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Time Overrun Study in Construction Projects of Rural Municipalities in Syangja, Gandaki Province, Nepal

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Abstract*— Time overrun in construction projects is one of the most frequent problems causing considerable negative impact on the project and participating parties. The main objective of this study is to identify the significant factors causing delay and the effects of delay in construction projects of rural municipalities in Syangja, Gandaki Province, Nepal. Rural Municipalities in Syangja allocate about 38 percent of their total budget in capital expenses; majority of which includes construction works. A literature review was conducted to identify 92 factors causing delays in construction projects and 18 effects of delays to the completion of the projects. A questionnaire survey was conducted to collect responses regarding the causes and effects from technical representatives of clients, consultants and contractors. Five most significant causes of delay factors according to the Relative Importance Index (RII) based on the responses of 54 respondents were: (1) Unavailability/ Inadequate availability of local construction materials like gravel, sand and earth soil due to restrictions in extraction of materials from rivers, (2) Low bidding on contracts, (3) Number of running projects in hand, (4) Absence of consultant's site staff, and (5) Delays in site mobilization. Five main effects of delay were: (1) Increase in overall project cost, (2) Increase in stress to the whole team, (3) Breach of contract schedule, (4) Disputes, and (5) Arbitration. Initial Environment Examination (IEE) or Environmental Impact Assessment (EIA) reports for the extraction of river bed materials needs to be approved on time to deal with the most significant factor causing delays. The construction projects implemented and procured in the Fiscal Year (F.Y.) 2076/077 B.S. through National Competitive Bidding (NCB) and completed by the end of F.Y. 2078/079 B.S. were studied to determine the time overrun and cost overrun. Kuvinde-Mattikhan-Nuwakot Road Part Ka; a project of Phedikhola Rural Municipality experienced the highest time overrun of 604.40 %.The Construction and Upgrading of Rodhikhola-Chitre-Ramche Rural Road, Harinas Rural Municipality-04 experienced the highest cost overrun of 8.85% due to addition of work and change in design.

Keywords—Time overrun; Delay factors; Delay effects ; Relative importance Index ; National Competitive Bidding

I. INTRODUCTION

Time overrun is a common problem in most of the construction projects. Construction delays are likely to occur due to factors related to various groups like contractor, consultant, client, material and equipment, labour, contract related and external factors. A case study by Shah on causes for delay and cost overrun of Australia, Malaysia and Ghana concluded that causes of delay and cost overrun differ from country to country and so does the measures to reduce impacts of the delay [13]. Delay and cost overrun are the most common problem that construction industry faces in developed and developing nations [4]. In a time overrun study of 35 public health building construction projects by Yadav and Mishra 65% of total projects suffered from time overrun ranging from 21% to 248% of their initial schedule [18].

In Europe, The undersea rail channel tunnel linking the United Kingdom and France with a length of about fifty kilometres faced increase in construction cost from £2600 million to £4650 million (1985 prices), which was eighty percent (80%) higher than the forecasted costs [6]. Another underground highway project failure in Boston, America occurred due to persistent tunnel leaks resulted a cost overrun of US $ 11 billion or two hundred seventy five percent (275%) [7]. Delay creates situation between client and contractor such as disputes, arbitration, litigation and total abandonment [12].

Nepalese construction industry contributes around 10 to 11 percent to the national GDP and it uses around 35 percent of the government budget. It is also estimated that the construction sector is creating employment opportunities for about one million people and is next to the agricultural sector in terms of employment generation [5]. Most of development projects implementation in Nepal has remained ineffective and failed to achieve the desired objectives. Time and cost overruns are common occurrence [10]. The Government of Nepal after promulgation of Constitution of Nepal – 2072 established federal government structure with 753 local levels. According to that, there are 6 metropolitan cities, 11 sub-metropolitan cities, 276 municipalities and 460 village bodies. Local level governments receive a significant amount of budget each year and a considerable percentage of which is allocated for construction works.

II. LITERATURE REVIEW

A. Time Overrun

Time overrun is a delay in timely completion due to delay of critical path activities and project goes beyond the designed schedule. Construction time is one of the measures for assessing the performance of a project and the efficiency of the project Organization. Timely completion of construction work is one of the major goals of the client and contractor

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because each party tends to incur additional costs and lose potential revenues in case completion is delayed [17].

B. Previous studies

The problem of delay, time overrun and cost overrun in construction projects are also key issues in the construction industry of developed countries. In a survey conducted electronically sending invitation links to 11000 potential respondents out of whom 219 experts completed the survey. Analysis of the collected data revealed that change orders, time-consuming decision making by the owner, and design errors were the most important causes of construction delays in the U.S. [12].

A systematic study conducted to review studies on construction project delays (CPDs) published between 1985 and 2018, revealed that the researchers from developing countries contributed the most to identify the causes of CPD. Weather/climate conditions, poor communication, lack of coordination and conflicts between stakeholders, ineffective or improper planning, material shortages, financial problems, payment delays, equipment/plant shortage, lack of experience/qualification/competence among project stakeholders, labour shortages and poor site management were identified as the ten most common CPDs [2].

