Edelweiss Applied Science and Technology
ISSN: 2576-8484
Vol. 9, No. 10, 662-676
2025
Publisher: Learning Gate
DOI: 10.55214/2576-8484.v9i10.10485

Exploring the managerial challenges in infrastructure projects: A statistical analysis

Basu Dev Lamichhane[1], Om Prakash Giri[2*], Suman Khadka[3], Arkar Htet[4]
[1]Tribhuvan University, Saraswati Multiple Campus, Kathmandu, Nepal; basudev.lamichhane@smc.tu.edu.np (B.D.L.).
[2,3]School of Engineering, Pokhara University, Pokhara-30, Nepal; omgpkr5@gmail.com (O.P.G.) smkhadka.2035@gmail.com (S.K.).
[4]Lincoln University College, Petaling Jaya, Malaysia; arkarhm@googlemail.com (A.H.).

Abstract: The main objective of this study is to examine the managerial challenges of road construction projects in Nepal. Improved road infrastructure is key to socio-economic progress. Identifying challenges hindering efficient road infrastructure development in rapidly growing countries like Nepal is essential for implementing improvement measures and promoting sustainable economic development. The study employs a mixed-methods approach, integrating qualitative interviews, quantitative analysis, and on-site observations. Surveys with contractors, clients, and consulting engineers, along with interviews with project managers, utilize a Likert five-point scale questionnaire, analyzed via the Relative Importance Index (RII), to comprehensively assess road construction challenges. The findings identify challenges, with stakeholders unanimously ranking poor project management, improper use of advance payments by contractor entrepreneurs, and financial constraints as the top three critical factors. The study outlines eleven effects of these challenges on road projects, emphasizing time overruns, scope changes, and cost escalations. Addressing these challenges and adopting proposed measures can enhance project outcomes, optimize resource allocation, and expedite construction timelines. Policymakers, practitioners, regulators, managers, and stakeholders are urged to implement these recommendations to mitigate obstacles and strengthen the effectiveness of road-building efforts in Nepal, fostering sustainable economic development and national resilience.

Keywords: *Efficiency, Project management, Road infrastructure, Sustainable economic development.*

1. Introduction

Many countries prioritize infrastructure development as a key component of their economic development strategy, especially those in the process of economic growth [1]. Construction activities worldwide are intensifying, with both developed and developing nations prioritizing large-scale infrastructure projects to foster economic growth and development [2]. Construction significantly impacts the environment through its direct energy use and the embodied energy in its materials [3].

Road infrastructure is vital for Nepal's economic and social advancement due to its challenging geography. Construction projects require substantial manpower, machinery, materials, and financial resources. Roads are critical for facilitating access to healthcare, education, markets, and other essential services, which are crucial for overall development in the country [4]. Despite rugged landscapes, steep slopes, deep valleys, and landslides, road networks in Nepal are crucial for connecting remote areas, supporting trade, and fostering socio-economic development. Monitoring activities and staff sanctions significantly enhance public road construction project implementation. Compliance with the procurement regulatory framework, familiarity with it, professionalism among staff, and perceived inefficiencies of the framework are deemed insignificant [5].

History: Received: 18 August 2025; Revised: 18 September 2025; Accepted: 22 September 2025; Published: 10 October 2025
* Correspondence: omgpkr5@gmail.com

Major limitations, including inadequate financial resources, technical capacity, environmental concerns, and political instability, have hindered Nepal's road infrastructure. The scarcity of resources, coupled with complex terrain, has made large-scale projects difficult to undertake and sustain. However, recognizing the importance of road infrastructure, the government has initiated projects like the National Road Network Improvement Project (NRNIP) to enhance connectivity. Throughout the entire life cycle of development, construction activities face different kinds of challenges. These challenges occur from initial work on-site through the construction period, operational period, and the final demolition phase when any structure comes to the end of its life. Although the construction phase is shorter than the other life phases, it nonetheless has a variety of challenges. The construction industry everywhere faces problems and challenges. These difficulties and challenges are present alongside a general situation of socio-economic stress, chronic resource shortages, institutional weaknesses, and inability to deal with key issues in developing countries [6]. Landslides, floods, erosion, and sediment pose significant hazards. However, it is apparent that this expertise is not always being used, and road construction has taken place without reference to the established manuals and guidelines [7].

During the construction phases of different projects, various types of challenges might be encountered, such as time overruns, cost overruns, natural drainage alterations, right-of-way issues, landslides, etc. To address these challenges, embracing technological advancements, fostering public-private partnerships, and engaging local communities are essential [8]. Conventional techniques in Nepal often neglect environmental and community aspects, making road construction costly and unsustainable. Strengthening governance, improving transparency, and investing in capacity-building are essential. External environmental factors and project management directly impact success throughout the Ghanaian public road construction project's pre-construction phases. Procurement-related factors specifically influence success during the works procurement phase [9]. Land acquisition, tender cancellations, weak contractor mobilization, equipment installation, funding constraints, law and order issues, delayed equipment supply, scope changes, forest clearance, slow construction progress, and cost escalation were major sources of delays and cost overruns in Ethiopia [10]. The primary causes of time overruns in public projects in Pakistan include legal issues (e.g., court stay orders and land acquisition), technical errors (such as low-quality drawings and bidding stage errors), and inadequate project management [11]. Major outcomes of road construction schedule overruns in Tripoli, Libya, include cost overruns, time extensions, disputes, loss of profit, contract breaches, poor work quality, and damaged company reputation [12].

Most construction projects' time and cost performance suffer due to a lack of quality control, project preparation, user management, and project management [13]. Similarly, Arantes and Ferreira [14] concluded that construction projects are hindered by improper planning, poor consultant performance, inefficient site management, owner influence, bureaucracy, and sub-standard contracts [14]. Bureaucracy in public administration, causing delays, is worsened by frequent political interference and corruption during this stage [15]. Road construction is a crucial component of infrastructure development, facilitating transportation, trade, and economic growth. In the aftermath of natural disasters or in areas requiring extensive reconstruction, road construction projects are often implemented under specialized entities like the National Reconstruction Authority (NRA).

Nepal's diverse climatic conditions, including heavy rainfall, snowfall, and extreme temperatures, pose significant challenges to road construction by causing damage and complicating projects. Seasonal variations like monsoons can lead to landslides and erosion, impacting infrastructure further. Projects must also address social factors such as land ownership, community resettlement, and stakeholder consultation. Adherence to environmental regulations is essential to protect fragile ecosystems, wildlife habitats, and water sources. This research aims to identify key obstacles and difficulties in road construction projects under the DLPIU of Gandaki Province and to understand their implications for project outcomes. By examining these challenges, their causes, and their impacts, the study seeks to provide insights and recommendations for improving road construction practices and achieving better project outcomes.

