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NARAYANGHAT-BUTWAL ROAD: DELAYS, STAKEHOLDERS PERCEPTION, AND COMPLETION STAGE RISKS

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ABSTRACT

This study examines the Narayanghat-Butwal Road: Delays, Stakeholders Perceptions, and Completion Stage Risks. The main causes of delay include poor communication with other stake holder (Forest, Electricity, Nepal Telecom, Irrigation, Ministry of Land Management). Delays in project commencement so that slow administrative mobilization and late site handover further delayed the project start. Due to impact of Covid-19 significantly impacted labour availability, supply chains, and operations. No planning before project starts and unrealistic project schedule bided by the contractor team during bidding also contributed to project delays.Correlation and regression analyses reveal that contractors and consultants strongly influence each other's perspectives, reflecting close collaboration in fieldwork. In contrast, clients' perceptions remain more independent, focusing primarily on financial and administrative concerns rather than direct project involvement. This gap affects the overall project coordination and delay management. At the project's completion stage, key risks were identified including Project budget increase due to price variation, too much pressure to complete the work by contractor, decline in revenue of the country, overall cost increase in the project and loss of confidence of contractor. Hierarchical cluster analysis grouped these risks into three main clusters, escalation and technical delays risks, planning and resource management risk & contractual, legal and economic uncertainty risks.

Keywords: *Narayanghat-Butwal Road, Cause of delays, correlation, Stakeholders perceptions, Risk in completion stage*

1. Introduction

Construction delays remain a persistent and critical challenge in infrastructure development, particularly in road projects. Defined as actions that increase the time required to complete contracted work, delays can significantly affect timelines, budgets, and quality outcomes. Research confirms that delays often due to weak coordination, poor planning, and external disruptions

can increase project costs and reduce quality, especially in developing countries (Zhang, 2021). Despite progress in project management and technology, construction delays are still widespread. Key contributors include stakeholder misalignment, resource limitations, poor site conditions, and complex contractual arrangements, which often lead to disputes and further slowdowns (Smith, 2023). A review of international studies highlights the importance of developing effective delay mitigation strategies, especially for stakeholders such as government agencies and contractors.

Many projects also suffer from insufficient formal analysis of delay causes and impacts (Duran, 2006). Even with contingency measures, accurate forecasting remains difficult, and poor delay management continues to affect infrastructure outcomes (Liu, 2022). Delay causes can be both internal and external. Internally, issues like frequent change orders, poor contractor supervision, labor shortages, and financial constraints are common. Externally, factors such as bad weather, material shortages, and transport disruptions play a major role (Al-Hazim, 2017). In developing contexts, delays are often normalized, but they result in substantial losses for both owners and contractors (Sweis, 2008).

In Nepal, infrastructure development is growing rapidly, attracting global expertise. However, many projects, despite having an expanding workforce, still face delays due to persistent management and logistical hurdles (Koirala, 2012). These delays can negatively impact the broader economy, making their resolution vital for sustainable development (Megha, 2013).

This study investigates delay factors in the Narayanghat-Butwal Road Project a vital 115 km section of Nepal's East-West Highway. The project, which includes road widening, drainage upgrades, and pavement improvements, is expected to enhance connectivity, reduce travel time, and boost economic activity by linking key municipalities and improving access to the Indian border and Gautam Buddha International Airport (Department of road, 2016). Its broader impacts include poverty reduction, improved market access, and support for rural development through reliable, all-weather transportation.

Research Objectives

This research focuses on understanding delays in the Narayanghat-Butwal Road Project through three main objectives:

1. To identify the causes of delays in construction of Narayanghat-Butwal road project.
2. To assess the correlation between the client, consultant and contractor perception regarding and develop regression model for the causes of delays in construction of Narayanghat-Butwal road Project.
3. To assess the construction risks in the completion stage due to the delay in the construction of Narayanghat-Butwal road project.

Literature Review

This chapter reviews empirical studies on construction delays in the Narayanghat-Butwal Road Improvement Project, synthesizing key findings and methodologies related to project-specific delay factors and stakeholder risk perceptions. Recent research highlights persistent coordination issues among clients, contractors, and consultants in Nepalese road projects, which contribute to delays

and cost overruns (Thapa & Gurung, 2024). The importance of integrating stakeholder perspectives and Completion Stage risk evaluation to manage time-related risks is emphasized (Lamsal et al., 2022). The review also examines similarities and differences across prior studies, noting the growing use of quantitative tools such as the Relative Importance Index (RII), correlation, regression, and risk assessment models to prioritize delay factors (Durdyev & Hosseini, 2019). Empirical evidence underscores that effective stakeholder engagement and risk management during project completion are vital for addressing construction delays in infrastructure projects.

Causes of Construction project delay

Construction delays, defined as the late completion of projects beyond planned or contractual schedules, remain a global issue affecting project performance, costs, and stakeholder relationships. Multiple studies have identified key causes, including poor coordination, resource shortages, ineffective communication, and evolving project complexities (Thapa & Gurung, 2024). Delays often lead to disputes, legal conflicts, and loss of trust among parties, with subcontractor inefficiencies, financing issues, and external disruptions like environmental or supply chain shocks further exacerbating the problem (Shrestha & Acharya, 2021). Despite technological progress, modern construction projects continue to face delays due to rising commercial pressures and risk mismanagement, underscoring the need for improved planning, stakeholder collaboration, and risk mitigation strategies (Sambasivan & Soon, 2007).

