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# Analysis of Factors resulting Schedule Overruns in Building Construction Projects in Bagmati Province

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**Abstract**
Construction project schedule overruns are a prevalent and persistent issue affecting both the global construction sector and the Nepalese construction industry. These overruns lead to significant cost escalations and hinder the timely completion of projects. Addressing this critical concern requires identifying the root causes of schedule overruns. This study aims to investigate the underlying reasons contributing to schedule overruns in various construction projects across different sectors in Bagmati Province, Nepal. The research thoroughly examines the factors leading to project delays and assesses their impacts. Furthermore, the study proposes effective strategies to mitigate these delays and enhance the punctuality of project deliveries.A multidimensional approach is adopted, combining insights from an extensive review of relevant literature, case studies, and in-depth interviews with key stakeholders in the Nepalese construction industry. The research identifies the top thirty factors responsible for schedule overruns in public health buildings with respect to their Relative Importance Index(RII), based on questionnaires and interviews with stakeholders and professionals involved in designing, supervising, and constructing these projects. By providing actionable solutions to these issues, this research aims to facilitate smoother and more efficient project completions, ultimately strengthening the construction industry and contributing to the nation's overall development.

**Keywords**
Schedule Overruns,Construction, Relative Importance Index, Health Related Buildings

## 1. Introduction

The construction industry plays a significant role in global business, driving various economic activities and making substantial contributions to a country's GDP. It also serves as a vital indicator of a nation's infrastructural development. The first and foremost objective of any construction project is the completion of the project successfully within the planned timeframe and allocated budget. However, the construction industry faces complexities, fragmentation, and limitations in terms of time and resources. As a result, it grapples with various challenges such as low productivity, compromised quality, delays in schedules, and exceeding budgets. These issues are even more pronounced in developing nations [1].

As the construction industry grows, the significance of effective planning and financial management becomes more prominent. Unfortunately, it has become common for projects to go beyond their initial schedules and budgets, making it a major issue within the industry [2]. The reasons for cost and schedule overruns are diverse, with some factors seeming insignificant in one project but crucial in another due to each project's unique circumstances. Addressing any challenge starts with identifying its underlying causes; subsequent actions rely on understanding these factors. To tackle the ongoing problem of construction schedule delays, it is essential to engage in continuous discussions and further research.

### 1.1 Statement of Problem

The persistent challenge faced by construction industry is the frequent occurrence of delays in schedules. In Nepal, construction project delays are common issues, with projects often not starting on time or getting stuck without progress.

An Asian Development Bank report found that only 15 percent of tasks in Nepal's public construction sector were completed within the expected timeframe, and the average delay was 37 months. These delays lead to higher costs, reduced benefits, and failure to meet development goals [3]. Likewise, out of 260 public health-related buildings planned to be finished in fiscal years 2075/76 and 2076/77 constructed by the health division of the Department of Urban Development and Building Construction, all 260 projects experienced delays.The project with the maximum delay is the Agnichowk Health Post in Dhading, delayed by 51 months, while the Khungri Health Post in Rolpa had the least delay of 2 months. A research study on Time Overrun and Its Impact on the Cost of Construction of Small Hydropower Projects in Nepal also concludes that delays have become the norm rather than the exception in various construction sectors [4].

Therefore, this study aims to identify the root causes of schedule overruns in building projects, prioritize the factors based on their impacts on project schedule overruns and recommend appropriate measures to mitigate the effects of these factors.

### 1.2 Objectives

The main objective of this research can be listed as follows:

- To identify the key factors contributing to construction project schedule overruns in Health related buildings of Bagmati Province
- To prioritize and rank the key factors contributing to construction project schedule overruns in Health related buildings of Bagmati Province

### 1.3 Limitations of the Study

The main objective of this research can be listed as follows:

- This study exclusively concentrates on public health building projects that have been executed under Department of Urban Development and Building Construction (DUDBC) within Bagmati Province, Nepal.
- The research in question confines its investigation to public health buildings constructed within the past decade such that the study captures contemporary insights and developments in the field of public health infrastructure.

## 2. Literature Review

### 2.1 Construction Sector

The construction sector is crucial for Nepal's infrastructure development, constructing and maintaining essential physical structures like roads, bridges, energy facilities, and urban facilities. It is vital due to Nepal's varied topography, enabling connectivity, supporting economic activities, and expanding the tourism industry. The sector generates diverse employment opportunities, reducing poverty, boosting the economy, and enhancing Disaster risk managements. In Fiscal Year 2078/79, the construction sector accounted for 5.8 percent of the country's total GDP. The efficient functioning of the sector is crucial for national development. However, construction projects are guided by time, cost, and quality parameters, to ensure serviceability and fulfill intended purpose.

