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Original Research Article

Identification of Causes of Delay in Road Projects: Cases in Gandaki Province, Nepal

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Abstract

The construction industry in Nepal is an important sector due to its enormous contribution to the country's economic development. This in terms of employment opportunities and attraction of Foreign Direct Investments which grossly contributes to the country's GDP. Due to various factors many construction projects are prone to delay. These delay factors can only be avoided by first identifying the factors and their sources. The objectives of this research were to find out the causes of delay and to find related importance in completed Road construction projects in SNRTP in Gandaki province in Nepal. The Relative Importance Index (RII) was used to rank the causes of delay. Similarly, reliability of research instrument was calculated using Cronbach's coefficient alpha. The results obtained indicate that the top major causes of delay were; weather and climatic condition (RII=0.898), delay in decision in relocation of service (RII=0.886), long chain of hierarchical decision making process (RII=0.885), land acquisition/donation (RII=0.884), inaccurate time estimation, errors during construction (RII=0.884), conflict between joint ownership of the project (RII=0.872), poor communication and coordination between the participants (RII=0.836), lack of database and experience for estimating activity duration and resources required in a construction (RII=0.818) ,owner's lack of experience and involvement (RII=0.809), shortage of materials /equipment (RII=0.807), improper project document management (RII=0.800), to least ranked consultant's reluctance for change and their flexibilities (RII=0.722) .Finally the top major delay mitigating measures were; Information sharing and Joint risk management, Enhancing Contractual management and administration capability, Making timely decision in project, Managing sufficient time and allocation of adequate team for project preparation, Completing pre-execution preparation of project before project starting, Investigating/studying the site properly, strengthening the skill/capability of human resources and selecting better Time for contract.

Keywords: Project delay, Likert scale, Relative Importance Index (RII), Reliability.

INTRODUCTION

Background of the Study

Due to very rapid rate of development work and the design and construction of major infrastructures like roads and bridges are unavoidable. At present, road transportation is main mode of transportation in Nepal for exceeding the volume of other available transportation modes. Construction of road is fundamental part of development that too in rural countryside has been a priority sector for the decades. Politicians and planners have given emphasis in developing sufficient road network in rural areas.

At the end of the fiscal year 2068/69, Nepal had 50,944 km of rural roads as per Department of Local Infrastructure Development and Agricultural Roads (DoLIDAR). Two-thirds of rural roads are earthen and remain inaccessible during the rainy season. Blacktopped and gravelled roads are poorly maintained, further affecting access. The rural transport infrastructure has been attracting around 6% of national budget (NPR 26 billion in the year 2011/12) which will be increasing over the years. The importance of local governments in promoting sustainable development of rural roads is being felt seriously. So SNRTP project was introduce to fulfil the objective.

The Government of Nepal (GoN) aims to provide all-weather road access to all VDCs by gradually upgrading the District Road Core Network (DRCN) and providing proper maintenance with the aim of promoting economic growth, providing access to

services and creating sustainable decent jobs in rural areas. Currently a large majority of roads are only fair-weather and in poor condition, with a large portion of roads not trafficable. Insufficient maintenance is being carried out, further aggravating the situation. In this context, GoN with support of the World Bank is implementing the Strengthening the National Rural Transport Program (SNRTP) project to strengthen the DRCN with a particular emphasis on the "Maintenance First" approach. This project will furthermore cover the upgrading and rehabilitation of rural roads as well as the construction of new river crossing structures to bring the roads to an all-weather maintainable standard. The project covered 36 districts listed below with a total population of more than 14.6 million people.

Table-1: SNRTP Project Districts in Nepal

Arghakhanchi	Kapilvastu	Rupandehi
Banke	Kaski*	Salyan
Bara	Lamjung*	Sankhuwasabha
Bardiya	Mahottari	Saptari
Bhojpur	Makwanpur	Sarlahi
Dang	Nawalparasi*	Sindhupalchowk
Dhading	Nuwakot	Siraha
Dhanusha	Palpa	Surkhet
Gorkha*	Parsa	Syangja*
Gulmi	Pyuthan	Tanahun*
Kailali	Rasuwa	Terathum
Kanchanpur	Rautahat	Udayapur

Source: (SNRTP, 2068)

OBJECTIVE OF STUDY

The objectives of the study will be as:

i) To identify the causes of delay in the SNRTP construction projects.
ii) To analyze Relative Importance Index (RII) of the various causes of delay.