Construction delays result from a wide range of internal and external factors, including management inefficiencies, technological challenges, financial issues, and environmental conditions. Time overruns are commonly classified as delays beyond anyone's control, owner-related delays, or contractor-related delays (Jomah, 2008). Recent research underscores the growing complexity of stakeholder interactions and external influences like regulatory shifts, supply chain disruptions, and market fluctuations that significantly affect project timelines (Khanal et al., 2023). Internal delays often originate from owners, contractors, or consultants, while external delays stem from government regulations, material suppliers, or climate-related challenges (Theodore, 2009). Effective communication, proactive risk management, and integrated collaboration among stakeholders are essential strategies for mitigating delays in modern infrastructure projects (Thapa & Gurung, 2024).

Construction project delays arise from various sources, primarily categorized into client, contractor, consultant, and external responsibilities. Client-related delays often stem from late site handovers, poor communication, frequent design changes, and financial mismanagement, including delayed payments and inadequate planning (Shrestha et al., 2021). Contractors contribute to delays through poor resource allocation, low labor productivity, unrealistic scheduling, and inadequate technical capacity (Mahamid, 2020). Consultants, responsible for design, supervision, and certification, also cause delays through late approvals, design errors, and weak site oversight (Assaf & Al-Hejji, 2006). External factors beyond project parties' control such as unfavorable weather, political instability, permit delays, inflation, and supply chain disruptions, significantly impact project timelines, especially in regions facing environmental and economic volatility (Amoah & Pretorius, 2020). These interconnected causes emphasize the need for effective stakeholder coordination, risk mitigation, and proactive planning to minimize delays in construction projects.

Construction Risk

Construction risks encompass a broad range of internal and external factors that hinder the timely, cost effective, and quality completion of projects. These risks include supply chain disruptions, labor shortages, regulatory changes, political instability, inflation, poor planning, contract disputes, scope changes, and unpredictable weather, all of which have been exacerbated by global challenges like the COVID-19 pandemic and climate change (Kumar & Singh, 2023). Risks can be classified as external (economic or political shifts), internal (technological or organizational issues), or legal (contractual disputes), with their impacts felt across all project stages, especially during completion when final payments, defect rectification, and legal claims often cause delays and cost overruns (Martinez & Torres, 2021). Recent studies stress that proactive risk identification, strong contract management, adaptive planning, clear communication, and stakeholder collaboration are critical to navigating both traditional and emerging risks, especially in developing contexts where external pressures and macroeconomic instability further complicate project execution (Goh & Abdul-Rahman, 2020).

Hierarchical Cluster Analysis in Construction Risk Management

Hierarchical Cluster Analysis (HCA) is increasingly used in construction risk management to categorize and prioritize risks by grouping similar factors, simplifying complex datasets, and enhancing mitigation strategies. Studies show HCA's value in identifying clusters related to technical, financial, environmental, and regulatory risks, especially in large-scale or sustainable projects (Chen & Zhao, 2023). Tools like Ward's method and dendrograms help visualize interrelated risks, improving stakeholder communication and decision-making (Nguyen et al., 2021). Integrations with RII, machine learning, and deep learning have further refined HCA's accuracy and real-time capabilities (Zhao & Kumar, 2024). Recent research emphasizes HCA's effectiveness in multi-stakeholder environments by aligning risk perceptions and enabling inclusive, adaptive management frameworks, making it a valuable tool for today's complex construction projects.

Delays in construction projects stem from a complex interplay of client, contractor, consultant, and external factors. Client-side issues like delayed payments, poor planning, and frequent scope changes significantly hinder progress (Mahmood et al., 2021), while contractor-related problems such as inadequate scheduling, poor site management, and resource shortages are worsened by labor and supply chain disruptions (Zhang et al., 2022). External factors like political interference, climate change, and global crises particularly COVID-19 continue to affect timelines (Chen & Zhao, 2023).. Completion Stage risks, including cost overruns, legal disputes, and inflation, require adaptive legal and financial strategies (Martinez & Lopez, 2021). These insights, particularly from the Narayanghat-Butwal Road Project, underscore the importance of a holistic assessment of delay causes across all stakeholders and project phases.

2. Materials and methods

Research Design

A research design functioned as a comprehensive plan that outlined the overall structure for conducting the study, detailing how data were to be collected, measured, and analyzed to address the research objectives. It served as the logical framework linking the research questions to the data collection and analysis strategies, ensuring methodological coherence and validity (Kinnear

& Taylor, 1987). In this study, the research design provided a systematic approach to investigating the causes of delays in the Narayanghat-Butwal Road Construction Project. It specified the type of information required, identified relevant data sources, and established the methods for gathering and analyzing that data. As Creswell (2014) described, a research design operated as "the blueprint that was actually followed to successfully complete the study," guiding the researcher from problem identification through to conclusion. The design adopted for this research was informed by established methodological frameworks, particularly the Research Onion model (Saunders, Lewis, & Thornhill, 2019). This ensured alignment between the study's philosophical stance, approach to theory development, methodological choice, research strategy, time horizon, and data collection methods. Specifically: (1) Philosophical foundation: Pragmatism, which enabled the integration of quantitative measurements with qualitative insights drawn from literature. (2) Approach to theory development: Deductive, which tested established theories and delay factors through empirical data. (3) Methodological choice: Predominantly quantitative, supported by contextual qualitative analysis. (4) Research strategy: Case study, focusing on the Narayanghat-Butwal Road Project to provide in-depth, context-specific insights. (5) Time horizon: Cross-sectional, with data collected at a single point in time to capture stakeholder perceptions. (6) Data collection and analysis: Structured questionnaire surveys supported by literature review, with statistical analysis performed using the Relative Importance Index (RII) method.