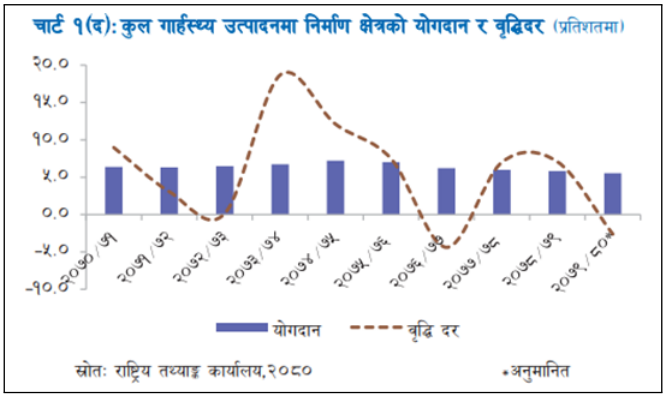


**Figure 1:** Contribution of Construction Sector on GDP (Source: National Economic Survey 2079/80)

### 2.2 Schedule Overruns

Scheduled overruns refer to the additional time required to complete a construction project beyond its initially planned duration [5]. Time overrun is defined as "a condition where a construction project does not complete within the designed time period" It happens when the work of contract does not complete in its prescribed time. These overruns can be caused by various actions or incidents that extend the time needed to fulfill contractual obligations. The completion of scheduled work within the agreed-upon time frame or even ahead of schedule is crucial for the successful execution of a project, and all project stakeholders are vested in monitoring the construction progress. Unfortunately, delays in projects are quite common, despite the evident importance of delivering projects on time.Moreover, construction project schedule overruns are often associated with various problems like Extension of time, Cost overruns, Conflicts and claims, arbitration and litigation , delayed delivery of the services, poor quality of completed works and negative social and economic impacts to the beneficiaries of the project [6, 7, 8]. Although multiple studies to identify causes of schedule overruns have been studied extensively, they have not been entirely effective in preventing project delays, as recent studies indicate that construction projects frequently exceed their expected timeframes [9].

### 2.3 Causes of Schedule Overruns

Schedule overruns in construction projects entail delays in completing the project within the initially set timeframe. These delays can be attributed to a range of factors and events that occur before and during the construction process. Most of these delay-causing factors are associated with construction-related parameters. Categorizing these factors facilitates in-depth research into their individual and combined effects. Consequently, research have identified different groupings of causes for schedule overruns, offering valuable insights into the understanding of construction delays.

#### 2.3.1 Previous Studies

For the purpose of identifying various causes of delays and their groups, extensive study of literature was carried out. To better understand the reasons behind project delays and group them logically, a thorough review of existing research was conducted. This review included 34 research papers from different places and projects to ensure wide ranges of factors were covered without repetition of similar ones. Among these papers, six didn't categorize the delay factors, and two grouped them based on aspects like planning, design, and engineering, which are similar to other categories like consultant-related factors. Fifteen categories of delay related factors were identified as they were listed on these research papers which are listed as below:

1. Contractor-related causes of schedule overruns.
2. Consultant-related causes of schedule overruns.
3. Material-related causes of schedule overruns.
4. Equipment-related causes of schedule overruns.
5. Labor-related causes of schedule overruns.

6. Client/owner related causes of schedule overruns.
7. Project/Contract related causes of schedule overruns.
8. Finance related causes of schedule overruns.
9. Environment/Site related causes of schedule overruns.
10. Public Authority/rules and regulation causes of schedule overruns.
11. Design/Drawing Related causes of schedule overruns.
12. Contractual Relationship causes of schedule overruns.
13. Planning, Scheduling and controlling related causes of schedule overruns.
14. Designer related causes of schedule overruns.
15. Causes of schedule overruns by external factors

Upon a comprehensive analysis of these factors, it was determined that certain categories of factors, such as those associated with designers, could be effectively amalgamated with consultant-related factors. Correspondingly, the categories of Materials and Equipment were identified to share analogous types of factors contributing to delays, and hence can be merged into a single category. Furthermore, factors related to planning, scheduling, and control were recognized to also implicate clients and contractors, as these entities hold primary responsibility for the project's strategic framework. Similarly, environment and site related factors can also be grouped to external factors. As a result, these refined ten groups of factors were reorganized and eight of them were adopted as the framework for investigating delay-related factors in the study.