According to the study conducted within Malaysian Construction Industries, ten most important causes of delays were (1) contractor's improper planning, (2) contractor's poor site management, (3) inadequate contractor experience, (4) inadequate client's finance and payments for completed work, (5) problem with subcontractors, (6) shortage in material, (7) labor supply, (8) equipment availability and failure, (9) lack of communication between parties, and (10) mistakes during construction stage. The study also identified six different effects of delays as (1) time overrun, (2) cost overrun, (3) disputes, (4) arbitration, (5) litigation, (6) total abandonment [10].

A case study conducted by Basit, M. et al. (2018) [2] of an interchange project in capital city of Pakistan revealed a time creep of 77% (187 days) of original contract duration (243 days) and resulted in EOT to 430 days as a result of which there was a major change in the critical path of the project .

Suwal and Shrestha (2016) [16] attempted to highlight the causes of the delay in motorable bridge construction of the Postal Highway Project under DOR. The study revealed that all the projects under Project office Dhangadi and Itahari suffered schedule overrun and project office Birganj suffered least with 60 % of the total projects. The main causes of delay were found to be unusually low bid by contractors, lack of planned pre-execution of the project, delay in receiving clearances from various government authorities, poor site management and supervision by the contractors due to large number of work in hand.

From the research by Subedi and Joshi (2020), [15] it was found the road projects under Strengthening National Rural Transport Programme (SNRTP) in the Gandaki Province are extended maximum 114% and minimum 24% and not timely completed. The most of the causes fall under unforeseen, external contributed events which couldn't be either in the control of clients or contractors. Besides, it was seen that, the projects for which contract agreement has been done generally in May, June and July, the projects were highly victimized for a longer period of extension.

C. Grouping of delay factors

In a study conducted in Egypt thirty-two delay factors were classified into nine major categories as (1) Financing, (2) Manpower, (3) Project changes, (4) Contractual relationships, (5) Environmental factors, (6) Equipment, (7) Rules and regulations, (8) Material and (9) Scheduling and Control [1].

Delay factors identified in different research literature from all around the world were collated and grouped into eighteen categories as (1) Financer, (2) Project-related, (3) Project Attributes, (4) Owner/Client, (5) Contractor, (6) Consultant, (7) Design-related, (8) Coordination, (9) Materials, (10) Plant/Equipment, (11) Labour/Manpower, (12) Environment, (13) Contract-related, (14) Contractual relationships, (15) External, (16) Changes, (17) Scheduling & Controlling and (18) Governmental relations [11].

In the study conducted to determine the delay factor and their effects by Sambasivan & Soon (2006) [12] the researchers identified the major causes of delays and categorized them as client related, contractor related, consultant related, labor related, material related, contract related, contract relationship related and external factors.

III. METHODOLOGY

A. Study Area

The study area as shown in Fig. 1 includes all six rural municipalities of Syangja district namely Aandhikhola, Arjunchaupari, Biruwa, Phedikhola, Harinas and Kaligandaki. A total budget of almost two billion twenty eight million Nepalese rupees is presented each year in rural municipalities of Syangja district. Out of the total budget about 38% is allocated under capital part and most of which comprise of construction works. Fig. 2 shows the breakdown of the total budget for the Fiscal Year (F.Y.) 2076/077 of all the rural municipalities of Syangja district.

B. Research Approach

The study was conducted through qualitative and quantitative analysis. Questionnaire survey was designed to get opinions from clients, consultants and contractors of construction companies in regards to the factors causing delays and effects of delays. Qualitative data acquired from clients consultants and contractors were analyzed.

C. Questionnaire Sections

A questionnaire was developed to assess the perceptions of clients, contractors and consultant on the relative importance of causes and effects of delay in construction works under authority of rural municipalities of Syangja, Gandaki Province, Nepal. The questionnaire comprised of three sections. The first section requested background information about the respondents.

The second part focused on the factors causing delay that were categorized into six groups as client related contractor related, consultant related, labour related, material and equipment related and external related factors. The respondents were asked to respond on 92 construction delay factors finalized through literature survey of past studies.