Study Area

The Narayanghat-Butwal Road was a key section of Nepal's East-West Highway, spanning about 115 km through Chitwan, Nawalparasi, and Rupandehi districts in the Narayani and Lumbini Zones

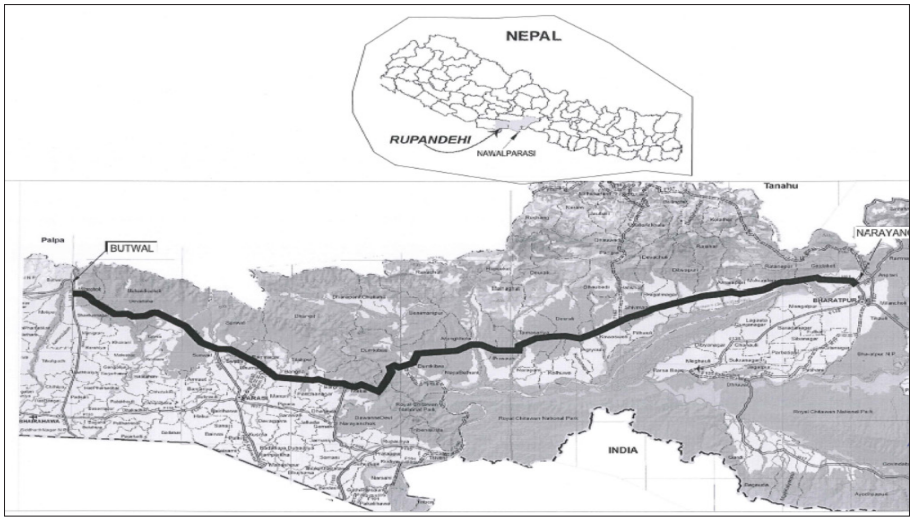

Figure 1. Narayanghat - Butwal Road (DOR, 2018)

(Department of Roads, 2016). It started at Pulchowk in Narayanghat and ended at Chauraha in Butwal. The route passed through seven municipalities and one rural municipality, connecting major urban centers, markets, and agricultural areas (Gurung et al., 2019). It also bordered the Buffer Zone of Chitwan National Park and crossed forested areas, adding environmental importance

(Sharma & Banjade, 2017). Strategically, it supported trade, mobility, and socio-economic growth in the region (Thapa & Gurung, 2024). Figure 1 showed its alignment within Nepal's highway network (Department of Roads, 2018).

Research Methodology

For **Objective 1**, aimed to identify causes of delays in the Narayanghat-Butwal Road Construction Project using a quantitative, structured approach. A thorough literature review and expert consultations helped compile and validate 67 delay causes factors across clients, contractors, consultants, and local government authorities, including 10 factors completion stage risks. A purposive sample of 313 respondents from these stakeholder groups completed a structured questionnaire using a 5-point Likert scale. Data were analyzed using the Relative Importance Index (RII) to rank delay causes factors by severity, with higher RII values indicating greater significance. The RII was calculated following Equation 1:

$$\mathrm{RII} = \frac{\sum \mathrm{W}}{\mathrm{A} * \mathrm{N}} (0 \leq \mathrm{RII} \leq 1) \tag{1}$$

Where:

W = weight assigned to each factor by respondents (1-5, from least to most severe)

A = highest possible weight (5 in this study)

N = total number of respondents

Objective 2 focused on analyzing the relationships among client, consultant, and contractor perceptions of delay causes in the Narayanghat-Butwal Road Construction Project. Using a quantitative approach, data were collected via a structured questionnaire with a 5-point Likert scale administered to the three stakeholder groups. Mean scores for each delay factor were calculated per group to represent average perceptions, enabling comparison and correlation analysis. Statistical techniques were applied to identify the strength and nature of relationships among stakeholder views, with the mean calculated following the standard formula (Equation 2).

$$\mathrm{X} = \frac{\sum_{\mathrm{i}=1}^{\mathrm{n}} W_i X_i}{\mathrm{n}} \tag{2}$$

Where:

X_i = mean value

WiXi = individual response

n = number of responses

Correlation Analysis

To explore the degree of alignment between stakeholder perceptions, the Pearson correlation coefficient (r) was applied. This measure quantifies the strength and direction of the linear relationship between two variables. The coefficient was calculated as

Formula Correlation coefficient Equation 3:

$$r = \frac{\sum(X_i - \bar{X})(Y_i - \bar{Y})}{\sqrt{\sum(X_i - \bar{X})^2 (Y_i - \bar{Y})^2}} \quad (3)$$

Where:

Xi and Yi = individual scores of the two variables being compared

X and Y = respective mean values

Correlation significance was tested at the 0.01 level (two-tailed) using IBM SPSS Statistics software. This approach, widely applied in construction management research (Shrestha & Adhikari, 2021), offers insights into consensus levels, which are critical for enhancing collaboration and reducing delays.

Regression Analysis

Following multiple linear regression was used to evaluate predictive relationships among stakeholder perceptions. Three regression models were developed: (1) Client perception as the dependent variable, with contractor and consultant perceptions as independent variables. (2) Contractor perception as the dependent variable, with client and consultant perceptions as independent variables. (3) Consultant perception as the dependent variable, with client and contractor perceptions as independent variables.

The regression analysis utilized the Forward Stepwise method to include only statistically significant predictors, thereby optimizing the explanatory power of the model. The multiple regression equation is presented in Equation 4:

$$Y = a + b_1X_1 + b_2X_2 + \ldots\ldots + b_mX_m \quad (4)$$

Where,

Y = dependent variables,

X1 to Xm = Independent variables,

A = constant and intercepts at Y axis,

b1 to bm = regression coefficients

Objective 3 aimed to evaluate construction risks at the completion stage of the Narayanghat-Butwal Road Project caused by delays. This involved identifying risk factors through a literature review and expert consultations with engineers, project managers, and officials involved in the project. A structured questionnaire using a 5-point Likert scale was administered to multiple stakeholders' clients, consultants, contractors, and local government representatives who rated each risk factor. The Relative Importance Index (RII) method was used to quantify and rank these risks, ensuring that the analysis reflected diverse stakeholder perspectives. Data analysis was conducted in Microsoft Excel to prioritize the most critical completion stage risks associated with delays.

