 and 2.

The extension of time in construction projects in Kageshwori Manohara Municipality closely aligns with the causes identified through the Principal Component Analysis (PCA). In Component 1, which includes factors such as insufficient information exchange during the design phase, inadequate engineer qualifications, insufficient information in drawings, limited site supervisor authority, and delayed consultant response, issues were observed in building and road projects. Component 2, which addresses ineffective quality control, inadequate design research and analysis, improper construction techniques, and inefficient project scheduling, also appeared in project execution challenges. Lastly, Component 3, capturing external factors like land acquisitions, unforeseen ground conditions, and changes in government policies (rising material prices and payload instructions), was evident in road and water supply projects.

4. CONCLUSIONS

This study focused on identifying the causes of Extension of Time (EoT) in construction projects within Kageshwori Manohara Municipality. Twelve significant causes of EoT were identified and categorized into three main groups: Design and Consultant-Related Issues, including delays in design preparation and insufficient consultant involvement; Project Management and Execution Challenges, such as poor resource allocation and ineffective scheduling; and External and Unforeseen Conditions, including adverse weather and regulatory delays. Addressing these causes was achieved through strategic planning, efficient project management, and adaptability to external factors to minimize delays in future projects.

This study utilizing Key Informant Interviews (KII) recommends strategies to minimize Extension of Time (EoT) in construction projects in Kageshwori Manohara Municipality. Suggestions include holding regular meetings to promptly resolve design issues using real-time online tools, providing continuous training for engineers, and conducting design reviews with experienced supervisors to address complications early. Empowering site supervisors with greater authority and streamlined escalation processes is advised, alongside strict progress monitoring through deadlines, penalties, and backup consultant support. The study relies on data from the municipality for the fiscal year 079/080, with limitations in data quality and completeness affecting the accuracy of the analysis. Major constraints include incomplete project records on time extensions and external factors such as policy changes or unforeseen events influencing project timelines. Despite efforts to account for these variables, fully capturing their impact remains challenging. While this study emphasizes actionable strategies, it does not delve into the development of standardized mathematical indices to systematically identify and analyze the root causes of EoT. As a future recommendation, researchers and practitioners are encouraged to explore methods for standardizing these indices, which could provide a robust framework for quantifying and addressing the fundamental reasons for project delays.

REFERENCES

1. Aryal, B., and Dhakal, B. (2022). Analysis of Extension of Time Impact on Project" s Performance: A Case Study of Projects in Hupsekot Rural Municipality. *South Asian Res. J. Eng.Tech.*, 4(5), 86-99.
2. Fawzy, S. A., El-Adaway, I. H., Perreau-Saussine, L., Abdel Wahab, M. S., and Hamed, T. H. (2018). Claims for extension of time and additional payment under common law FIDIC: Civil law analysis. *Journal of Legal Affairs and Dispute Resolution in Engineering and Construction*, 10(4), 06518002.
3. Mehmedinović, S. (2017). Fundamentals of application factor analysis in education and rehabilitation. *Journal for Interdisciplinary Studies HUMAN*, 7(1), 61-65.
4. Mishra, A. K., Bhandari, S., & Jha, T. (2018). Factors affecting performance and time extension of ongoing construction projects under town development fund,

Nepal. *J. Adv. Res. Const. Urban Arch.*, 3(4), 7-25.

5. Prajapati, A. (2022). *Assessment of Project Delay in Selected Building Construction in Bhaktpur District*, Pokhara University.
6. Sanni-Anibire, M. O., Mohamad Zin, R., & Olatunji, S. O. (2022). Causes of delay in the global construction industry: a meta analytical review. *International Journal of Construction Management*, 22(8), 1395-1407.
7. Yusuwan, N. M., Adnan, H., Rashid, Z. Z. A., Ismail, W. N. W., & Mahat, N. A. A. (2021). Towards a successful extension of time (eot) claim: a consensus view of construction professionals via a modified delphi method. *Engineering Journal*, 25(1), 263-274.