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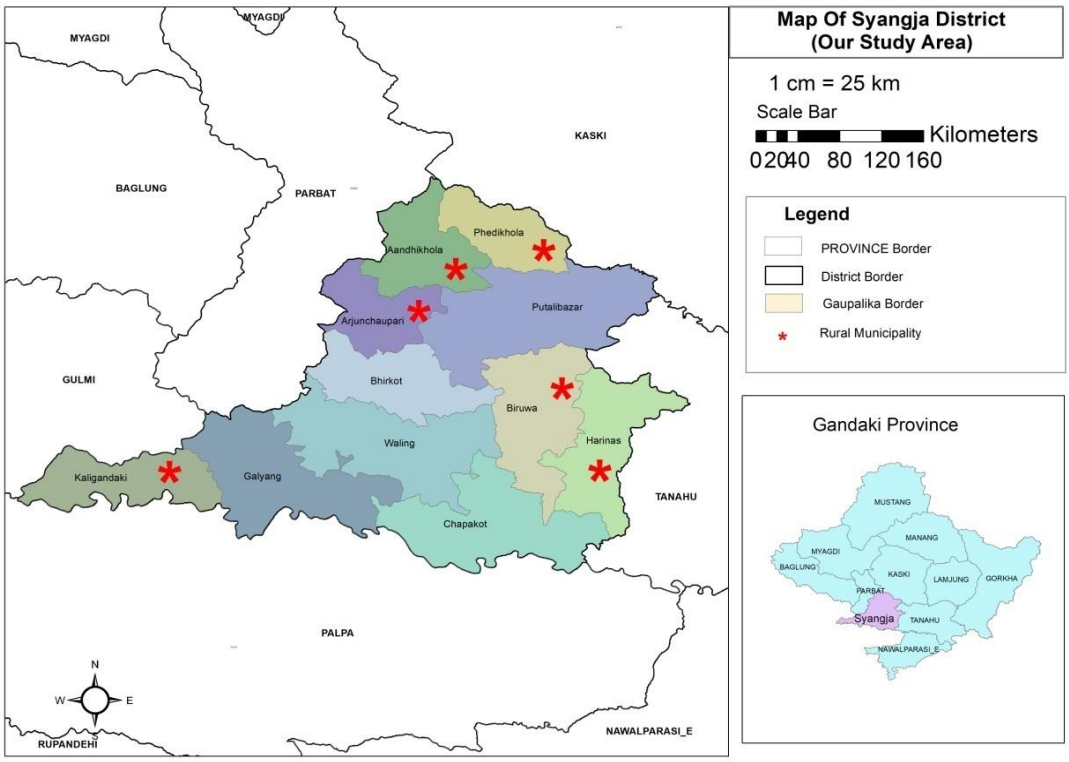

Fig. 1 Study Area (Source: Survey Department Syangja)

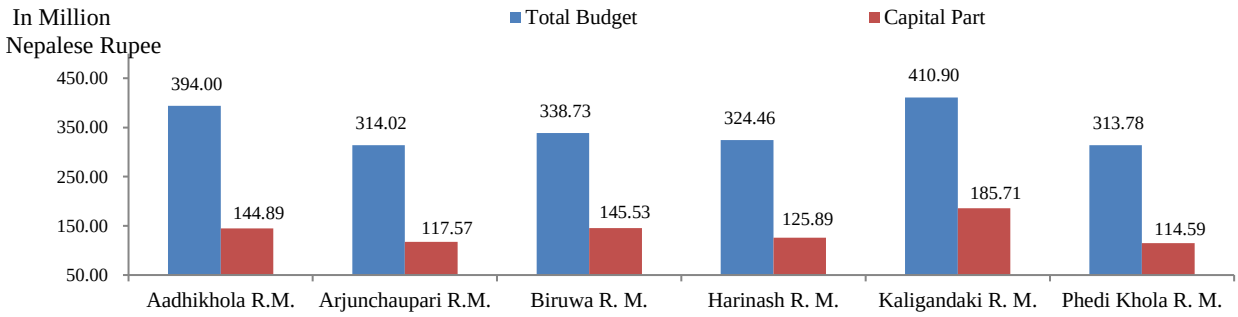

Fig. 2 Breakdown of total budget in rural municipalities

1. Client related factors: Lack of experience of owner in construction, Delay in Contract Agreement, Delay in providing work order for the site, Late mobilization advance payment to the awarded contract, Delay in interim progress payments by owner, Suspension of work by owner, Interference by the owner in the construction operations, Unrealistic contract duration, Delay in issuing of change orders by the owner, Slow decision making by the owner organization, Lack of Coordination with contractors and consultant, Delay in the settlement of contractors' claims by the owner, Contract modifications (replacement and addition of new work to the project and change in specifications), Inapplication of price escalation clause of PPR 2064 in Contract Document, Unavailability of construction material testing labs in local level institution, Change in Scope of the project, Ambiguities, mistakes, and inconsistencies in specifications and drawings, Subsurface site conditions materially differing from contract documents, Original contract duration is too short and Improper project feasibility study.
2. Contractor related factors: Lack of motivation among contractor's members, Shortage of contractor's administrative Personnel, Shortage of technical personnel in the contractor's organization, Poor communications by the contractor with the parties involved in the project, Slow preparation of changed orders requested by the contractor, Ineffective contractor head office involvement in the project, Poor controlling of sub-contractor(s) by the contractor, Poor qualifications of the contractor assigned to the project, Improper technical studies by the contractor during the bidding stage, Low bidding

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of contract, Failure to evaluate site, Delays in site mobilization, Ineffective planning and scheduling of the project by the contractor, Delay in field survey by the contractor, Ineffective control of project progress by the contractor, Inefficient quality control by the contractor, Improper construction methods implemented by the contractor, Difficulties in financing project, Late procurement of materials, Poor qualification of the contractor's technical staff, Poor site management and supervision by the contractor, Re-work due to errors during construction, Number of running projects in hand, Poor communication and coordination by contractor with other parties and Delays in sub-contractors' work.