Hierarchical Cluster Analysis of Completion Stage Risks

Hierarchical Cluster Analysis (HCA) was performed on standardized RII scores, which were normalized using Z-score to ensure comparability presented Equation 5.

$$Z = \frac{(X - \mu)}{\sigma} \tag{5}$$

Where:

X = original RII value

μ = mean RII for each factor across stakeholders

σ= standard deviation of RII scores

This normalization ensured that all risk factors contributed equally to the clustering process. Agglomerative hierarchical clustering was then applied using Ward's linkage method with Squared Euclidean Distance as the similarity measure as following Equation 6:

$$D^2(X, Y) = \sum (X_i - Y_i)^2 \tag{6}$$

Where,

Xi and Yi are the RII scores of two risk factors for the ith stakeholder group.

The study employed a specific linkage method and distance metric to effectively group related construction risk factors. A dendrogram was used to visualize the clustering process, and based on the analysis of agglomeration coefficients, a three-cluster solution was selected. These clusters represented: (1) Escalation and Technical Delay Risks, (2) Planning and Resource Management Risks, and (3) Contractual, Legal, and Economic Uncertainty Risks. This combined quantitative and qualitative approach provided a comprehensive framework for categorizing and understanding Completion Stage vulnerabilities in delayed road construction projects.

Sampling Technique and sample size

A purposive sampling technique was employed to select participants from four primary stakeholder groups directly engaged in the Narayanghat-Butwal Road Project. Given the technical and specialized nature of the construction activities, only individuals with direct involvement, relevant expertise, and supervisory or decision-making responsibilities were included. The stakeholder groups comprised: (1) Clients: Project managers, senior division engineers, engineers, and sub-engineers from Narayanghat-Butwal Road pakage 1 (NB1), Narayanghat-Butwal Road package 2 (NB2), Bharatpur Road Division, and Butwal Road Division. (2) Consultants: Team leaders, deputy team leaders, resident engineers, assistant resident engineers, engineers, and specialized experts in bridge engineering, materials, environment, social resettlement, and safety from NB1 and NB2 Roads. (3) Contractors: Team leaders, site engineers, office engineers, civil engineers, quality control engineers, supervisors, technicians, and design team members from NB1 and NB2 Roads. (4) Local Government Authorities: Mayors, engineers, sub-engineers, and assistant sub-engineers from nine municipalities along the project corridor.

The final sample comprised 313 respondents, distributed as follows: 77 Clients, 74 Consultants, 83 Contractors, and 79 Local Government Authorities. This approach captured a complete range of perspectives from stakeholders directly involved in project planning, execution, supervision, and governance, thereby enhancing the accuracy, reliability, and validity of the study findings.

Data Collection

Data collection combined primary sources structured questionnaires, field observations, and interviews with stakeholders directly involved in the Narayanghat-Butwal Road Project and secondary sources such as academic literature and reports. This mixed approach ensured comprehensive and valid insights by capturing detailed stakeholder perspectives alongside contextual background information.

Analysis of Data

The study primarily used quantitative data from questionnaires and observations, analyzed with SPSS and the Relative Importance Index (RII) to rank construction delay factors and risks. Qualitative insights from literature and experts complemented the quantitative analysis. Results were presented using descriptive statistics and visual tools like tables and graphs for clear interpretation and comparison.

Validity

A content validity technique was employed to make sure the questionnaire accurately recorded the reasons behind the delays in the Narayanghat-Butwal Road Project. Expert judgment, a review of the literature, and discussions with important parties such as the thesis supervisor, Department of Roads experts, and clients, consultants, and contractors were all part of this process. Their input improved the questionnaire to include context-specific and useful elements pertinent to major road projects in Nepal. By carefully addressing every pertinent aspect of the project's construction delays, the finished tool showed strong content validity.

Reliability Test

Cronbach's Alpha was used to assess the reliability of the 77-item questionnaire covering construction delays, stakeholder perceptions, and Completion Stage risks. Of the 313 responses received. The reliability test produced a high Cronbach's Alpha value of 0.933, indicating excellent internal consistency. This confirms that the questionnaire is a reliable and statistically robust instrument for further analysis and drawing valid conclusions about delay factors in the Narayanghat-Butwal Road Project.

3. Result and Conclusions

This chapter analyzes questionnaire data from clients, contractors, consultants, and local authorities to identify key delay causes in the Narayanghat-Butwal Road project. Using the Relative Importance Index (RII) and a five-point Likert scale, delay factors were categorized and ranked by severity. The findings highlight major causes of delays across stakeholder groups, informing targeted recommendations to minimize future delays.

Clients' Perspective

Table 1 presents the top five causes of delay as perceived by clients. The financial problem of contractor emerged as the most significant factor (RII = 0.714), corroborating findings from previous South Asian studies where contractor cash flow constraints critically hinder project progress (Sambasivan & Soon, 2007). Delays in project commencement (RII = 0.699) were attributed to bureaucratic inefficiencies and late approvals, echoing similar issues identified by (Aibinu and Jagboro, 2002). Labor issues, specifically low wages and high working hours of labors, and Poor communication with other stake holder (Forest, Electricity, Nepal Telecom, Irrigation, Ministry of Land Management) (both RII = 0.694), were also prominent. These reflect the institutional coordination challenges emphasized by Nepalese scholars (Ghimire & Manandhar, 2020). Additionally, contractors managing multiple projects simultaneously (RII = 0.691) tend to under allocate resources, leading to delays, consistent with (Faridi and El-Sayegh's, 2006) observations.