Edelweiss Applied Science and Technology
ISSN: 2576-8484
Vol. 9, No. 10: 662-676, 2025
DOI: 10.55214/2576-8484.v9i10.10485

Transport is pivotal as the "engine of growth and development" in economies, catering to the economic, social, political, cultural, and technological needs of individuals and society at large [16]. Cost overruns in construction projects are influenced by design problems, inaccurate estimation, poor planning, weather, poor communication, stakeholder competence, financial issues, price fluctuations, contract management, and ground/soil conditions [14]. Timely completion is a major success measure for construction projects. To overcome delays, projects are often extended or expedited, resulting in inevitable added costs. Ensuring efficient management and planning is essential to minimize these delays and associated expenses. Lack of control over subcontractors reflects a contractor's poor management skills or an ineffective contractual framework, potentially causing conflicts, low productivity, and negative attitudes on site [17].

A construction project delay is a time overrun beyond the agreed delivery date or the completion date specified in the contract [18]. To succeed, a project must be completed on time and meet cost and quality requirements. Thus, timely completion is a key parameter for measuring project success. However, delays vary based on circumstances such as environmental and geographical context, cultural differences, construction methods, management systems, involved entities, public policies, economic environment, resource access, and the political climate of the study's country [19].

In Afghanistan, contractor-related factors are the primary cause of delays in construction projects. Political instability, war, and insecurity are identified as the most significant external factors contributing to these delays [20]. The significant challenges in Oman's construction projects include poor contract management, a lack of experienced workers, delayed drawing approvals, scope changes, and poor project planning [21].

Key factors contributing to cost overruns in construction include poor equipment maintenance, material shortages, financing issues between owners and contractors, labor shortages, inflation in material prices, changes initiated by owners, high transportation costs, equipment breakdowns, and construction errors leading to rework [22]. Cost overruns in road construction projects are primarily caused by delays in payment, design changes during construction, quantity changes due to site conditions, delayed design approvals, utility relocation delays, and poor inter-agency communication [23]. To mitigate delays caused by approval issues and late decisions, as well as to address slow labor mobilization, implementing a detailed work breakdown structure is essential. Assigning responsibilities ensures that all project tasks are well-defined and managed effectively [24].

To achieve optimal efficiency and effectiveness in construction project management, it is crucial to plan and schedule the procurement of tools, materials, and labor with precision in purchasing, transportation, and delivery. This includes selecting efficient transportation routes and methods to access project sites, aligning with time and cost objectives, and ensuring onsite supervisory consultants are prepared to oversee contractor methods effectively [25]. Addressing the scarcity of project management training, improving coordination during project planning, and addressing the shortage of skilled construction workers are crucial steps to reducing delays and fostering sustainable economic development [26]. Handling unexpected situations in construction projects requires contractors to employ proactive risk management strategies, foster organizational resilience, and cultivate collaborative relationships. These approaches enhance readiness to anticipate, plan for, and manage potential interruptions for successful project delivery [27].

The construction industry in Nepal, for instance, is a crucial driver of national development, contributing approximately 5.7% to the country's Gross Domestic Product (GDP). Foreign Direct Investment (FDI) plays a significant role in this sector, particularly in major infrastructure projects such as hydropower, roads, bridges, and airports [28]. Construction activities involve translating designs into reality within a specified timeframe and require coordination of various resources [29]. Project management plays a vital role in leading and managing labor, resources, and equipment to achieve project goals [30]. Several challenges affect the construction projects are:

Edelweiss Applied Science and Technology
ISSN: 2576-8484
Vol. 9, No. 10: 662-676, 2025
DOI: 10.55214/2576-8484.v9i10.10485

Land Acquisition, Resettlement, and Compensation: Acquiring land for road construction projects, especially when owned by private entities, can be a lengthy and complex process. Adhering to legal compensation requirements for structures, plots, and public and private properties is essential [31].

Delay in Clearance of Right of Way (ROW): Underestimating the consequences of ROW issues at the project outset often leads to delays in clearance. ROW clearance, usually done during the contractor's mobilization period, sees minimal progress by the time resources are mobilized, causing project delays [32].

Traffic problems during construction: Construction activities can create traffic management challenges, resulting in traffic jams and inconvenience to commuters. Increased traffic load on existing roads can damage infrastructure and utilities, affecting transportation and soil conditions [33].

Stakeholder Management Issues: Effective stakeholder management is crucial for project success. Poor management can lead to conflicts, controversies, cost overruns, and delays. Coordination and addressing stakeholders' needs are vital [34].

Schedule Constraints: Inadequate project scheduling can lead to significant cost increases or delays [35]. Proper planning, resource allocation, and anticipation of productivity factors are essential for successful project execution [36].

Environmental Challenges: Road construction activities can have adverse environmental impacts, particularly during the rainy season. Unsuitable ground conditions can delay construction, leading to extended timelines and transportation inconveniences [37].

Poor Project Management: Effective project management is critical for project success. Issues such as inexperienced project managers, weak site management, and a lack of skilled resources can lead to inefficiencies and hinder progress [38].

Variation Orders: Changes during construction often necessitate variation orders to modify the scope of work. Critical variations can cause delays, increased costs, and additional resource demands. Proactive change management strategies are essential [39].

Scarcity of Financial & Material Resources: Insufficient financial and material resources pose significant challenges for road construction projects. Delays in material procurement can disrupt schedules and incur penalties. Effective monitoring and resource evaluation are necessary for managing scarcity [40]. Past studies have explored various aspects of road construction projects in Nepal, including the evaluation of local road works, labor-based participatory approaches, land acquisition problems, delays, and stakeholder perceptions. However, there is a need for further research, particularly focusing on the challenges of road construction projects in rural areas of Gandaki Province, Nepal, as existing literature is limited in this context. Such research can provide valuable insights for addressing the unique challenges faced in rural road construction projects and contribute to the overall development of the region.

2. Materials and Methods

Descriptive analysis was used to present respondents' background details, mean and standard deviation, and rank data by group and overall using the Relative Importance Index (RII). The questionnaire was designed in a clear and simple format, enabling participants to understand and respond autonomously and effectively. The research flow chart is shown in Figure 1.