1. Client-related causes of schedule overruns.
2. Contractor-related causes of schedule overruns.
3. Consultant-related causes of schedule overruns.
4. Materials and Equipment related causes of schedule overruns.
5. Labor-related causes of schedule overruns.
6. Project/Contract Related causes of schedule overruns.
7. Finance related causes of schedule overruns.
8. Causes of schedule overruns by external factors

#### 2.3.2 List of Factors obtained from Literature Review

[3, 4, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19]

**Client Related factors**

1. Poor communication and coordination with other parties
2. Changes in the Design/scope of works during Construction
3. Delay in approval and decision making
4. Delay in work progress payments
5. Late site handover to contractor
6. Selection of inappropriate contractors
7. Lowest bid tender award
8. Lack of experience of owner
9. Low financial incentives for contractor to finish ahead of schedule
10. Late Approval of Variation Order
11. Non Payment or Delayed payment of Legit Contractor claims
12. Ineffective delay penalties
13. Late Acquisition of Site

**Contractor Related factors**

1. Late site mobilization
2. Contractor inadequate experience
3. Rework due to error and defective work
4. Use of Conventional/ Inappropriate Construction Technology
5. Ineffective planning and scheduling
6. Delays in Sub contractor works
7. Poor site management and supervision
8. Excessive subcontracting of Works
9. Multiple number of contract by single contractor

**Consultant Related factors**

1. Delayed Review of Documents
2. Insufficient experience of consultant
3. Delays in inspection and testing
4. Delays in Producing Designs and Revisions
5. Complexity in Designs
6. Design Changes during Construction

**Materials and Equipment Related factors**

1. Shortage of Construction Materials
2. Changes in materials specifications during construction
3. Delayed Procurement of materials
4. Low Quality Construction Materials
5. Lack of Advanced Equipment
6. Low productivity and efficiency of equipment
7. Poor Material Procurement Plan

**Labour Related factors**

1. Insufficient Skilled Manpower
2. Unavailability of Unskilled Manpower
3. Conflicts between Labors
4. Strikes by site personnel
5. Low motivation and morale of labor
6. Low Productivity of workers
7. Lack of trainings of workers
8. Poor Living Standard of Workers at Site
9. Poor Grievance Handling

**Project / Contract Related factors**

1. Disputes between contracting parties
2. Discrepancy in Contracts
3. Insufficient Coordination between Project Parties
4. Issues in Obtaining Permission from Local Authorities

**Finance Related factors**

1. Low Financial capability of Contractor
2. Inadequate fund /Owner financial problem
3. Delay payment by contractor to subcontractor
4. High interest rates
5. Inflation/Price escalation

**External factors**

1. Adverse Weather and Geography
2. Change in rules and regulation
3. Accidents during construction
4. Public Obstruction
5. Unexpected geological condition
6. Force Majeure( Strikes, Pandemics, Natural Calamities)
7. Political Interventions
8. Insufficient Insurance Mechanisms
9. Corruption

## 3. Methodology

The primary aim of this research was to identify the factors responsible for delays in the construction of public health buildings by the Department of Urban Development and Building Construction (DUDBC)in Bagmati Province.The research was conducted through a series of well-defined steps, including a comprehensive review of existing literature to identify common factors leading to project delays in construction, a survey using questionnaires to collect relevant data, thorough data collection and analysis, extensive statistical assessment to prioritize factors of delays and a discussion of the findings with subsequent conclusions and recommendations aimed at informing stakeholders in the construction sector.

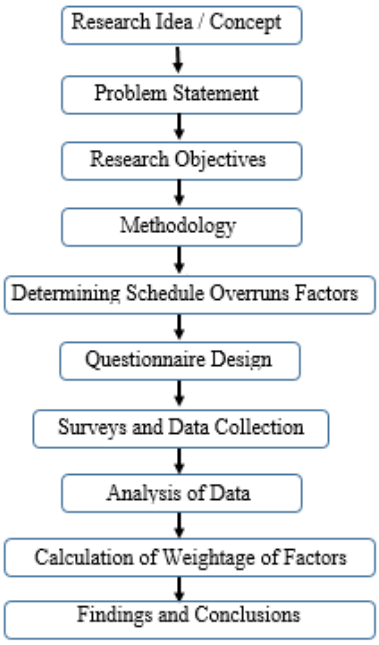


**Figure 2:** Research Methodology flowchart

### 3.1 Research Design

#### 3.1.1 Sample Size

Cochran (1963) developed an equation to determine an appropriate sample size for populations of significant size [**?**]. This equation is valid when you want to ensure your sample represents the population adequately. The key variables in this equation are as follows:

$$n_0 = \frac{Z^2 pq}{e^2}$$

- $n_0$: The required sample size.
- $Z$: The value from the standard normal distribution corresponding to the desired confidence level
- $e$: The desired level of precision.
- $p$: The estimated proportion of the attribute of interest in the population.
- $q$: The complementary proportion to p, i.e., $q = 1 - p$.