3. Consultant related factors: Insufficient resources of consultant, Inadequate experience of consultant, Poor qualification of consultant engineers' staff assigned to the project, Delay in finalization of design details and drawings, Poor design and discrepancies in design documents, Delays in certifying contractor's interim bills, Slow response and poor inspection, Incomplete Documents, Absence of consultant's site staff, Delayed supervision and slow decisions making, Defective design and specification, Poor assessment of environmental issues and Poor identification of risk factors during planning and design phase.
4. Labour related factors: Shortage of labors, Low productivity level of labors, Personal conflicts among labors, Injuries of labors, Unavailability of skilled labor in local market, Migration of labor force from one project to other project without completing their work job, Absence of labor at government holidays like Dashain, Tihar, Chhat Parva and other and Low skill of manpower
5. Material and equipment related factors: Shortage of required materials, Delay in material delivery, Change in material prices, Change in material specifications, Unavailability of local construction materials like gravel, sand and earth soil due to restriction in exploitation of river, Delivery of poor quality construction material at site, Shortage of required equipments, Failure of equipments, Shortage of supporting and shoring installations for excavations, Inadequate equipment used for the works, Delay in mobilization of equipments to site, Lack of timely repair of equipments in site and Lack of supply of sufficient quantity of fuel required for operation of equipments.
6. External related factors: Severe weather conditions on the job site, Lack of tools and equipment on the market, Poor site conditions (location, ground, etc.), Poor economic conditions (currency, inflation rate, etc.), Waiting time for approval of drawings and test samples of materials, Lack of cooperation from concerned offices during the process of land acquisition for project, Change in the weather and climate condition during construction, Change in the government regulation and laws, Strike by different political parties, Disturbance from public during construction, Accident during construction, Delay due to natural disaster to the site area and Unexpected geological condition.

Third section of the questionnaire focused on the effects of construction delay in the construction projects. The eighteen effects of the construction delay identified were: Increase in overall project cost, Increase in the market risk, Breach of contract schedule, Decrease in the overall efficiency, Decreases safety of individuals, Increase in the land acquisition cost, Increase in the material cost, Increase in the labor charge, Dispute, Arbitration, Total abandonment, Litigation, Increases stress to overall team, Acceleration of work to meet the predetermined schedule, Poor quality due to acceleration, Loss of goodwill in the market, Bad impression to the donor agency and Less utilization of project benefit.

A five-point Likert scale ranging from 1 (strongly disagree0 to 5 (strongly agree) was adopted to capture the importance of causes and effects of delays.

The convenience sampling techniques was used to determine the sample size from the total population. We distributed the questionnaire through email to different rural municipalities, contractors and consultants. This sampling method enabled us to obtain response on time. Complete set of questionnaire was mailed to potential fifty seven respondents. The Table I shows the response percentage of each group.

$$n = \frac{N}{(1+N*e^2)} \text{ (Yamane,1997)} \quad (1)$$

Where, n is the sample size, N is the population size and e is the margin of error (10% in this case).

D. Calculation of relative importance indices of factors

Sambasivan M., & Soon Y. W. [12] used the Relative Importance Index (RII) method to determine the relative importance of causes of delays and the effects of delay. The same method was adopted in this study within various parties (i.e. clients, contractors or consultants). The five point scale ranged from 1 (Strongly Disagree) to 5 (Strongly Agree) was adopted and used to calculate RII for each factor as follows:

$$RII = \frac{\sum W}{A*N} \quad (2)$$

Where, W is the weight given to each of the factors by the respondents (ranging from 1 to 5), A, is the highest weight (i.e. 5 in this case), and N is the total number of respondents.

Where, W is the weight given to each of the factors by the respondents (ranging from 1 to 5), A, is the highest weight (i.e. 5 in this case), and N is the total number of respondents. The value of RII had a range from 0 to 1, higher the value of RII, higher was the rank of that cause or effect of delays. These rankings were used to compare the relative importance of the factors as perceived by the three parties of respondents (i.e. clients, consultants and contractors).

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TABLE I. RESPONDENTS OF QUESTIONNAIRE SURVEY

S.N.	Description	Total	Target	Respondents	Percentage
1	Clients	30	24	22	91.67%
2	Contractors	20	17	16	94.11%
3	Consultants	18	16	16	100.00%
	Total	68	57	54	94.74%

RII values of each cause were used to assess the general and overall rankings in order to give an overall picture of the causes of delay of construction works in rural municipalities. The similar method was adopted for ranking the effects.

IV. ANALYSIS OF DATA

The demographic characteristics of the respondents are as shown in Table II. The table shows the frequency of occurrence of each option of gender, age group, qualification, working position and its frequency of occurrence according to the response, largest project involved based on estimated cost and number of projects in a year.

A. Reliability of Research Instrument

Cronbach's coefficient alpha (α) was used to test the reliability of five point Likert's scale used in the survey. The acceptable lower limit for Cronbach's alpha is generally considered to be 0.7, all the, client related (α = 0.914), contractor related (α = 0.919), consultant related (α = 0.900), labour related (α = 0.748), material and equipment related (α = 0.914), external related (α = 0.867) factors using measurement of internal consistencies approach showed that Cronbach's alpha are greater than 0.7. These fall within the acceptable value considered for research instrument's reliability.