Edelweiss Applied Science and Technology
ISSN: 2576-8484
Vol. 9, No. 10: 662-676, 2025
DOI: 10.55214/2576-8484.v9i10.10485

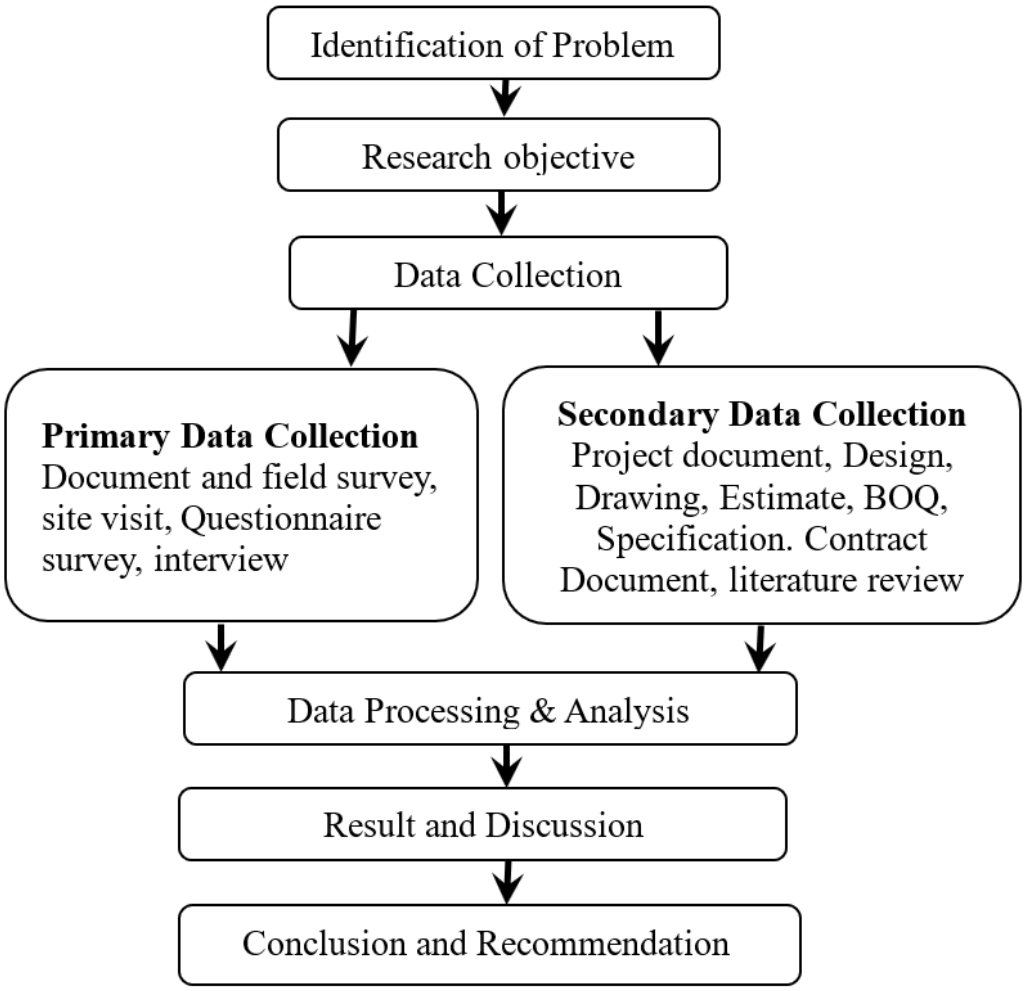

Figure 1.
Research flow chart.

The study assesses challenges in road construction from the construction to completion phases. It focuses on projects in Gandaki Province under the National Reconstruction Authority, implemented by DLPIU. The list of selected projects is provided in Table 1.

Table 1.
List of projects under study.

SN	Project Name	Client	Contractors
1	Mirmi-Waigha-Ridi Road	DLPIU, Syangja	M/S CAB- Sagarmatha JV, Dhumbarahi, Kathmandu
2	Gharkhola-Khiwang-Sikha-Ghodepani Road	DLPIU, Myagdi	M/S Motidan/Jayamata JV, Maharajgunj, Kathmandu
3	Bhimad-Banumati Road	DLPIU, Tanahu	M/S Sapana- Mahadev Khimti JV, Putalisadak, Kathmandu
4	Patichaur-Maidan-Lapsibot Road	DLPIU, Parbat	M/S Asis-Fewa JV
5	Hemja-Khanepani-Lumre-Siding Road	DLPIU, Kaski	M/S Himdung & Thokar / Dragon JV
6	Sisuwa Polyangtar Road	DLPIU, Kaski	M/S Aashish/ Fewa JV

Edelweiss Applied Science and Technology
ISSN: 2576-8484
Vol. 9, No. 10: 662-676, 2025
DOI: 10.55214/2576-8484.v9i10.10485

This study employed a mixed-methods strategy combining qualitative and quantitative techniques. Through a comprehensive literature review, analysis of previously used questionnaires, and multiple discussions with supervisors, qualitative approaches were utilized to determine the purpose, structure, duration, and content of the questionnaires. After collecting responses, a quantitative approach was applied to categorize and quantify the data. Secondary data was obtained from literature reviews and existing project documents. Relevant project documents were collected from LIDPO, Kaski. The population includes the client, consultant, and contractor for the selected road construction projects. Due to the small size, the entire population was considered the sample. Table 2 illustrates the distribution of both the population and the sample.

Table 2.
Population and sampling.

SN	Description	Population	Sample
1	Client's (Engineer)	11	11
2	Contractor (Engineer)	6	6
3	Consultant (Engineer)	7	7
		24	24

The research questionnaire was developed from a literature review to identify key factors and challenges. Existing questionnaires were reviewed and adjusted to meet study objectives. Pilot testing ensured reliability and validity, prompting refinements [41]. Feedback from the pilot phase guided revisions, culminating in a finalized questionnaire. It features clear, concise questions aimed at comprehensively gathering pertinent information from the target population. The collected data were analyzed using SPSS software, encompassing statistical techniques such as frequency distributions, means, standard deviations, variances, and reliability analysis. In this research, Cronbach's alpha coefficient was employed to assess the reliability of the scales used. According to Pallant [42], the reliability of a scale can vary depending on the sample size, with fewer items potentially leading to lower reliability coefficients. The calculation of Cronbach's alpha provided insight into the internal consistency of the scale, evaluating how well individual items correlated with the overall measure. The Relative Importance Index (RII) method, as used by Sambas Ivan and Soon (Y.W.), was applied to determine the significance of various challenges across different categories (Client-related, Consultant-related, Contractor-related, Designer-related, Labour-related, Materials-related, Equipment-related, External-related). Respondents rated each challenge on a five-point Likert scale ranging from 1 (not important) to 5 (extremely important). The RII for each factor was calculated using the formula:

$$RII = \frac{\sum W/A}{N}$$

Where:

- $\sum W$ is the sum of weights given to each factor by respondents,
- A is the maximum possible score (in this case, 5),
- N is the total number of respondents.