In situations where you have a large population but lack information about the proportion's variability, it's common to assume maximum variability, which corresponds to p = 0.5 (50 percent). Additionally, if you aim for a 90 percent confidence level with a precision of ±10 percent, you can apply Cochran's formula to determine the required sample size, which turns out to be 68 in this case.

#### 3.1.2 Research Data Collection techniques

In this thesis report, key informants were drawn from the government sector, specifically individuals with over 15 years of experience in the construction and supervision of public health buildings. These seasoned professionals played a crucial role in validating the questionnaires that were subsequently distributed to research respondents. The research targeted professionals within the construction sector, including Project Managers, Engineers, Architects, and Consultants, all of whom possessed substantial experience in the construction of health-related buildings. The research focused on projects spanning the small, medium, and large categories, all within the Bagmati Province of Nepal, during the past decade. A total of 100 questionnaires were sent out to gather responses, with the distribution divided into 55 respondents working under the Department of Urban Development and Building Construction (DUDBC), 45 respondents employed by contractors involved in health-related building construction.

Data collection for this research relied on a combination of primary and secondary techniques. Notably, the questionnaire was used as a primary tool, given its widespread use in data collection. Kobo Toolbox was used as data collection platform to efficiently distribute standardized questionnaires to a large pool of respondents. The data collected through these questionnaires was subsequently analyzed.

### 3.2 Analysis of Data

The ranking of the factors of delays was carried out by analysis of Relative Importance Index.The Relative Importance Index (RII) is a useful tool for assessing the relative significance of various factors or variables, particularly when using a Likert scale. This approach helps in ranking delays factors based on their perceived importance. The RII formula can be expressed as follows:

$$\text{RII} = \frac{\sum (W_i \times A_i)}{AN}$$

where,

- $W_i$ represents the weight or importance assigned to each factors (1 for very low, 2 for low, 3 for moderate, 4 for high, and 5 for very high).
- $A_i$ represents the number of respondents ranking the factors (very low, low, moderate, high, very high).
- $AN$ is the total number of respondents.
- RII helps in ranking the delay factors based on their perceived importance.

## 4. Results and Discussion

### 4.1 Introduction

This chapter presents a comprehensive overview of the data collection process and the subsequent analysis of results obtained from an online questionnaire. The questionnaire gathered a total of 80 responses, representing key stakeholders in the construction of public health buildings. These respondents were categorized into two distinct groups:

- Engineers and Architects under DUDBC (Department of Urban Development and Building Construction): This group comprised 45 professionals who are actively engaged in the planning and construction of public health buildings within the government sector.
- Engineers and Architects working under Contractors: Within this category, 35 engineers and architects were surveyed, all of whom are associated with contractors responsible for the construction of public health buildings.

**Table 1:** Survey Statistics

| Research Population | Questionnaire sent | Response received |
|---|---|---|
| Government Engineers | 55 | 45 |
| Contractors | 45 | 35 |
| **Total** | **100** | **80** |

The identification of the number of engineers working within the government sector and contracting agencies involved in the public health sector was sourced directly from DUDBC records. Additionally, details regarding the contracts awarded to contractors were obtained from the Federation of Contractors' Associations of Nepal (FCAN). The questionnaire was then thoughtfully crafted and disseminated to these identified stakeholders.

### 4.2 General Information of Respondents

This section presents a comprehensive overview of the respondents, focusing on their respective group affiliations, the roles they occupy within their organizations or as consultants, their academic qualifications, and their experience within the relevant field. Additionally, this section includes detailed graphical and statistical analyses of the respondent data for thorough examination and understanding.

Most of the respondents were from government sector. One third of the respondents were with experience of five to ten years. More than 80 Percent of respondents have responded that they have frequently experienced construction delays.