TABLE II. DEMOGRAPHIC CHARACTERISTICS OF RESPONDENTS

Demographic Characteristics	Frequency	Percent
Gender		
Male	49	90.74
Female	5	9.26
Age Group		
18-27	11	20.37
28-37	32	59.26
38-47	7	12.96
48 and above	4	7.41
Qualification		
Intermediate	10	18.52
Bachelors	34	62.96
Masters (M.E./MSc.)	10	18.52
Working Position		
Client Engineer/ Jr. Engineer	22	40.74
Contractor/ Technical Representative	16	29.63
Consultant/ Technical Representative	16	29.63
Largest Project involved based on estimated cost		
< 20 Million Rupees	9	16.67
20 - 50 Million Rupees	13	24.07
50 - 100 Million Rupees	6	11.11
> 100 Million Rupees	26	48.15
Number of Project in a year		
< 20 nos.	33	61.11
20 - 40 nos.	9	16.67
40 - 60 nos.	3	5.56
> 60 nos.	9	16.67

B. Causes of Delay

The primary data collected from the section second of the questionnaire was analyzed from the viewpoint of clients, consultants and contractors. The relative importance index, RII, was computed for each cause to identify the most important causes.

Based on the ranking, the five most significant causes of construction delays as perceived by clients were: (1) unavailability of local construction materials like gravel, sand and earth soil due to restriction in exploitation of river (RII = 0.845), (2) low bidding of contract (RII = 0.827), (3) number of running projects in hand (RII = 0.827), (4) inefficient quality control by the contractor (RII = 0.809), (5) ineffective planning and scheduling of the project by the contractor (RII = 0.800), (6) improper technical studies by the contractor during the bidding stage (RII = 0.800), (7) incomplete documents (RII = 0.800), (8) poor communications by the contractor with the parties involved in the project (RII = 0.800), and (9) poor site management and supervision by the contractor (RII = 0.800). The five most important causes of construction delays as perceived by contractors were: (1) unavailability of local construction materials like gravel, sand and earth soil due to restriction in exploitation of river (RII = 0.875), (2) delayed supervision and slow decisions making (RII = 0.850), (3) shortage of required materials (RII = 0.813), (4) change in the weather and climate condition during construction (RII = 0.813), and (5) unavailability of construction material testing labs in local level institution (RII = 0.813). The five most important causes of construction delays as perceived by consultants were: (1) unavailability of local construction materials like gravel, sand and earth soil due to restriction in exploitation of river (RII = 0.838), (2) ineffective planning and scheduling of the project by the contractor (RII = 0.838), (3) number of running projects in hand (RII = 0.825), (4) low bidding of contract (RII = 0.813), (5) delays in site mobilization (RII = 0.813), and (6) poor communication and coordination by contractor with other parties (RII = 0.813).

From the above section, it is seen that unavailability of local construction material due to restriction in exploitation of river is the most significant factor causing delay as perceived by each group of respondents. Table III shows the ranking of categories of delay as perceived by clients, contractors and consultants individually and the overall ranking.

Spearman's correlation coefficient was determined to test the degree of agreement between the three groups of respondents as to the causes of delays. Table IV gives the result of correlation among the ranks of clients, contractors and consultants. There is high degree of agreement between response of clients and consultants.

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C. Effects of Delay

The primary data collected from the third section of the questionnaire form was analyzed from the viewpoint of clients, consultants, and contractors. Equation (2) was used to calculate RII value and ranking were done based on individual group of respondents and overall response.

The five most significant effects of delay as response of clients were: (1) increase in overall project cost (RII = 0.836), (2) increases stress to overall team (RII = 0.836), (3) dispute (RII = 0.836), (4) arbitration (RII = 0.836) and (5) breach of contract schedule (RII = 0.800). The five most important effects of delay as response of contractor were: (1) increase in overall project cost (RII = 0.863), (2) breach of contract schedule (RII = 0.850), (3) dispute (RII = 0.813), (4) increase in material cost (RII = 0.813), (5) decrease in overall efficiency (RII= 0.813) and (6) increase in labor charge (RII = 0.813).the significant effects of delay as perceived by consultants were: (1) increases stress to overall team (RII = 0.925), (2) increase in overall project cost (RII = 0.913), (3) breach of contract schedule (RII = 0.875), (4) poor quality due to acceleration (RII = 0.863), (5) arbitration (RII = 0.800) and (6) litigation (RII =0.800).

From the above discussion it is seen that three effects of delay perceived by parties are common: increase in overall project cost, breach of contract schedule, dispute.

Spearman's correlation coefficient was determined to test the degree of agreement between the three groups of respondents as to the effects of delays. Table V gives the result of correlation among the ranks of clients, contractors and consultants. There is high degree of agreement between response of clients and consultants.