Contractors' Perspective

From the contractors' viewpoint Table 1, Poor communication with other stake holder (Forest, Electricity, Nepal Telecom, Irrigation, Ministry of Land Management) was the leading cause of delay (RII = 0.786). This finding aligns with the fragmented governance issues noted by (Ghimire and Manandhar, 2020) in Nepal's infrastructure projects. Due to impact of Covid-19 pandemics ranked second (RII = 0.778), reflecting disruptions in labor availability and supply chains, as reported globally (Zhao et al., 2020). Unrealistic project schedule bided by the contractor team themselves (RII = 0.757) highlight a common tendency to underestimate timelines during bidding, a problem documented by (Sweis et al., 2008). Further, Delays in initiated variation order by consultant (RII = 0.752) and Delay in approval of drawing document and requirement changes by Client (RII = 0.745) indicate governance inefficiencies affecting project agility (Assaf & Al-Hejji, 2006).

Consultants' Perspective

Table 1 consultants ranked delays in project commencement highest (RII = 0.757), attributing this to late site handovers and administrative bottlenecks, consistent with (Durdyev et al.'s, 2017) findings. Due to Impact of Covid-19 and Poor communication with other stake holder (Forest, Electricity, Nepal Telecom, Irrigation, Ministry of Land Management) were equally significant (RII = 0.751), underscoring the pandemic's disruptive effects (Zhao et al., 2020) and persistent coordination issues (Thapa et al., 2019). Consultants also emphasized No planning before project starts (RII = 0.746); a critical factor identified in early project risk management literature (Chan & Kumaraswamy, 1997). Release of budget at the end of fiscal years (RII = 0.743) further constrained procurement and cash flow, corroborating (Pokharel's, 2019) insights on Nepalese public infrastructure financing.

Local Government Authorities' Perspective

Table 1 local government authorities highlighted political and administrative instability as dominant delay factors (Table 1). Change in political power at center level topped the list (RII = 0.706), reflecting the vulnerability of projects to leadership transitions and policy shifts, as discussed by (Khadka, 2021). Delays in project commencement (RII = 0.704) and Political interference by political parties (RII = 0.704) pointed to client favoritism, approval delays, and inefficient bureaucratic processes, consistent with (Adhikari's, 2020) analysis. Multiple projects by contractors (RII = 0.681) and

Ignorance in penalizing for delay in contractor for delays (RII = 0.678) further exacerbated project inefficiencies, mirroring patterns identified by (Sambasivan and Soon, 2007).

Overall Causes of Delay

Table 1 synthesizes these perspectives into an overall ranking of delay causes. Poor communication with other stake holder (Forest, Electricity, Nepal Telecom, Irrigation, Ministry of Land Management) emerged as the most critical factor (RII = 0.725), highlighting bureaucratic red tape and fragmented approval processes, as noted by (Karki et al., 2019). Delays in project commencement (RII = 0.719) and Due to Impact of Covid-19 (RII = 0.711) follow closely, emphasizing the combined effects of procedural bottlenecks and unprecedented global disruptions. No planning before project starts (RII = 0.693) and Unrealistic project schedule bided by the contractor team (RII = 0.692) round out the top five, reinforcing the need for improved early-stage project management and realistic bidding practices (Durdyev et al., 2017).Collectively, these findings underscore the critical need for enhanced stakeholder coordination, realistic scheduling, and responsive governance mechanisms to mitigate delays and improve the timely completion of infrastructure projects in Nepal and comparable developing contexts.

Table 1. Top 5 causes of delay by stakeholder group and overall causes of delay (RII and Rank)

	Perspective by the clients		Perspective by the contractors		Overall analysis of delay causes	
S.N.	**Causes of Delays**	**RII (Rank)**	**Causes of Delays**	**RII (Rank)**	**Causes of Delays**	**RII (Rank)**
1	Financial problem of contractor	0.714 (1)	Poor communication with other stake holder (Forest, Electricity, Nepal Telecom, Irrigation, Ministry of Land Management)	0.786 (1)	Poor communication with other stake holder (Forest, Electricity, Nepal Telecom, Irrigation, Ministry of Land Management)	0.725 (1)
2	Delays in commencement	0.699 (2)	Due to Impact of Covid-19	0.778 (2)	Delays in project commencement	0.719 (2)
3	Low wages and High working hours of labors	0.694 (3)	Unrealistic project schedule bided by the contractor team	0.757 (3)	Due to Impact of Covid-19	0.711 (3)
4	Poor communication with other stake holder (Forest, Electricity, Nepal Telecom, Irrigation, Ministry of Land Management)	0.694 (3)	Delays in initiated variation order by consultant	0.752 (4)	No planning before project starts	0.693 (4)
5	Multiple projects by contractors	0.691 (4)	Delay in approval of drawing document and requirement changes by Client	0.745 (5)	Unrealistic project schedule bided by the contractor team	0.692 (5)

Perspective by the consultants'		Perspective by the local government authorizes	
Causes of Delays	RII (Rank)	Causes of Delays	RII (Rank)
Delays in project commencement	0.757 (1)	Change in political power at center level	0.706 (1)
Due to Impact of Covid-19	0.751 (2)	Delays in project commencement	0.704 (2)
Poor communication with other stake holder (Forest, Electricity, Nepal Telecom, Irrigation, Ministry of Land Management)	0.751 (2)	Political interference by political parties	0.704 (2)
No planning before project starts	0.746 (3)	Multiple projects by contractors	0.681 (3)
Release of budget at the end of fiscal years	0.743 (4)	Ignorance in penalizing for delay in contractor for delays	0.678 (4)

Correlation Analysis

Table 2 Pearson's correlation coefficients were computed to assess the degree of association between the perceptions of Clients, Contractors, and Consultants regarding the causes of delays in the Narayanghat-Butwal Road Project. The results, presented in Table 2, indicate statistically significant positive correlations among all three stakeholder groups at the 0.01 significance level.