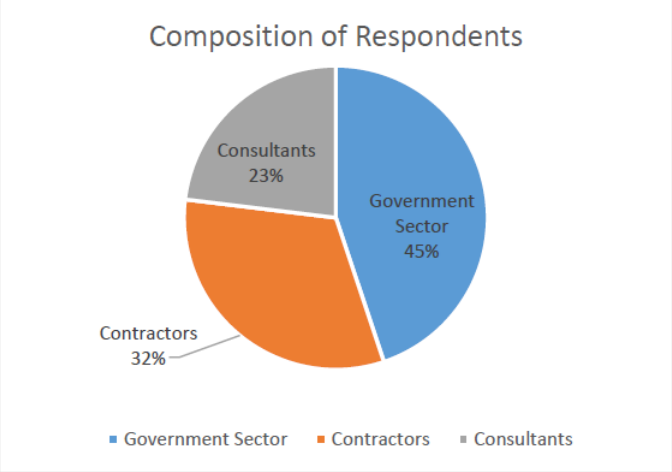


**Figure 3:** Composition of Respondents

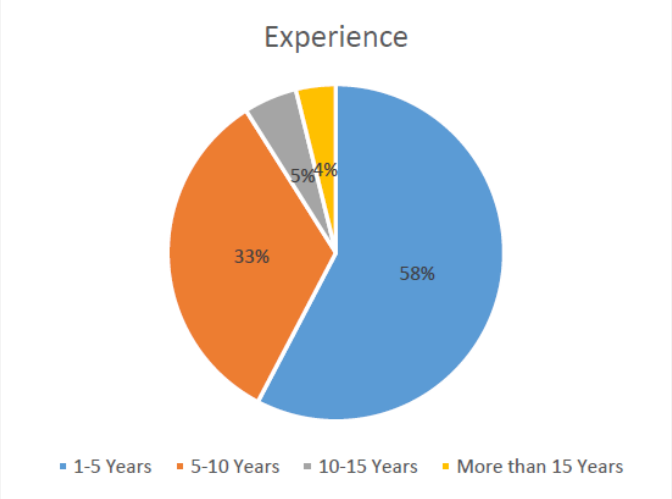


**Figure 4:** Experience of the Respondents

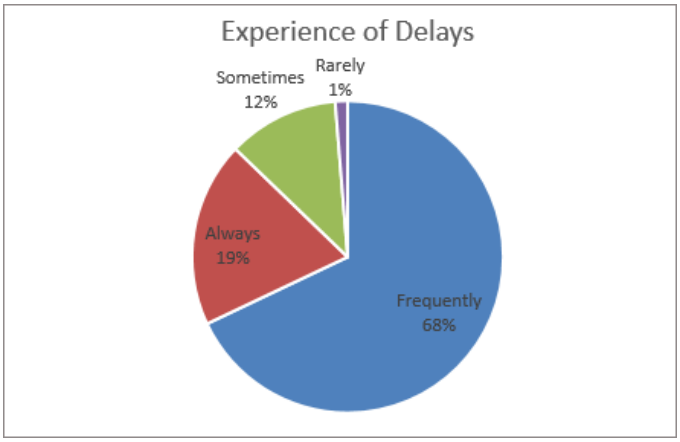


**Figure 5:** Experience of delays

### 4.3 Reliability Checking of data

Cronback Alpha value was used to measure the internal consistency between the response of various factors. The

higher value of cronback alpha (95 percent) i.e. above 70 percent signifies that there is high internal consistency between the responses of various factors.

| Reliability check (Chronbach Alpha) | | |
|---|---|---|
| no. of test item | k | 62 |
| sum of item variance | Es2i | 56.06 |
| variance of total score | s2t | 849.524 |
| | alpha | 0.95 |

**Figure 6:** Cronbach Alpha Value

### 4.4 Corelation between views of Contractors and Clients

The results indicate a positive and statistically significant correlation between "RII (Contractors)" and "RII (Engineers)." This means that as one variable increases, the other tends to increase as well, and vice versa. The strength of correlation is moderate to strong, with a higher coefficient in the case of Spearman's rho (0.657)

**Correlations**

| | | | RII (Contractors) | RII(Engineers) |
|---|---|---|---|---|
| Spearman's rho | RII (Contractors) | Correlation Coefficient | 1.000 | .657** |
| | | Sig. (2-tailed) | . | .000 |
| | | N | 62 | 62 |
| | RII(Engineers) | Correlation Coefficient | .657** | 1.000 |
| | | Sig. (2-tailed) | .000 | . |
| | | N | 62 | 62 |

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

**Figure 7:** Corelation between Responses

### 4.5 Ranking of delay factors based on categories

In accordance with the Likert scale responses provided by diverse participants, a comprehensive analysis of factors within each category, as well as an overall assessment, has been conducted. The results of this analysis are presented in tabular format below.

**Table 2:** Client related Factors

| Rank | RII | Client related factors |
|---|---|---|
| 1 | 0.810 | Delay in approval and decision making |
| 2 | 0.800 | Changes in the Design/scope of works during Construction |
| 3 | 0.782 | Delay in work progress payments |
| 4 | 0.762 | Poor communication and coordination with other parties |
| 5 | 0.756 | Late Approval of Variation Order |
| 6 | 0.744 | Selection of inappropriate contractors |
| 6 | 0.744 | Lowest bid tender award |
| 6 | 0.744 | Late Acquisition of Site |
| 9 | 0.713 | Late site handover to contractor |
| 10 | 0.710 | Non Payment or Delayed payment of Legit Contractor claims |
| 10 | 0.710 | Ineffective delay penalties |
| 12 | 0.674 | Lack of experience of owner |
| 13 | 0.628 | Low financial incentives for contractor to finish ahead of schedule |