TABLE III. RANKS OF CATEGORIES OF FACTORS CAUSING DELAY

S.N.	Group of Factor Causing delay	RII Client	Rank Client	RII Contractor	Rank Contractor	RII Consultant	Rank Consultant	Overall RII	Overall Rank
1	Contractor	0.768	1	0.655	6	0.753	1	0.730	1
2	Material and Equipment	0.714	3	0.706	4	0.738	2	0.719	2
3	External	0.671	5	0.761	1	0.733	3	0.716	3
4	Consultant	0.738	2	0.734	2	0.586	6	0.691	4
5	Labour	0.675	4	0.658	5	0.673	4	0.669	5
6	Client	0.631	6	0.710	3	0.651	5	0.660	6

TABLE IV. SPEARMAN'S RANK CORRELATION COEFFICIENTS OF RANK FOR CAUSES OF DELAYS

			Rank of Client	Rank of Contractor	Rank of Consultant
Spearman's rho	Rank of Client	Correlation Coefficient	1.000	0.115	0.437**
		Sig. (2-tailed)	.	0.273	0.000
		N	92	92	92
	Rank of Contractor	Correlation Coefficient	0.115	1.000	0.162
		Sig. (2-tailed)	0.273	.	0.124
		N	92	92	92
	Rank of Consultant	Correlation Coefficient	0.437**	0.162	1.000
		Sig. (2-tailed)	0.000	0.124	.
		N	92	92	92
*. Correlation is significant at the 0.05 level (2-tailed).					

TABLE V. SPEARMAN'S RANK CORRELATION COEFFICIENTS OF RANK FOR EFFECTS OF DELAYS

			Rank of Client	Rank of Contractor	Rank of Consultant
Spearman's rho	Rank of Client	Correlation Coefficient	1.000	0.214	0.523*
		Sig. (2-tailed)	.	0.393	0.026
		N	18	18	18
	Rank of Contractor	Correlation Coefficient	0.214	1.000	0.220
		Sig. (2-tailed)	0.393	.	0.380
		N	18	18	18
	Rank of Consultant	Correlation Coefficient	0.523*	0.220	1.000
		Sig. (2-tailed)	0.026	.380	.
		N	18	18	18
*. Correlation is significant at the 0.05 level (2-tailed).					

D. Time overrun calculation

$$\text{Time Overrun} = \frac{\text{Extended Time}}{\text{Initial Contract Period}} * 100 \quad (3)$$

Time overrun calculation presented in the Table VI shows that time overrun range from 41.37 % to 604.40%. Kuvinde Mattikhan Nuwakot Road Part Ka under Phedikhola Rural Municipality experienced maximum time overrun of 604.40 % due to COVID- 19, monsoon, and insufficient temperature for pitching works.

E. Cost overrun calculation

Cost overrun is one of the major effects of time overrun in construction project. Cost overrun occurs in construction project due to increase in the overhead cost, underutilization of resources and price escalation. It can be defined as actual cost increase at the completion compared to the initial estimated cost of the construction project. Cost overruns of projects with at least single variation order are calculated using equation (4) and presented in Table VII.

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$$\text{Cost Overrun} = \frac{\text{Additional cost}}{\text{Initial Contract Amount}} * 100 \quad (4)$$

The Construction and Upgrading of Rodhikhola-Chitre-Ramche Rural Road, Harinas Rural Municipality-04, experienced the highest cost overrun of 8.85% due to change in design and addition of woks.

V. DISCUSSION OF RESULTS

This section discusses the result obtained by analyzing the causes of delay and effects of the delays. In the later part we discuss the findings about delay in rural municipalities.

The ten most significant causes of delays based on the responses of clients, contractors, consultants were: (1) unavailability of local construction materials like gravel, sand and earth soil due to restriction in exploitation of river (RII = 0.852), (2) low bidding of contract (RII = 0.796), (3) number of running projects in hand (RII = 0.796), (4) absence of consultant's site staff (RII = 0.770), (5) delays in site mobilization (RII = 0.767), (6) delays in sub-contractors' work (RII = 0.763), (7) shortage of required materials (RII = 0.763), (8) ineffective planning and scheduling of the project by the contractor (RII = 0.759), (9) lack of cooperation from concerned offices during the process of land acquisition for project (RII = 0.756), (10) unrealistic contract duration (RII=0.752), (11) improper construction methods implemented by the contractor (RII=0.752), (12) late procurement of materials (RII=0.752), (13) poor communication and coordination by contractor with other parties (RII=0.752) and (14) delayed supervision and slow decisions making (RII=0.752), as highly significant causes of delay. Figure 4.4 shows perception of clients, contractors and consultants about causes of delay rank wise based on the overall RII value.

A. Unavailability of local construction materials

Unavailability of local construction materials like gravel, sand and earth soil due to restriction in exploitation of river is the most significant cause causing the construction delays. Due to the scarcity of local construction materials the contractor seeks for cheap materials and without construction material the overall work progress is affected.

B. Low bidding of contract

Contractors usually bid on the basis of estimated amount and go below by certain percentage to get the contract. In doing so, the contractors bid without proper rate analysis and during contract execution period the contractor tries to avoid the items which hinders the progress of the project.

C. Number of running projects in hand

Local contractors take number of construction project in hand at a time and are unable to manage resources and thus projects do not complete on time and needs extension of time for completion.