The correlation between Clients and Contractors was moderate ($r = 0.426$, $p < 0.01$), as was the correlation between Clients and Consultants ($r = 0.455$, $p < 0.01$). This suggests a partial alignment in their perceptions of delay causes. In contrast, a strong correlation was observed between Contractors and Consultants ($r = 0.874$, $p < 0.01$), indicating a high level of agreement between these two groups. This pattern is consistent with previous findings that Contractors and Consultants, due to their more direct involvement in project execution and supervision, tend to share similar viewpoints, whereas Clients who typically focus more on administrative and oversight roles may have somewhat differing perspectives (Shrestha & Adhikari, 2021).

Table 2. Correlation between clients, contractors and consultants' perceptions on delay causes

	Client	Contractor	Consultant
Client	1	0.426**	0.455**
Contractor	0.426**	1	0.874**
Consultant	0.455**	0.874**	1

Correlation is significant at the 0.01 level (2-tailed).

Regression analysis client perception

The regression model examines how contractor and consultant perceptions of delays influence the client's perception of project delays in the Narayanghat-Butwal Road Project. From Table 3 The model was expressed as:

$$Y_{client} = 2.202 + 0.05X_1 + 0.242X_2 \quad (7)$$

Where,

Yclient is the client's perception,

X1 represents contractor perception, and

X2 represents consultant perception.

The intercept of 2.202 is statistically significant, indicating a substantial baseline perception of delay from the client independent of the other variables. While the consultant's perception shows a stronger positive influence on the client's perception (coefficient 0.242) compared to the contractor's (coefficient 0.05), neither variable's effect is statistically significant at the 5% level, as reflected by their p-values (0.130 for consultant, 0.602 for contractor). This implies that, although consultants seem to have a greater impact on client perceptions than contractors, the model does not find strong evidence that either significantly predicts the client's view of delays.

Regression analysis Contractor perception

The regression model predicting the contractor's perception of delays in the Narayanghat-Butwal Road Project was expressed as:

$$Y_{contractort} = .1.754 + 0.086X_1 + 1.419X_2 \quad (8)$$

Where,

Ycontractor represents the contractor's perception of project delays,

X1 is the client's perception, and

X2 is the consultant's perception.

The intercept of -1.754 is statistically significant, establishing a baseline contractor perception even without input from clients or consultants. The client's influence (coefficient 0.086) shows a very weak positive relationship with contractor perception but is statistically insignificant, indicating minimal impact. Conversely, the consultant's influence (coefficient 1.419) is strong and highly significant, with a large standardized beta of 0.858, demonstrating that consultants have a major and meaningful effect on contractors' perceptions of delays. Overall, this analysis highlights that consultants play a critical role in shaping contractor views about project delays, while client perceptions have little statistical influence in this model.

Regression analysis Consultant perception

The regression model predicting the consultant's perception of delays in the Narayanghat-Butwal Road Project is expressed as:

$$Y_{consultant} = 1.028 + 0.147X_1 + 0.502X_2 \quad (9)$$

where,

Yconsultant represents the consultant's perception of project delays, while X1 and X2 denote the client's and contractor's perceptions, respectively.

The analysis shows that the intercept (1.208) is statistically significant, indicating a firm baseline level of perceived delays by consultants when client and contractor inputs are zero. The client's influence, with a coefficient of 0.147 and a low standardized beta of 0.101, reveals a weak positive relationship that is not statistically significant. In contrast, the contractor's influence is much stronger, with a coefficient of 0.502 and a standardized beta of 0.831, supported by a highly significant p-value. This demonstrates that contractors' perceptions have a substantial and statistically significant impact on how consultants perceive delays, while client perceptions do not significantly affect consultants in this model. Overall, the model highlights the dominant role of contractors' perspectives in shaping consultant views on project delays.

Table 3. Combined regression results for stakeholder perceptions

Dependent Variable	Predictors	B	Std. Error	Beta	t	Sig.	R	R^2	Adj. R^2	Std. Error of Estimate
Client	Constant	2.202	0.289	–	7.628	0.000	0.459	0.211	0.186	0.203
	Contractor	0.050	0.095	0.120	0.524	0.602				
	Consultant	0.242	0.158	0.351	1.534	0.130				
Contractor	Constant	-1.754	0.474	–	-3.701	0.000	0.875	0.765	0.758	0.265
	Client	0.086	0.163	0.036	0.524	0.602				
	Consultant	1.419	0.113	0.858	12.604	0.000				
Consultant	Constant	1.208	0.271	–	4.450	0.000	0.879	0.772	0.765	0.158
	Client	0.147	0.096	0.101	1.534	0.130				
	Contractor	0.502	0.040	0.831	12.604	0.000				

Risk of completion stage

The analysis of Completion Stage risks in the Narayanghat-Butwal Road project used stakeholder ratings on a five-point Likert scale, quantified by the Relative Importance Index (RII). Risks were ranked by severity, with ties broken by frequency of high-risk ratings. This method identified the most critical risks perceived by clients, contractors, and consultants, helping prioritize mitigation efforts to ensure timely project completion.