The RII ranges between 0 and 1, with higher values indicating greater importance of the challenges in the project context. The same approach ranked the effects of these challenges. Weighted average RIIs across client, consultant, and contractor groups determined ranks, highlighting challenges' perceived importance and their impact on project outcomes. Validation in this research involved rigorous steps to ensure credibility and reliability. A pilot survey with senior officials refined the questionnaire, and SPSS analysis showed strong reliability (Cronbach's alpha: 0.81-0.90).

3. Results

This chapter presents research results from analyzing questionnaires and project document reviews, focusing on schedule, cost, social, and environmental challenges as perceived by stakeholders: clients,

Edelweiss Applied Science and Technology
ISSN: 2576-8484
Vol. 9, No. 10: 662-676, 2025
DOI: 10.55214/2576-8484.v9i10.10485

contractors, and consultants in NRA Road Construction Projects. It includes the identification and ranking of these challenges based on their significance and impact. The study also examines the primary effects of these challenges, assigning ranks based on survey responses. Overall perspectives on related challenges. Table 3 provides an overview of respondents' perspectives on various challenges in road construction projects, categorized by groups such as poor project management, financial issues, environmental factors, and others. Each challenge is evaluated based on its mean score, RII, and corresponding rank. Challenges perceived as most critical include poor project management by contractors (rank 1, RII = 0.78), improper utilization of advance payments (rank 2, RII = 0.78), and financial constraints alongside poor financial management (rank 3, RII = 0.74). Geological factors like landslides (rank 4, RII = 0.72) and adverse weather conditions such as excessive rainfall (rank 5, RII = 0.71) also feature prominently. Other significant challenges identified include inadequately skilled professionals, safety concerns, budget planning issues, and political interference. These findings emphasize the multifaceted nature of challenges impacting road construction projects and highlight priorities for mitigation strategies and enhanced project management practices.

Table 3.
Overall perspective of respondents.

Item	Group of challenges	Mean	RII	Rank
1	Poor project management by the contractor	3.92	0.78	1
2	Improper utilization of the advance payment by the contractor	3.88	0.78	2
3	Lack of finance and poor financial management by the contractor	3.71	0.74	3
4	Geological factors (occurrence of landslide)	3.58	0.72	4
5	Adverse weather conditions (excessive Rainfall)	3.54	0.71	5
6	Lack of skilled professionals by the contractor	3.46	0.69	6
7	Low concern over Occupational health and safety	3.46	0.69	7
8	Poor cost estimation/ Budget planning by the client	3.38	0.68	8
9	Inflation	3.38	0.68	9
10	Poor environment and social safeguard management by the client	3.38	0.68	10
11	Variation order/addition of works (Insufficient project planning)	3.38	0.68	11
12	Political factors/interference (Changes in rules & regulations frequently)	3.38	0.68	12
13	Slow decision-making & tedious project approval by the client	3.33	0.67	13
14	Lack of retention of employees of the contractor	3.33	0.67	14
15	Lack of experience of the design team	3.25	0.65	15
16	Lack of coordination between government authorities (for utilities installation/removal)	3.17	0.63	16
17	Incomplete /inadequate survey data and quantity estimations	3.17	0.63	17
18	Hydrological factors (occurrence of floods)	3.17	0.63	18
19	Poor coordination and integration among stakeholders	3.08	0.62	19
20	Lack of alternative roads/ Site inaccessibility	3.04	0.61	20
21	Temperature /Climate conditions at the project site	3.04	0.61	21
22	Lack of coordination among the laborers & technicians of the contractor	2.96	0.59	22
23	Unavailability of equipment	2.88	0.58	23
24	Unavailability of construction materials	2.83	0.57	24

Edelweiss Applied Science and Technology
ISSN: 2576-8484
Vol. 9, No. 10: 662-676, 2025
DOI: 10.55214/2576-8484.v9i10.10485

25	Lack of accessibility to the equipment maintenance workshop	2.79	0.56	25
26	Lengthy project development period (change in site condition due to late bidding)	2.79	0.56	26
27	Delay in payment from the client	2.63	0.53	27
28	Unavailability of Material Transportation and Storage Facility	2.67	0.53	28
29	Shortages of Labor	2.67	0.53	29
30	Lack of proper classification of roads & respective standardization	2.67	0.53	30
31	Cultural & religious factors	2.50	0.50	31
32	Incomplete or poor specification	2.46	0.49	32

3.1. Overall Perspectives of Stakeholders on the Effects of Challenges on the Road

Table 4 outlines the effects of various challenges on road construction projects, based on mean scores, RII, and corresponding ranks. The most significant impact reported is time overrun and delays in overall project progress (rank 1, RII = 0.85), followed closely by changes in the scope of work (rank 2, RII = 0.82) and cost overruns (rank 3, RII = 0.78). Environmental issues such as landslides and unstable slopes (rank 4, RII = 0.76) also prominently affect project outcomes. Other effects include delays in public service delivery, damage to the client's office image, and hindrances to long-term project vision. These findings highlight the major consequences of challenges in road construction, emphasizing the need for effective mitigation strategies and improved project management practices to enhance efficiency, quality, and stakeholder satisfaction in infrastructure development initiatives.

Table 4.
Effects of Challenges on Road Construction.

S. No.	Effects of Challenges on Road Construction	Mean	RII	Rank
1	Time overrun/Delay in the overall progress of work	4.25	0.85	1
2	Change in the scope of work	4.08	0.82	2
3	Cost Overrun	3.88	0.78	3
4	Environmental problems (landslides & unstable slopes)	3.79	0.76	4
5	Inability to provide the service (transport) to the public within the promised time	3.46	0.69	5
6	Harms the image of the client's office for work progress	3.46	0.69	6
7	Delays the development of other infrastructures	3.46	0.69	7
8	Harms the long-term vision of projects	3.38	0.68	8
9	Conflicts between the parties	3.33	0.67	9
10	Unable to maintain the quality of work	3.21	0.64	10
11	Increase in Corruption (focusing on personal benefit)	3.04	0.61	11

3.2. Time Overruns

Most road construction projects undertaken by the National Reconstruction Projects in Gandaki faced time overruns. Table 5 details the extent of these overruns, showing each project's initial contract period (T1), extension period, completed time (T2), and time overrun ratio (t = T2/T1). Projects like Mirmi-Ridi, Hemja-Siding, and Sisuwa-Polyangtar experienced overruns of 83% to 89%. In contrast, Patichaur-Maidan, Bhimad-Banumati, and Gharkhola-Ghodepani faced more significant delays, with time overrun ratios exceeding 100%. These figures highlight substantial challenges in project scheduling and adherence to timelines.