Statement of Problem

Project management involves integrated management of quality, cost, schedule, communication and risk. Time, cost and quality are the three main interrelated indicators of the project performance, without managing resources such as people, materials and machine properly the project suffer delays and cost overrun and it was found that the most of the projects under SNRTP have not been completed within the scheduled time and cost. Among them almost all of Upgrading of roads and bridges have been suffered from delays and no projects have been completed in scheduled time in all implemented projects in Gandaki Province till now. Delays have result in dispute and a claim among the project participants, if at fault the industry as a whole, cost overrun could bring about project abandonment and a drop in project construction activities, bad reputation and inability to secure project finance.

LITERATURE REVIEW

General

Construction project is a mission undertaken to create a unique facility, product or service within the specified scope, quality, time and cost. In practice, however, most of construction projects encounter delays, poor quality workmanship and delay of construction project require an in-depth investigation to improve the output of the construction industry. It is uncommon to see construction projects failing to achieve their mission of creating facilities within the specified cost and time. Hardly few projects get completed on time and within the estimated cost since the construction projects are exposed to uncertain environments because of such factors as construction complexity, presence of various interests groups such as the project owner, end users, consultants, contractors, financers, materials, equipment, climatic environment, economic and political environment and statutory regulation. The successful execution of the construction projects, keeping them within estimated cost and prescribed schedulers, primarily depends on the existence of an efficient construction sector capable of sustained growth and development in order to cope with the requirements of social and economic development and to utilize the latest technology in planning and execution. Adequate planning at early stages of a project is crucial for maintaining delays and cost overruns.

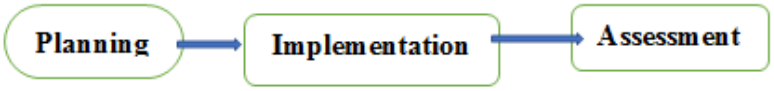
The construction industry is regarded as one of the main sectors contributing to economic growth in any country. The success of construction projects is usually measured by three key indicators, time, cost and quality [1]. However, failure of satisfying project requirements has been repeatedly occurred, especially when projects are completed beyond contract period. Such case is called delay which is defined as the time exceeded the project duration stated on the contract [2]. These delays have been proven in many countries, for instance, infrastructure projects in both Ethiopia and India have suffered from time delay where 80% and 72% of them were delivered late [3]. In Saudi Arabia, the average delay among 49 roads and bridges projects

was 39% [4]. Studied shows in Kenyan roads based on the fact that 70% of these projects were not completed on time. The magnitude of this issue may significantly appear in Jordanian roads since the delay reached to 455% of contract duration observed in one case study [5]. There are many reasons contributing to project delay and vary from country to country. They can be caused by project parties; manpower, machineries and some of them are uncontrollable such as weather effects. Despite of the efforts made by professionals to achieve the project in a timely manner, the responsibility for delay is mainly associated with them in many cases. For example, contractor was responsible for 40% of delay in Ethiopia [6]. While the owner was mainly blamed in Saudi Arabia since the contribution to project delay reached to 53% from his side [7]. In Palestine, delays caused by equipment and material received more importance than those caused by professionals. However, this review presents the factors, groups and their perceived importance according to the findings of previous studies.

Introduction to different terminology used in contract document

Quality Assurance Plan (QAP)

Quality Assurance (QA) means a process for assuring the reliability of measurement data. QA principles and practices enable you to acquire data of the type and quality you need. The quality of the data must be documented in order to be scientifically and legally defensible. The purpose of preparing a QA Project Plan is to ensure that all necessary steps are taken to acquire data of the type and quality needed. A project or study is a logical sequence of activities grouped into three categories:



Lists the goals and objectives of a study

a. Identifies the type and quality of data needed.
b. Describes the sampling and measurement procedures needed to acquire those data.
c. Describes the QC and assessment procedures needed to ensure that the study objectives are met.