**Table 3:** Contractor related Factors

| Rank | RII | Contractor related factors |
|---|---|---|
| 1 | 0.85 | Ineffective planning and scheduling |
| 2 | 0.84 | Poor site management and supervision |
| 3 | 0.79 | Multiple number of contracts by a single contractor |
| 4 | 0.78 | Contractor inadequate experience |
| 5 | 0.78 | Excessive subcontracting of works |
| 6 | 0.75 | Late site mobilization |
| 7 | 0.74 | Rework due to error and defective work |
| 8 | 0.74 | Use of Conventional/Inappropriate Construction Technology |
| 9 | 0.74 | Delays in subcontractor works |

**Table 4:** Consultants related Factors

| Rank | RII | Consultant related factors |
|---|---|---|
| 1 | 0.828 | Design Changes during Construction |
| 2 | 0.749 | Delayed Review of Documents |
| 3 | 0.744 | Delays in Producing Designs and Revisions |
| 4 | 0.733 | Insufficient experience of consultant |
| 5 | 0.713 | Delays in inspection and testing |
| 6 | 0.659 | Complexity in Designs |

**Table 5:** Materials and Equipment related Factors

| Rank | RII | Material and Equipment related factors |
|---|---|---|
| 1 | 0.772 | Shortage of Construction Materials |
| 2 | 0.764 | Delayed Procurement of materials |
| 3 | 0.756 | Poor Material Procurement Plan |
| 4 | 0.749 | Lack of Advanced Equipment |
| 5 | 0.744 | Low productivity and efficiency of equipment |
| 6 | 0.718 | Changes in materials specifications during construction |
| 7 | 0.710 | Low Quality Construction Materials |

**Table 6:** Labour related Factors

| Rank | RII | Labour related factors |
|---|---|---|
| 1 | 0.813 | Insufficient Skilled Manpower |
| 2 | 0.810 | Lack of training of workers |
| 3 | 0.710 | Low Productivity of workers |
| 4 | 0.682 | Poor Living Standard of Workers at Site |
| 4 | 0.682 | Poor Grievance Handling |
| 6 | 0.672 | Unavailability of Unskilled Manpower |
| 7 | 0.649 | Low motivation and morale of labor |
| 8 | 0.585 | Strikes by site personnel |
| 9 | 0.551 | Conflicts between Labors |

**Table 7:** Project / Contract related Factors

| Rank | RII | Project / Contract related factors |
|---|---|---|
| 1 | 0.810 | Disputes between contracting parties |
| 2 | 0.779 | Discrepancy in Contracts |
| 3 | 0.777 | Insufficient Coordination between Project Parties |
| 4 | 0.736 | Issues in Obtaining Permission from Local Authorities |

**Table 8:** Finance related Factors

| Rank | RII | Finance related factors |
|---|---|---|
| 1 | 0.805 | Inadequate fund/Owner financial problem |
| 2 | 0.800 | Low Financial capability of Contractor |
| 3 | 0.797 | Delay payment by contractor to subcontractor |
| 4 | 0.741 | Inflation/Price escalation |
| 5 | 0.731 | High interest rates |

**Table 9:** External Factors

| Rank | RII | External factors |
|---|---|---|
| 1 | 0.772 | Corruption |
| 2 | 0.700 | Force Majeure (Strikes, Pandemics, Natural Calamities) |
| 3 | 0.692 | Public Obstruction |
| 4 | 0.687 | Adverse Weather and Geography |
| 5 | 0.677 | Political Interventions |
| 6 | 0.674 | Insufficient Insurance Mechanisms |
| 7 | 0.672 | Change in rules and regulation |
| 8 | 0.641 | Unexpected geological condition |
| 9 | 0.618 | Accidents during construction |

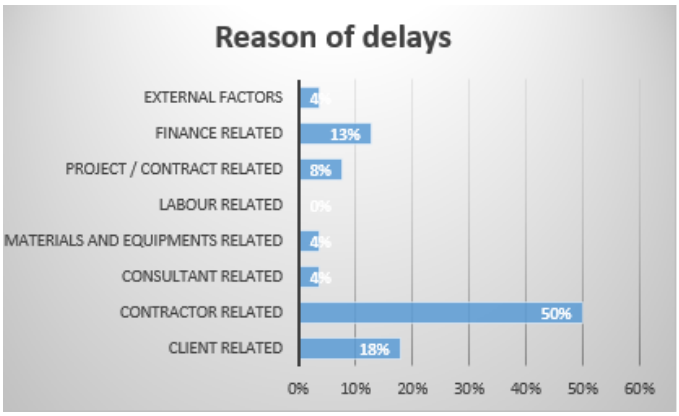


**Figure 8:** reasons of delays based on responses

### 4.6 Ranking of Top Thirty delay factors

Based on the overall response of respondents, the RII of different factors were calculated and analyzed. The outcome of the analysis has been listed in table as below:

**Table 10:** Top 30 Factors of delays

| Category | Rank | RII | Factors |
|---|---|---|---|
| Contractor | 1 | 0.850 | Ineffective planning and scheduling |
| Contractor | 2 | 0.840 | Poor site management and supervision |
| Consultants | 3 | 0.828 | Design Changes during Construction |
| Labour | 4 | 0.813 | Insufficient Skilled Manpower |
| Project | 5 | 0.810 | Insufficient Coordination between Project Parties |
| Labour | 6 | 0.810 | Lack of training of workers |
| Client | 7 | 0.810 | Delay in approval and decision making |
| Finance | 8 | 0.805 | Inadequate fund/Owner financial problem |
| Client | 9 | 0.800 | Changes in the Design/scope of works during Construction |
| Contractor | 10 | 0.800 | Low Financial capability of Contractor |
| Finance | 11 | 0.797 | Delay payment by contractor to subcontractor |
| Contractor | 12 | 0.790 | Multiple number of contract by single contractor |
| Contractor | 13 | 0.780 | Contractor inadequate experience |
| Client | 14 | 0.780 | Delay in work progress payments |
| Contractor | 15 | 0.780 | Excessive subcontracting of Works |
| Project | 16 | 0.779 | Issues in Obtaining Permission from Local Authorities |
| Project | 17 | 0.777 | Disputes between contracting parties |
| External | 18 | 0.772 | Corruption |
| Materials and equipment | 19 | 0.772 | Shortage of Construction Materials |
| Materials and equipment | 20 | 0.764 | Delayed Procurement of materials |
| Client | 21 | 0.760 | Poor communication and coordination with other parties |
| Materials | 22 | 0.756 | Poor Material Procurement Plan |
| Contractor | 23 | 0.750 | Late site mobilization |
| Client | 24 | 0.750 | Low financial incentives for contractor to finish ahead of schedule |
| Consultants | 25 | 0.749 | Delayed Review of Documents |
| Materials and equipments | 26 | 0.749 | Lack of Advanced Equipment |
| Consultants | 27 | 0.744 | Delays in Producing Designs and Revisions |
| Client | 28 | 0.744 | Late Acquisition of Site |
| Materials and equipment | 29 | 0.744 | Low productivity and efficiency of equipment |
| Finance | 30 | 0.741 | Inflation/Price escalation |

## 5. Conclusions and Recommendations

In conclusion, our research has underscored a concerning trend in the construction of health buildings within Bagmati

Province, revealing that delays plague approximately 80 percent of projects. This pervasive issue warrants immediate attention from all stakeholders within the sector. Based on our findings, we have identified the top ten causes of these delays:

- Ineffective Scheduling and Planning
- Poor Site Management and Supervision
- Changes in Designs during Construction
- Insufficient Skilled Manpower
- Insufficient Coordination between Project Parties
- Lack of Training for Workers
- Delay in Approval and Decision Making
- Inadequate Funding/Owner Financial Issues
- Changes in the Design/Scope of Work during Construction
- Low Financial Capability of Contractors

It is evident that many of these delay factors can be proactively addressed during the design phase by implementing robust scheduling and planning strategies for construction activities. Furthermore, enhancing the skills of our workforce through training programs can boost productivity and mitigate potential delays.

In light of these findings, we offer the following recommendations to alleviate the delay problem and improve the overall efficiency of health building construction projects in Bagmati Province:

- **Advanced Planning and Scheduling:** Prioritize the development of comprehensive project schedules and plans that consider potential bottlenecks and contingencies, reducing the risk of delays.
- **Enhanced Site Management:** Implement effective site management and supervision practices to ensure that construction activities proceed smoothly and efficiently.
- **Stability in Design:** Minimize changes in design specifications during construction by thoroughly reviewing and finalizing designs before the commencement of building activities.
- **Skilled Workforce:** Invest in training programs and skill development for construction workers to enhance their capabilities and productivity on-site.
- **Improved Collaboration:** Foster better communication and coordination among all project stakeholders to streamline decision-making processes and reduce approval delays.
- **Financial Planning:** Address financial challenges by securing adequate funding and financial resources, ensuring that owner financial problems do not hinder project progress.
- **Experienced Project Managers:** Appoint specialized project managers with expertise in project scheduling and control to oversee construction projects, particularly for contractors with low financial capacity.