Edelweiss Applied Science and Technology
ISSN: 2576-8484
Vol. 9, No. 10: 662-676, 2025
DOI: 10.55214/2576-8484.v9i10.10485

Table 5.
Time Overrun Occurrence.

S. No.	Project name	Contract period (T1)	Extension period	Completed time (T2)	Time Overrun Occurrence	Ratio (t)= T2/T1	Remarks
1	Mirmi-Ridi	18	14.94	32.94	3	83%	
2	Hemja-Siding	18	16.02	34.02	3	89%	
3	Sisuwa-Polyangtar	18	16.02	34.02	3	89%	
4	Patichaur-Maidan	18	28.08	44.08	4	156%	T >100
5	Bhimad-Banumati	18	46.08	64.08	7	256%	
6	Gharkhola-Ghodepani	18	43.56	61.56	6	242%	

Time overrun for each of the projects studied is calculated with the following relation:

$$\text{Time Overrun} = \frac{\text{Extended Time}}{\text{Initial Contract Period}} * 100$$

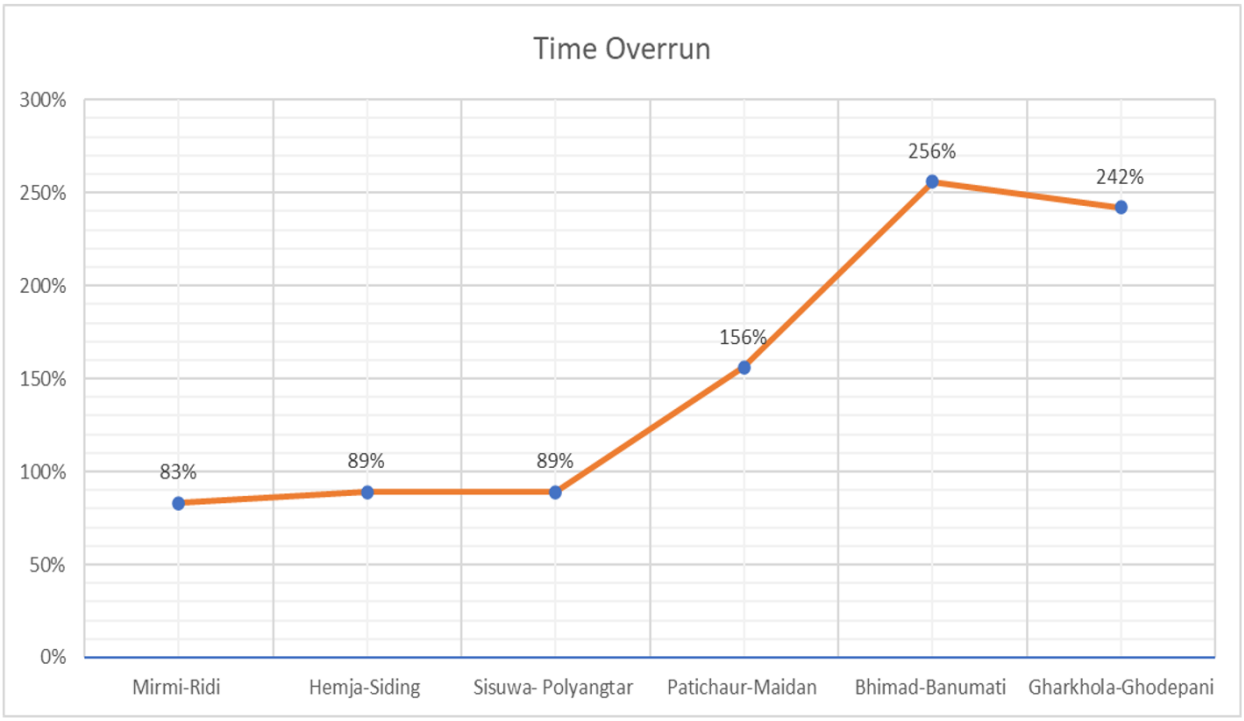

Figure 2.
Trend Analysis of Time Overrun of NRA Projects.

Figure 2 illustrates extensive time overruns ranging from 83% to 256% across various road construction projects. The Bhimad-Banumati Road project stands out with the highest time overrun of 256%, primarily due to several documented factors in the extension of time (EOT) records. Initial delays were caused by the COVID-19 pandemic, followed by disruptions during the monsoon season. Additional complications included a shortage of materials during critical phases, such as base laying, exacerbated by temporary closures of crusher industries in Kotre. Further delays resulted from issues

Edelweiss Applied Science and Technology
ISSN: 2576-8484
Vol. 9, No. 10: 662-676, 2025
DOI: 10.55214/2576-8484.v9i10.10485

with timely payment extensions, budget disbursement delays to subcontractors, financial crises, and liquidity shortages, highlighting the complexities and setbacks faced during execution.

Similarly, the Gharkhola-Khiwang-Sikha-Ghodepani Road project experienced the second-highest time overrun of 242%. This project faced delays due to local community obstructions, lack of access during monsoon seasons, and relocation of electric poles. The situation worsened with COVID-19 lockdowns, government restrictions, and infrastructure collapses such as the Beni Bridge. Local obstructions and adverse weather conditions, including pre-monsoon rainfall and harsh climate factors such as cold weather and snowfall, further impeded progress. Shortages of construction materials compounded the delays, underscoring the project's vulnerability to external environmental and logistical challenges.

3.3. Cost Overrun

Cost overruns in construction projects often result from time overruns, leading to higher overhead costs, resource underutilization, and price escalation due to extended durations. Table 6 illustrates cost overruns across various road construction projects, including the original contract amount, value of variation orders (V.O.), revised contract amount, and the percentage of variation orders relative to the original amount. Significant cost overruns were observed in projects like Mirmi-Ridi and Gharkhola-Ghodepani, with overruns of 14.31% and 14.98%, respectively, due to additional work or scope changes. In contrast, Bhimad-Banumati had a minimal overrun of 0.08%, while Patichaur-Maidan and Hemja-Siding faced higher percentages at 9.50% and 11.75%, respectively. These figures highlight financial challenges from unforeseen circumstances or modifications, emphasizing the need for effective cost-management strategies in project planning and execution.

Table 6.
Cost Overrun Occurrence.