D. Absence of consultant's site staff

Due to absence of consultant's site staff in the projects there is delay in decision making regarding discrepancy in the design details and this results in delay of project completion.

E. Delays in site mobilization

Delay in site mobilization is one of the most significant causes in causing delay in construction projects. The result of this research indicates that contractors face problem in finance management and thus cannot mobilize resources in site on time. Delay in initial stage is carried over and project completion is delayed.

The ten most significance effects of delays based on the overall response of respondents were: (1) Increase in overall project cost (RII = 0.867), (2) increases stress to overall team (RII = 0.844), (3) breach of contract schedule (RII = 0.837), (4) dispute (RII = 0.804), (5) arbitration (RII = 0.800), (6) Litigation (RII = 0.778), (7) total abandonment (RII = 0.763), (8) increase in market risk (RII = 0.759), (9) increase in material cost (RII = 0.759), (10) acceleration of work to meet predetermined schedule (RII = 0.759) and (11) bad impression to the donor agency (RII = 0.759).

F. Increase in overall project cost

Delay in critical activities lead to time overrun, as it requires more time for completion. Time overrun induce increase in overhead cost and price escalation that cause increase in overall project cost.

G. Increases stress to overall team

Delay in completion of construction project induces stress to all the parties involved in the construction project. It depends upon the perception of an individual based upon their experiences. It is identified as one of the effects of delayed completion of construction projects.

H. Breach of contract schedule

Any contract agreement requires a start date and a date of completion. A schedule of works is prepared in the beginning and when a project is delayed breach of contract schedule is bound to happen unless the schedule is revised on extension of time.

TABLE VI. SCENARIO OF TIME OVERRUN

S.N.	Name of Project	Initial Contract Period in Days	Delay Duration in Days	Time Overrun %	Rural Municipality
1	Tri sahid Secondary school RCC Framed structure academic building construction work. Aandhikhola-01,Panchamul	365	0	0.00%	Aandhikhola
2	Upgrading of Arjunchaupari to Ward No 6 Rural Road	120	0	0.00%	Arjunchaupari
3	Upgrading of Arjunchaupari to Ward No 2 Rural Road	150	288	192.00%	Arjunchaupari
4	Construction of Ward No 2 ward office	150	378	252.00%	Arjunchaupari
5	Upgrading of Ward No 3,4 and 5 Rural Road	158	288	182.28%	Arjunchaupari
6	Upgrading of Arjunchaupari Narbhangang Rural Road	54	0	0.00%	Arjunchaupari

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7	Industrialization Gabion Box Construction	107	0	0.00%	Arjunchaupari
8	Industrialization village Gate and Gabion Box Construction	94	89	94.68%	Arjunchaupari
9	Arjunchaupari Pohor Maila Prasodhan Kendra	120	227	189.17%	Arjunchaupari
10	Construction of Gravel, Drain and Widening of Biruwa Shikharsingh Damsaddhi Bhaldada Motar Bato,	128	124	96.88%	Biruwa
11	The Construction and Upgrading of Rodhikhola-Chitre-Ramche Rural Road , Harinas Rural Municipality-04	365	151	41.37%	Harinas
12	Dalit Basti Bikash Karyakram in ward 4	180	365	202.78%	Kaligandaki
13	Dalit Basti Bikash Karyakram in ward 1	180	365	202.78%	Kaligandaki
14	Kuvinde Mattikhan Nuwawkot Road Chainage 0+735 to 1+850	544	0	0.00%	Phedikhola
15	Sarketari Aarukharka Galem Panchase Road Chainage 0+140 to 0+940	544	0	0.00%	Phedikhola
16	Kuvinde Mattikhan Nuwawkot Road Part Ka	91	550	604.40%	Phedikhola
17	Multipurpose Assembly Hall	365	247	67.67%	Phedikhola
18	Bhalupahad Seti Khola Suspension Bridge Construction	454	0	0.00%	Phedikhola
19	Ward no 1 Ramkot Ward Office Building	454	0	0.00%	Phedikhola

TABLE VII. SCENARIO OF COST OVERRUN

S.N.	Name of Projects	Initial Contract Amount in (NRs.)	Contract Agreement after VO (NRs.)	Additional Amount (NRs.)	Cost Overrun %	Rural Municipality
1	Upgrading of Ward No 3,4 and 5 Rural Road	18,039,741.23	18,469,097.34	429,356.11	2.38	Arjunchaupari
2	Industrialization village Gate and Gabion Box Construction	4,030,945.04	4,108,135.69	77,190.65	1.91	Arjunchaupari
3	The Construction and Upgrading of Rodhikhola-Chitre-Ramche Rural Road , Harinas Rural Municipality-04	18,227,038.09	19,840,401.43	1,613,363.34	8.85	Harinas

I. Breach of contract schedule

Any contract agreement requires a start date and a date of completion. A schedule of works is prepared in the beginning and when a project is delayed breach of contract schedule is bound to happen unless the schedule is revised on extension of time.

J. Dispute

Dispute arises between construction parties in case the other parties don't fulfill their obligation mentioned in the contract agreement. In case delay occurs in completion of construction on time as per the contract, it is likely that dispute arises in between the contractor and client. In situations, contractor overlooks the factors of contractor causing delay and tries to get time extension without any liquidated damage, while client try to penalize contractor with liquidated damage for delay in completion of construction works.