By implementing these recommendations, we can work collectively to mitigate delays, enhance project efficiency, and ultimately improve the construction process for health buildings in Bagmati Province. It is our hope that these measures will contribute to the successful and timely completion of vital healthcare infrastructure projects in the region.

## 6. Further Research

The limitations of this research can be used as starting point for further researches that can be conducted on this topic.

- Further study to validate the outcomes of the research with similar prevalent research works or case studies can be carried out.
- Furher researches can be carried out only prioritizing the top three catagories of factors causing schedule overruns in public health buildings.

## References


[1] Remon F Aziz and Asmaa A Abdel-Hakam. Exploring delay causes of road construction projects in Egypt. *Alexandria Eng. J.*, 55(2):1515–1539, 2016.

[2] Onur Selcuk, Harun Turkoglu, Gul Polat, and Miklós Hajdu. An integrative literature review on the causes of delays in construction projects: evidence from developing countries. *Int. J. Constr. Manag.*, 0(0):1–13, 2022.

[3] Mahendra Bhattarai. Causes of Delay in Construction Projects in Nepal. *Saudi J. Eng. Technol.*, 8(06):108–114, 2023.

[4] Anjay Kumar Mishra and P S Aithal. Financial Impact Assessment of Time Overrun: A Case of Second Small Towns Water Supply and Sanitation Sector Project, Nepal. *SSRN Electron. J.*, 2020.

[5] A A Aibinu and G O Jagboro. The effects of construction delays on project delivery in Nigerian construction industry. *Int. J. Proj. Manag.*, 20(8):593–599, 2002.

[6] Omayma Motaleb and Mohammed Kishk. An investigation into causes and effects of construction delays in UAE. *Assoc. Res. Constr. Manag. ARCOM 2010 - Proc. 26th Annu. Conf.*, (January 2010):1149–1157, 2010.

[7] M. Haseeb, Xinhai Lu, Aneesa Bibi, Maloof-ud Dyian, and Wahab Rabbani. Problems of Projects and Effects of Delays in the Construction Industry of Pakistan. *Aust. J. Bus. Manag. Res.*, 01(06):41–50, 2012.

[8] Murali Sambasivan and Yau Wen Soon. Causes and effects of delays in Malaysian construction industry. *Int. J. Proj. Manag.*, 25(5):517–526, 2007.

[9] Sadi A. Assaf and Sadiq Al-Hejji. Causes of delay in large construction projects. *Int. J. Proj. Manag.*, 24(4):349–357, 2006.

[10] Suresh Kumar Chaudhary. An Analysis of the Key Factors Causing Delays on RCC Building Construction Projects in " Malkot Village " Kalikot District , Nepal. (January), 2023.

[11] Reshma Mary Johnson and Robin Itty Ipe Babu. Time and cost overruns in the UAE construction industry: a critical analysis. *Int. J. Constr. Manag.*, 20(5):402–411, 2020.

[12] Gui Xiang Chen, Ming Shan, Albert P.C. Chan, Xu Liu, and Yi Qing Zhao. Investigating the causes of delay in grain bin construction projects: the case of China. *Int. J. Constr. Manag.*, 19(1):1–14, 2019.

[13] Hemanta Doloi, Anil Sawhney, K. C. Iyer, and Sameer Rentala. Analysing factors affecting delays in Indian construction projects. *Int. J. Proj. Manag.*, 30(4):479–489, 2012.

[14] Junaid Tariq and S. Shujaa Safdar Gardezi. Study the delays and conflicts for construction projects and their mutual relationship: A review. *Ain Shams Eng. J.*, 14(1):101815, 2023.

[15] Adnan Enshassi, Jomah Al Najjar, and Mohan Kumaraswamy. Delays and cost overruns in the construction projects in the Gaza Strip. *J. Financ. Manag. Prop. Constr.*, 14(2):126–151, 2009.

[16] Mbuyamba Mbala, Clinton Aigbavboa, and John Aliu. Causes of delay in various construction projects: A literature review. *Adv. Intell. Syst. Comput.*, 788(January):489–495, 2019.

[17] D Obodoh. Causes and Effects of Construction Project Delays in Nigerian Construction Industry. *IJISET - International J. Innov. Sci. Eng. Technol.*, 3(5):65–84, 2016.

[18] Qais Amarkhil, Emad Elwakil, Bryan Hubbard, and Vetria L. Byrd. A framework to standardize causes of construction delay. *Int. J. Constr. Manag.*, 23(11):1791–1804, 2023.

[19] Mulenga Mukuka, Clinton Aigbavboa, and Wellington Thwala. Understanding Construction Projects' Schedule Overruns in South Africa. *ICCREM 2015 - Environ. Sustain. Build. - Proc. 2015 Int. Conf. Constr. Real Estate Manag.*, (September):591–602, 2015.