SN	Project Name	Original Contract Amount	Variation Order (VO) Amount	Rev. Contract Amount	VO %
1	Mirmi-Ridi	239,900,818.75	34,335,989.45	274,236,808.20	14.31%
2	Gharkhola-Ghodepani	279,135,220.81	41,824,683.37	320,929,919.35	14.98%
3	Bhimad-Banumati	302,881,127.35	243,288.37	303,124,415.72	0.08%
4	Patichaur-Maidan	276,775,464.69	26,292,347.18	303,067,811.87	9.50%
5	Hemja-Siding	260,197,239.47	30,561,551.53	290,758,791.00	11.75%
6	Sisuwa-Polyangtar	213,299,550.58	30,978,043.44	244,277,594.02	14.52%

Time overrun for each of the projects studied is calculated with the following relation:

$$\text{Cost Overrun} = \frac{\text{Additional Amount}}{\text{Initial Contract Amount}} * 100$$

Edelweiss Applied Science and Technology
ISSN: 2576-8484
Vol. 9, No. 10: 662-676, 2025
DOI: 10.55214/2576-8484.v9i10.10485

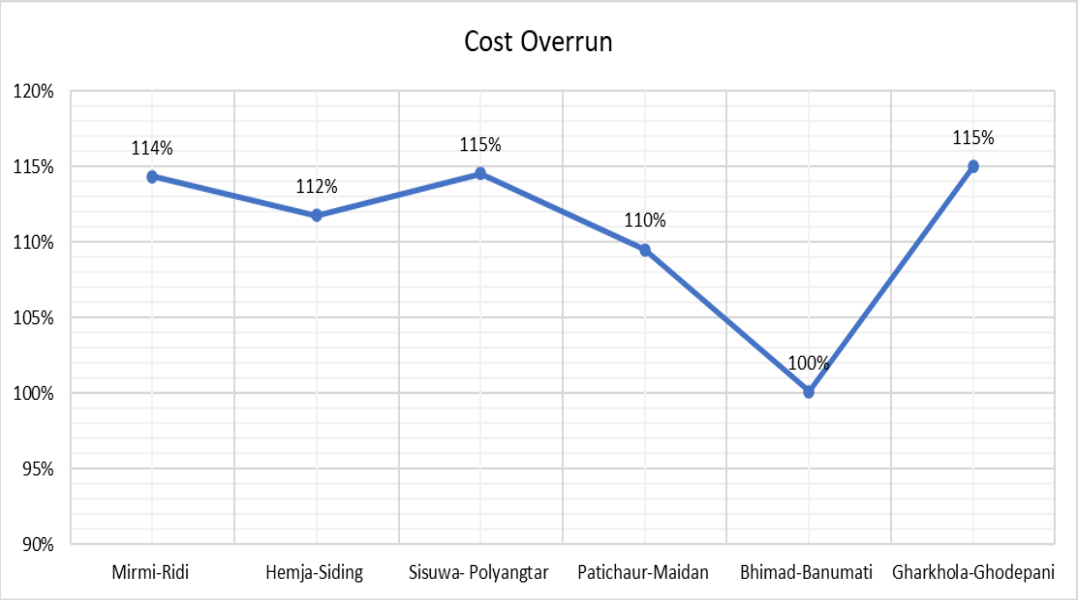

Figure 3.
Trend Analysis of Cost overrun of NRA road Projects.

3.4. Factors Causing Cost Overrun

- Alignment change and protection work on Mirmi Waigha Ridi Road.
- Change in scope from DBST to Premix and Asphalt work on Hemaja and Sisuwa roads.
- Landslide protection works and changes from high-grade DBST surface to rigid pavement during the implementation phase on Patichaur-Lapsibot Road.
- Stakeholders' demands and protection work due to landslides on Gharkhola-Godepani Road.

3.5. Mitigation Measures Suggested by Respondents

Implementing effective mitigation measures can reduce challenges and negative effects of road construction projects, promoting smoother activities. The identified measures are:

- Conduct thorough feasibility studies and site assessments before starting construction to prepare advanced planning and design.
- Ensure estimates, designs, and surveys are appropriate and accurate based on actual site conditions.
- Build flexibility into construction schedules to accommodate unexpected delays without compromising quality.
- Implement rules and regulations effectively with proper resource allocation, management, and a well-planned management system.
- Ensure strong utilization of advance payments and proper use of all resources and skilled manpower as needed.
- Maintain proper coordination, participation, and communication among stakeholders, providing timely updates on construction progress and potential disruptions.
- Engage with stakeholders (local communities, businesses, and residents) to gather input and address concerns before construction begins, and keep them informed about project progress and potential disruptions.
- Ensure all parties are responsible for performing their work efficiently.

Edelweiss Applied Science and Technology
ISSN: 2576-8484
Vol. 9, No. 10: 662-676, 2025
DOI: 10.55214/2576-8484.v9i10.10485

- Implement construction technologies and methods with optimized project planning and coordination.
- Divide the project into manageable phases to minimize the overall impact on traffic and nearby businesses and to ensure smooth progress of work.
- Prioritize safety by implementing proper signage, barriers, and flaggers to protect workers and drivers from accidents.
- Conduct regular safety audits and training for construction workers, and ensure that first aid kits and emergency numbers are available on the construction site.

Past research revealed that corruption, financial constraints, unrealistic contract durations, and non-compliance with contractual terms are typical procurement challenges in Tanzanian road construction, leading to financial penalties, project abandonment, and contractual disputes [43]. Delays, substandard work, budget deviations, and disputes between clients and service providers are frequently reported in road construction projects [44]. Road construction project goals (cost, time, quality) are hindered by the client's internal weaknesses in planning, implementing, managing, and financing the projects [45]. Construction projects exceed estimated time and budget due to clients' internal weaknesses and inefficiencies in managing and controlling the project [46]. Various factors contribute to delays in construction projects, including inadequate design, poor stakeholder communication, contractor inexperience, planning deficiencies, delays in material delivery and testing, labor shortages and skill deficits, and external influences such as regulatory changes and unforeseen events [41].

Contractor's financial constraints, poor labor productivity, and shortages of skilled labor are significant resource-related factors contributing to cost overruns in infrastructure projects [47]. Climate conditions, unforeseen works, errors in project documentation, inadequate project planning, legal regulations, and communication issues among participants are influential factors in construction projects. Contractors must ensure proper activity performance to enhance productivity and improve construction project outcomes [48].