Client Perspective

Table 4 highlights that clients perceive the project budget increase due to price variation as the most significant risk (RII = 0.719). This finding aligns with studies such as (Alzara et al., 2016), which emphasize that inflation, inadequate budgeting, and market volatility are primary drivers of cost

escalation in infrastructure projects within developing countries. The second-highest risk identified is the loss of confidence in the contractor (RII = 0.699), consistent with Assaf and Al-Hejji, 2006, who note that contractor demotivation, especially due to delayed payments or scope changes, can lead to poor performance and project abandonment. Other significant concerns include Too much Pressure to complete the work by contractor (RII = 0.688), Overall cost increase in the project (RII = 0.678), and Further delay in rectification works (RII = 0.657), echoing findings by (Doloi et al., 2012) regarding quality compromises and prolonged handover phases.

Contractor Perspective

According to Table 4, contractors also rank project budget increase due to price variation as the top risk (RII = 0.745), reinforcing the critical impact of material cost escalation noted by (Haseeb et al., 2011). The Decline in Revenue of the country (RII = 0.735) reflects concerns about delays or reductions in public funding, an issue emphasized by (Kazaz et al., 2005) in the context of macroeconomic instability. Contactor may go legally for their claim raised (RII = 0.723) and Too much Pressure to complete the work by contractor (RII = 0.723), which resonate with (Doloi et al., 2012), who discuss how strained contractual relationships and unrealistic schedules lead to inefficiencies and quality issues. The Quantity variation from Bill of Quantity (RII = 0.720) is recognized as a root cause of scope creep and cost overruns (Frimpong et al., 2003).

Consultant Perspective

Consultants, as presented in Table 4, consider the Decline in Revenue of the country (RII = 0.700) the foremost risk, underscoring the influence of macroeconomic factors on project funding, consistent with (Haseeb et al., 2011). The Too much Pressure to complete the work by contractor (RII = 0.697) ranks second, supporting (Doloi et al., 2012)'s findings on the detrimental effects of rushed schedules. The Overall cost increase in the project (RII = 0.692), Further delay in rectification works (RII = 0.684), and Chances of reconciliation on final bills (RII = 0.673) highlight common close-out phase issues, in line with (Frimpong et al., 2003).

Local government authories' Perspective

Local government authorities and external stakeholders, summarized in Table 4, identify the Overall cost increase in the project (RII = 0.673) as the highest risk, reflecting well-documented challenges of inflation and scope changes in infrastructure projects (Assaf and Al-Hejji, 2006). The tied second-ranked risks, Decline in Revenue of the country and Loss of Confidence of contractor (both RII = 0.671), emphasize the financial and relational vulnerabilities in project delivery. Too much Pressure to complete the work by contractor (RII = 0.668) and Project budget increase due to price variation (RII = 0.653) complete the top five risks, resonating with previous research on contract management and economic fluctuations (Doloi et al., 2012).

Overall Risk Ranking

An aggregated analysis (Table 4) synthesizes the perspectives of all stakeholders, revealing Project budget increase due to price variation (RII = 0.698) as the most critical risk overall. This finding

highlights the need for flexible contract provisions and vigilant financial controls to mitigate cost overruns (Flyvbjerg, 2003). Too much Pressure to complete the work by contractor (RII = 0.695) ranks second, emphasizing the negative impact of unrealistic timelines on quality and safety (Doloi et al., 2012). The Decline in Revenue of the country (RII = 0.691) underscores macroeconomic risks that affect funding reliability, while Overall cost increase in the project (RII = 0.688) and Loss of Confidence of contractor (RII = 0.684) further indicate systemic challenges in project closeout, including change management and stakeholder relations (Assaf and Al-Hejji, 2006).These findings collectively underscore the critical importance of proactive financial planning, realistic scheduling, effective communication, and stakeholder trust to ensure successful and timely project completion in Nepalese infrastructure projects and similar developing contexts.

Table 4. Top 5 Risk of completion stage by stakeholder group and overall Risk of completion stage (RII and Rank)

S.N.	Perspective by the clients		Perspective by the contractors		Perspective by the consultants'	
	Risk of completion stage	RII (Rank)	Risk of completion stage	RII (Rank)	Risk of completion stage	RII (Rank)
1	Project budget increase due to price variation	0.719 (1)	Project budget increase due to price variation	0.745 (1)	Decline in Revenue of the country	0.700 (1)
2	Loss of Confidence of contractor	0.699 (2)	Decline in Revenue of the country	0.735 (2)	Too much Pressure to complete the work by contractor	0.697 (2)
3	Too much Pressure to complete the work by contractor	0.688 (3)	Contactor may go legally for their claim raised	0.723 (3)	Overall cost increase in the project	0.692 (3)
4	Overall cost increase in the project	0.678 (4)	Too much Pressure to complete the work by contractor	0.723 (3)	Further delay in rectification works	0.684 (4)
5	Further delay in rectification works	0.657 (5)	Quantity variation from Bill of Quantity	0.720 (4)	Chances of reconciliation on final bills	0.673 (5)

Perspective by the local government authorizes		Overall risks during the completion stage	
Risk of completion stage	RII (Rank)	Risk of completion stage	RII (Rank)
Overall cost increase in the project	0.673 (1)	Project budget increase due to price variation	0.698 (1)
Decline in Revenue of the country	0.671 (2)	Too much Pressure to complete the work by contractor	0.695 (2)
Loss of Confidence of contractor	0.671 (2)	Decline in Revenue of the country	0.691 (3)
Too much Pressure to complete the work by contractor	0.668 (3)	Overall cost increase in the project	0.688 (4)
Project budget increase due to price variation	0.653 (4)	Loss of Confidence of contractor	0.684 (5)