K. Arbitration

Arbitration is a form of Alternative Dispute Resolution (ADR), in which odd number of arbitrators, generally three are appointed to resolve dispute outside formally established court of justice.

L. Provision in Act and Regulation

There is a provision for time extension in the Public Procurement Act [6] and Public Procurement Regulation [7] in case it is unavoidable to extend contract duration due to force majeure, inability of the public entity to make necessary arrangements by it or other reasonable grounds, the competent authority may extend the term on prescribed grounds.

As per the provision of rule 120, Period of procurement contract may be extended. Notwithstanding anything contained in the rule 120, no extension of term shall be so made as to exceed fifty percent of the original term of the contract [7].

VI. RECOMMENDATION TO REDUCE DELAYS

The recommendations to three parties involved in various stages of the construction works based upon the results and finding are discussed below

A. Recommendation for the clients

- Clients should determine initial contract duration in a scientific manner with proper scheduling of works based on the nature of works, availability of materials, environmental conditions and other external factors. The original contract should be realistic and sufficient to complete the works.
- Clients should make necessary arrangements for laboratory testing of material if possible by establishing a laboratory or facilitate in testing of materials in nearby laboratory. It is recommended that rural municipality should establish a civil laboratory under its organization structure as it can be useful to test construction materials used in construction works procured from different methods.
- Before selection of any construction project its feasibility study should be done by the client.
- Clients should coordinate with contractors and consultant to deal and make quick decision about the ambiguities, mistakes, and inconsistencies in specifications and drawings.
- To avoid the chance of Sub-surface site conditions materially differing from contract documents client

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should closely keep an eye on the soil investigation report and design of the structures.

- The client should pay the contractors after completion of works and settle the claims of contractor on time.

B. Recommendation for the contractors

- The contractors should perform their rate analysis for each item; evaluate site, availability of materials, local labors and other possible risk factors before participating in any bid to avoid excessive low bidding.
- The contractors should keep proper records of number of running projects in hand and the same should be considered in evaluation criteria for selection of contractors by implementing agency.
- The contractors should mobilize resources at site on time and properly control pace and quality of the sub-contractors' works.
- The contractors should perform effective planning and scheduling of the projects to prevent possible time overrun. For which the contractor should appoint experienced engineer as project manager.
- The contractors should take approval for use, source of material from project manager and procure material on time as required on site.
- The contractor should use proper construction methods as per relevant specifications.

C. Recommendation for consultants

- There should be provision for consultant's supervising site staff during construction phase to carry out works as per approved design and specifications.
- The consultants should finalize design details and submit a complete set of the documents within the allocated timeframe.
- The consultants should consider all possible risk factors and conduct proper assessment of environmental issues during planning and design phase to avoid the defective design and specification.
- The consultant should make decision on time about design discrepancies in design documents
- The consultant should monitor the construction work closely by making inspections at appropriate times.

VII. CONCLUSION

We investigated the causes and effects of delays facing in the construction projects in rural municipalities of Syangja, Gandaki Province, Nepal. A questionnaire was prepared and mailed to 57 potential respondents among the three major parties of construction project (clients, consultants and contractors). The measurement of reliability of responses by internal consistencies approach showed that Cronbach's alpha are greater than 0.7. We identified main causes of delay and most significant causes were : (1) unavailability of local construction materials like gravel, sand and earth soil due to restriction in exploitation of river, (2) low bidding of contract, (3) number of running projects in hand, (4) absence of consultant's site staff, (5) delays in site mobilization, (6) delays in sub-contractors' work, (7) shortage of required materials, (8) ineffective planning and scheduling of the project by the contractor, (9) lack of cooperation from concerned offices during the process of land acquisition for project, (10) unrealistic contract duration, (11) improper construction methods implemented by the contractor, (12) late procurement of materials, (13) poor communication and coordination by contractor with other parties and (14) delayed supervision and slow decisions making. We identified main effects of delay and they were: (1) Increase in overall project cost, (2) increases stress to overall team, (3) breach of contract schedule, (4) dispute, (5) arbitration, (6) Litigation, (7) total abandonment, (8) increase in market risk, (9) increase in material cost, (10) acceleration of work to meet predetermined schedule and (11) bad impression to the donor agency. Eleven construction projects of rural municipalities out of selected nineteen projects finalized by the end of F.Y. 2077/078 suffered time-overrun. Among the project suffering time extension The Construction and Upgrading of Rodhikhola-Chitre-Ramche Rural Road, Harinas Rural Municipality-04, experienced time extension of 41.37%. Kuvinde Mattikhan Nuwakot Road Part Ka of Phedikhola Rural Municipality experienced the highest time overrun of 604.40 %. We believe that the result of this study can be of immense help to construction parties (clients, contractors and consultants) and research students. The possibility of delay in construction projects can be reduced by better understanding the cause of delay. Similar study can be conducted throughout the country at different level of government. Some of the causes of delay are project and location specific thus it is necessary to perform a separate study.

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