4. Conclusion

This study identifies and assesses significant challenges impacting road construction projects in Nepal, particularly those under the National Reconstruction Authority (NRA) in the Gandaki Province. Several key challenges were identified through the literature review. A set of questionnaires was prepared, pilot testing was conducted, and data were collected to identify major challenges in road construction projects. The major challenges include poor project management, improper utilization of advance payments, and financial constraints affecting contractors' capabilities. These issues lead to time overruns, scope changes, and cost overruns, negatively impacting project timelines, budgets, and quality standards. Effective project management strategies are essential for mitigating these challenges. Employing experienced project managers and utilizing project management tools can optimize resource allocation, scheduling, and outsourcing, thereby enhancing efficiency and ensuring timely delivery. Enforcing stricter financial controls on advance payments ensures funds are used exclusively for project expenses. The study emphasizes the importance of collaboration among government bodies, the private sector, civil society, and local communities to address these challenges collectively. Fostering partnerships and inclusivity improves project governance, transparency, and accountability in road infrastructure development. This approach enhances project outcomes, promotes sustainable development, and builds resilience against disruptions such as natural disasters and economic fluctuations, ensuring infrastructure development aligns with national standards and contributes to Nepal's socio-economic progress and regional connectivity. Additionally, the findings guide stakeholders in prioritizing and improving road construction performance through informed strategic planning for Nepal and other developing countries with similar contexts.

Edelweiss Applied Science and Technology
ISSN: 2576-8484
Vol. 9, No. 10: 662-676, 2025
DOI: 10.55214/2576-8484.v9i10.10485

Transparency:

The authors confirm that the manuscript is an honest, accurate, and transparent account of the study; that no vital features of the study have been omitted; and that any discrepancies from the study as planned have been explained. This study followed all ethical practices during writing.

References

[1] A. H. Memon, A. Q. Memon, S. H. Khahro, and Y. Javed, "Investigation of project delays: Towards a sustainable construction industry," *Sustainability*, vol. 15, no. 2, p. 1457, 2023. https://doi.org/10.3390/su15021457

[2] C. Xiong, V. Beckmann, and R. Tan, "Effects of infrastructure on land use and land cover change (LUCC): The case of Hangzhou International Airport, China," *Sustainability*, vol. 10, no. 6, p. 2013, 2018. https://doi.org/10.3390/su10062013

[3] L. Chu, Y. Zou, D. Masiliūnas, T. Blaschke, and J. Verbesselt, "Assessing the impact of bridge construction on the land use/cover and socio-economic indicator time series: A case study of Hangzhou Bay Bridge," *GIScience & Remote Sensing*, vol. 58, no. 2, pp. 199-216, 2021. https://doi.org/10.1080/15481603.2020.1868212

[4] O. P. Giri, "Perception-Based assessment of the factors causing delays in construction projects," *Engineering*, vol. 15, no. 7, pp. 431-445, 2023b. https://doi.org/10.4236/eng.2023.157033

[5] N. Mwelu, S. Watundu, and M. B. Moya, "Contractors' perception of success factors for implementing public road construction projects," *Australasian Accounting, Business and Finance Journal*, vol. 18, no. 2, pp. 98-119, 2024. https://doi.org/10.14453/aabfj.v18i2.07

[6] G. Ofori, "Challenges of construction industries in developing countries: Issues and opportunities," *Construction Management and Economics*, vol. 20, no. 1, pp. 5–7, 2002.

[7] G. Hearn, W. Amponsah, and K. Mensah, "Application of geotechnical guidelines in road construction in developing countries: Case studies and lessons," *International Journal of Construction Engineering and Management*, vol. 6, no. 3, pp. 45–59, 2017.

[8] World Bank, *Nepal energy infrastructure sector assessment*. Washington, DC: World Bank, 2019.

[9] C. Barajei, N. A. Kheni, E. Appiah-Kubi, H. Danso, and A. W. Iddrisu, "Enhancing the success of Ghanaian public road construction projects," *Cogent Engineering*, vol. 10, no. 1, p. 2199514, 2023. https://doi.org/10.1080/23311916.2023.2199514

[10] S. G. Tadewos and D. Patel, "Factors influencing time and cost overruns in road construction projects: Addis Ababa, Ethiopian scenario," *International Research Journal of Engineering and Technology*, vol. 5, pp. 177-180, 2018.

[11] S. Idrees and M. T. Shafiq, "Factors for time and cost overrun in public projects," *Journal of Engineering, Project, and Production Management*, vol. 11, no. 3, pp. 243–254, 2021. https://doi.org/10.2478/jeppm-2021-0023

[12] A. Y. Alfakhri, A. Ismail, and M. A. Khoiry, "The effects of delays in road construction projects in Tripoli, Libya," *International Journal of Technology*, vol. 9, no. 4, pp. 766-774, 2018. https://doi.org/10.14716/ijtech.v9i4.2219

[13] S. Wyke, S. M. Lindhard, and J. K. Larsen, "Using principal component analysis to identify latent factors affecting cost and time overrun in public construction projects," *Engineering, Construction and Architectural Management*, vol. 31, no. 6, pp. 2415-2436, 2024. https://doi.org/10.1108/ECAM-02-2022-0189

[14] A. Arantes and L. M. D. Ferreira, "Underlying causes and mitigation measures of delays in construction projects: An empirical study," *Journal of Financial Management of Property and Construction*, vol. 25, no. 2, pp. 165-181, 2020. https://doi.org/10.1108/JFMPC-03-2019-0029

[15] S. Nightingale, H. Spiby, K. Sheen, and P. Slade, "Factors influencing school building construction projects' abandonment Abstract," *Tourism Recreation Research*, vol. 80, pp. 106–117, 2018.

[16] N. O. Ogunseye, O. E. Oyejola, U. O. Salisu, S. O. Momodu, and S. O. Fasina, "Socio-economic impacts of road infrastructure development during- and post-construction in a fast-growing city in Nigeria," *Transport and Communications*, vol. 8, no. 1, pp. 25–35, 2020.

[17] H. Doloi, A. Sawhney, K. Iyer, and S. Rentala, "Analysing factors affecting delays in Indian construction projects," *International Journal of Project Management*, vol. 30, no. 4, pp. 479-489, 2012. https://doi.org/10.1016/j.ijproman.2011.10.004

[18] S. A. Assaf and S. Al-Hejji, "Causes of delay in large construction projects," *International Journal of Project Management*, vol. 24, no. 4, pp. 349-357, 2006. https://doi.org/10.1016/j.ijproman.2005.11.010

[19] Y. J.-T. Zidane and B. Andersen, "The top 10 universal delay factors in construction projects," *International Journal of Managing Projects in Business*, vol. 11, no. 3, pp. 650-672, 2018. https://doi.org/10.1108/IJMPB-05-2017-0052

Edelweiss Applied Science and Technology
ISSN: 2576-8484
Vol. 9, No. 10: 662-676, 2025
DOI: 10.55214/2576-8484.v9i10.10485

[20] S. Kivrak and M. Y. Baha, "Causes of delay in road construction projects in Afghanistan: Causes of delay in road projects in Afghanistan," *Journal of Scientific & Industrial Research*, vol. 83, no. 1, pp. 46-57, 2024. https://doi.org/10.56042/jsir.v83i1.2791

[21] T. Al Amria and M. Marey-Pérezb, "Towards a sustainable construction industry: Delays and cost overrun causes in construction projects of Oman," *Journal of Project Management, Journal of Project Management*, vol. 5, pp. 87-102, 2020. https://doi.org/10.5267/j.jpm.2020.1.001

[22] C. Gupta and C. Kumar, "Study of factors causing cost and time overrun in construction projects," *International Journal of Engineering Research & Technology*, vol. 9, no. 10, pp. 202-206, 2020.