Hierarchical Cluster Analysis of Completion Stage Risks

To analyze the construction risks at the completion stage of the Narayanghat-Butwal Road Project, a Hierarchical Cluster Analysis (HCA) was conducted using standardized Relative Importance Index (RII) scores from clients, contractors, consultants, and local government authorities. Figure 2 Employing Ward's linkage method and the Squared Euclidean Distance metric, the analysis identified three distinct clusters of risk factors. The first cluster, labeled Escalation and Technical Delay Risks, includes Further delay in rectification works and Project budget increase due to price variation, highlighting challenges related to unfinished work and inflation-driven cost escalations during project closeout. The second cluster, Planning and Resource Management Risk, uniquely comprises more planning from existing facilities, indicating a critical project-specific deficiency in integrating new and existing infrastructure. The third and largest cluster, Contractual, Legal, and Economic Uncertainty Risks, groups risks such as chances of reconciliation on final bills, Contractor may go legally for their claim raised, too much pressure to complete the work by contractor, Overall cost increase in the project, Decline in revenue of the country, and Loss of confidence of contractor. This cluster reflects the compounded effects of contractual disputes, scope variations, and macroeconomic instability on project completion. The distinct grouping of these risks underscores the multifaceted nature of Completion Stage challenges and suggests that effective mitigation requires integrated approaches addressing technical, managerial, contractual, and economic dimensions. These findings provide a valuable framework for prioritizing risk management efforts in large infrastructure projects within developing country contexts.

4. Conclusion

The study identified key causes of delay in the Narayanghat-Butwal Road Project, with Poor communication with other stake holder (Forest, Electricity, Nepal Telecom, Irrigation, Ministry of Land Management) being the foremost issue. Delays in project commencement due to administrative inefficiencies and Due to Impact of Covid-19 also significantly impacted progress. No planning before project starts and Unrealistic project schedule bided by the contractor team.

The second objective analyzed the interrelationships among stakeholder perceptions. The correlation and regression analyses indicate strong alignment between Contractors and Consultants on delay causes in the Narayanghat-Butwal Road Project, while Clients show only moderate agreement with Contractors and Consultants. Contractor and Consultant perceptions significantly influence each other, but Client perceptions remain largely independent. This highlights the close working relationship between Contractors and Consultants in managing project delays, contrasted with Clients' more detached administrative role. These insights emphasize the need for improved communication and coordination among all stakeholders to better address project delays.

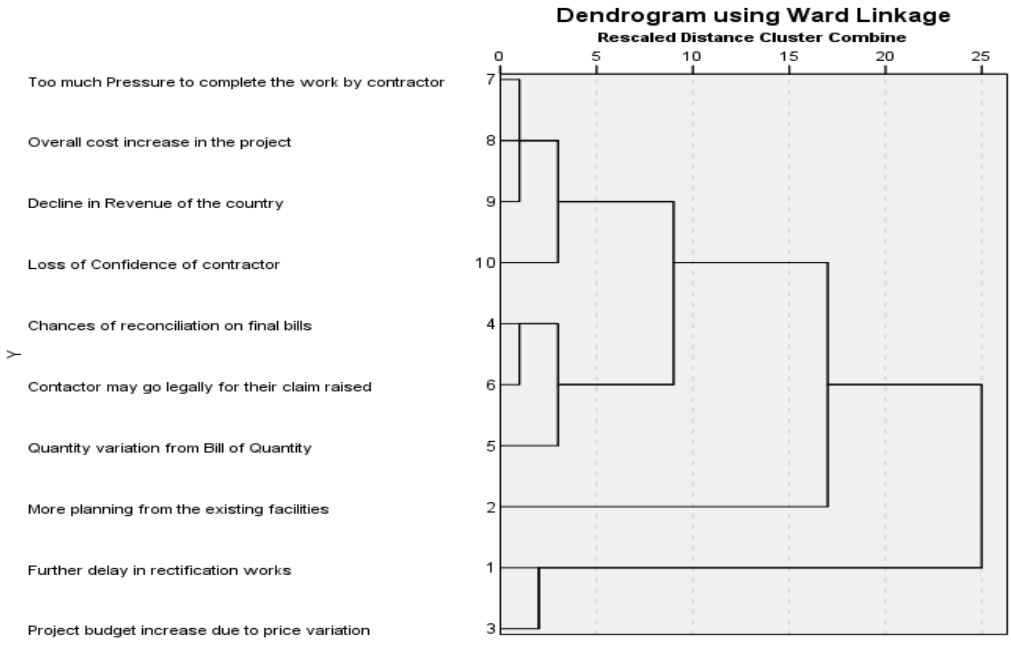

Figure 2. Dendrogram produced using Ward's linkage method (SPSS generated)

The study identifies key completion stage risks in the Narayanghat-Butwal Road Project shared by all stakeholders, primarily financial and managerial challenges. The top risks include Project budget increase due to price variation, too much Pressure to complete the work by contractor, Decline in Revenue of the country, Overall cost increase in the project, and Loss of Confidence of contractor. Hierarchical cluster analysis groups these risks into cost escalation and technical delays, planning deficiencies, and contractual and economic uncertainties. The findings highlight the need for better contract provisions, realistic scheduling, integrated planning, and strong financial management to ensure timely and successful project completion.

5. Conflict of interest

The author affirms that there are no financial, personal, or professional conflicts of interest that could have influenced the research findings, interpretations, or conclusions presented in this study. All procedures and analyses were conducted objectively and independently, without any external pressure or bias from individuals or institutions associated with the Narayanghat-Butwal Road Project. The study was carried out solely for academic and research purposes.

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