[23] P. K. Lende and A. D. Rathod, "Study of factors affecting cost overrun in road construction project," *International Journal of Research in Engineering, Science and Management*, vol. 1, no. 8, pp. 115-119, 2018.

[24] A. B. Negesa, "Assessing the causes of time overrun in building and road construction projects: The Case of Addis Ababa City, Ethiopia," *Journal of Engineering*, vol. 2022, no. 1, p. 8479064, 2022. https://doi.org/10.1155/2022/8479064

[25] M. M. Suta and I. Prasetia, "Analysis of delay in implementation of work on road projects in highways division of Katingan regency," *Technium: Romanian Journal of Applied Sciences and Technology*, vol. 19, pp. 40-49, 2024. https://doi.org/10.47577/technium.v19i.10597

[26] S. Tabriz and M. S. Islam, "Delay in completion of the construction projects in Bangladesh: Likert scale analysis for identifying the obstacles based on the relative importance index. Kuet," 2024. https://www.researchgate.net/publication/378334262

[27] M. M. A. El-Wafa and I. Mosly, "An extensive examination of the barriers faced by contractors leading to project delays," *Global Journal of Engineering and Technology Advances*, vol. 18, no. 03, pp. 152-167, 2024. https://doi.org/10.30574/gjeta.2024.18.3.0050

[28] Nepal Economic Survey, "Economic survey 2020/21. Ministry of Finance, Government of Nepal," 2021. https://mof.gov.np/

[29] D. Seymour, *Construction management: New directions*. Oxford, UK: Blackwell Publishing, 2002.

[30] Project Management Institute, *A guide to the project management body of knowledge (PMBOK® Guide)*, 7th ed. Newtown Square, PA, USA: Project Management Institute, 2021.

[31] Q. Duan, Y. Li, and H. Zhang, "Land acquisition, resettlement, and compensation in infrastructure projects: Challenges and solutions," *Journal of Construction Engineering and Management*, vol. 143, no. 5, p. 04017012, 2017.

[32] P. Tiwari, R. Shrestha, and S. Adhikari, "Right-of-way issues and project delays in road construction: Evidence from Nepal," *International Journal of Construction Management*, vol. 19, no. 3, pp. 215–227, 2019.

[33] L. Zhang, J. Li, and Y. Wang, "Environmental and infrastructural impacts of road construction: Evidence from developing regions," *Journal of Infrastructure Systems*, vol. 24, no. 3, p. 04018016, 2018.

[34] S. Kumar, R. Sharma, and A. Singh, "Stakeholder management in infrastructure projects: Challenges and best practices," *International Journal of Project Management*, vol. 39, no. 7, pp. 881–895, 2021.

[35] O. P. Giri, "Assessment of Key Risk Factors Impacting Construction Project Performance," *International Journal of Construction Management*, vol. 25, no. 4, pp. 1231-1241, 2025.

[36] P. Verma and R. Singh, "Project scheduling and resource allocation in infrastructure projects," *International Journal of Construction Management*, vol. 19, no. 6, pp. 495–507, 2019.

[37] S. Rao, A. Kumar, and P. Mehta, "Environmental challenges in road construction projects: A study from developing countries," *Environmental Impact Assessment Review*, vol. 85, p. 106444, 2020.

[38] S. Kumar and V. Jain, "Poor project management practices and their effect on construction outcomes," *International Journal of Project Management*, vol. 36, no. 7, pp. 956–968, 2018.

[39] S. Nath, R. Kumar, and P. Sharma, "Managing variation orders in construction projects: Impacts on cost and schedule," *International Journal of Construction Management*, vol. 19, no. 4, pp. 321–332, 2019.

[40] J. Li and X. Yao, "Resource scarcity and its effect on construction project performance," *Journal of Construction Engineering and Management*, vol. 147, no. 1, p. 04020123, 2021.

[41] O. P. Giri, "Choosing sampling techniques and calculating sample size," *Indonesian Journal of Teaching in Science*, vol. 4, no. 2, pp. 165-176, 2023a.

[42] J. Pallant, *SPSS survival manual: A step by step guide to data analysis using SPSS for Windows*, 2nd ed. Maidenhead, UK: Open University Press, 2005.

[43] B. Israel, "The impact of clients' procurement challenges on the substance goals of roads construction projects in Songwe, Tanzania," *International Journal of Construction Management*, vol. 23, no. 12, pp. 2144-2150, 2023. https://doi.org/10.1080/15623599.2022.2045861

[44] O. K. Phillips-Alonge, "The influence of partnering on the occurrence of construction requirement conflicts and disputes," *International Journal of Construction Management*, vol. 19, no. 4, pp. 291-306, 2019. https://doi.org/10.1080/15623599.2018.1435236

[45] T. Wang, M. Abdallah, C. Clevenger, and S. Monghasemi, "Time–cost–quality trade-off analysis for planning construction projects," *Engineering, construction and architectural management*, vol. 28, no. 1, pp. 82-100, 2021. https://doi.org/10.1108/ECAM-12-2017-0271

[46] A. Amadi, "A cross-sectional snapshot of the insider view of highway infrastructure delivery in the developing world," *International Journal of Construction Management*, vol. 19, no. 6, pp. 472-491, 2019. https://doi.org/10.1080/15623599.2018.1452097

[47] A. S. A. M. Alhammadi and A. H. Memon, "Ranking of the factors causing cost overrun in infrastructural projects of UAE," *International Journal of Sustainable Construction Engineering and Technology*, vol. 11, no. 2, pp. 204-211, 2020. https://doi.org/10.30880/ijscet.2020.11.02.025

[48] E. Raphael, O. A. Nkechi, and U. A. Chinedu, "Mitigation measures towards projects cost overrun in road infrastructure projects constructed by local firms in Nigeria," *International Journal of Advanced Multidisciplinary Research and Studies*, vol. 3, no. 2, pp. 225–233, 2023.

Edelweiss Applied Science and Technology
ISSN: 2576-8484
Vol. 9, No. 10: 662-676, 2025
DOI: 10.55214/2576-8484.v9i10.10485