Extension of time (EoT)

Delays in construction activities may give rise to a need for an application of extension of time, to provide sufficient time to complete the project. Most standard form of contract contain provisions that list out relevant events that allow a contractor to apply time extensions; the contract often expressly states that the claim should be made and dealt with timely as possible with the delaying events. Unfortunately, no specific explanation with regards to the assessment of the claim is given, and this is left to the professionals involved in the project. Often, interpretation varies depending on the experience and preference of the individual party. The absence of clear guidelines and mutual agreement between parties involved regarding the assessment of construction delay will sometimes sparks a dispute amongst them [8].

In SNRTP Project, The Project Manager shall decide whether and by how much to extend the Intended Completion Date within 21 days of the Contractor asking the Project Manager for a decision upon the effect of a Compensation Event or Variation and submitting full supporting information at least 7 days prior to the intended completion date. If the Contractor has failed to give early warning of a delay or has failed to cooperate in dealing with a delay, the delay by this failure shall not be considered in assessing the new Intended Completion Date.

Variation Order (VO)

The cost of a construction project is one of the most important factors in the construction industry. Due to many reasons, the total cost of a project can significantly vary from the initial estimated cost. The reasons could be changes in scope of work, specifications, or any other contract documents. In the construction industry, variation orders are created when changes occur. It is an official document that states the changes made into the original agreement between the client and the contractor. When a variation order is created, it brings several negative effects to both the client and the contractor [9].

Liquidated damage (LD)

In a construction context, delay liquidated damages (LDs) typically represent an agreed, fixed amount (usually a daily or weekly rate) payable by a contractor to the employer in circumstances where the contractor fails to complete the work under the contract by the date for completion specified in the contract (being either the original date for completion, or where the date has been extended in accordance with the contract, the extended date for completion). It is not unusual for the total amount of LDs to be capped at a percentage of the contract price.

The following are commonly cited as a few of the benefits to the parties in agreeing a rate of LDs as part of their contract:

a. It quantifies the risk of late completion and permits a contractor to properly consider the risk at the tender stage;
b. It provides the parties with certainty
c. It removes the need for the employer to prove the actual damage suffered.

In SNRTP project the liquidated damages for the whole of the Works are 0.05 percent of the final Contract Price per day. And that for the Milestones are as under; Milestone 1: 0.005% of Contract Price per day, Milestone 2: 0.025% of Contract Price per day and Milestone 3: 0.05% of Contract Price per day

Liquidated damage for Milestone 1 will be levied until end of Milestone 2, and then only liquidated damage of Milestone 2 will be levied until end of Milestone 3, and so on. No Two liquidated damage will be applicable at one time.

The maximum amount of liquidated damages for the whole Works is Ten (10) percent of contract price.

Price Adjustment

Price adjustment is a modification made to the overall price of a contract to take account of legitimate changes in the costs of performing the contract. It is a mechanism to protect both buyers and sellers from unforeseeable input price fluctuations. This guidance note discusses price adjustment provisions for goods, works, and plant contracts. Price adjustment provisions are planned during the procurement planning and bid preparation stages. Price adjustment provisions are meant to give protection to the contractor against price escalation. Cumulative impacts of price escalation can be substantial in contracts with long delivery and completion periods. Contracts that include large, price-sensitive materials or commodities can also experience abrupt and significant increases in price. Price adjustment may also pass on savings to the borrower (or grant recipient) due to the downward movements in price.

Defects liability period (DLP)

Construction contracts usually include a defects liability period during which the Contractor is responsible for repairing or rectifying defects that appear in the works. The period usually commences upon practical completion of the works and runs for a specified time frame (sometimes also known as the Maintenance period). Under a construction contract, one of the Contractor's primary obligations is to carry out and complete the works to the standard set out in the contract. The defects liability period is intended to complement this liability by setting out how and when the Contractor must remedy defective work which becomes apparent during the defects liability period. In effect, the defects liability obligation recognizes that defects will arise in the period following completion and includes the obligation to repair those defects in the general obligation to complete the works to the required standard. The defects liability period provides a practical mechanism to the Employer for the repair or making good of defects which may not be apparent before completion, without resorting to dispute resolution. Making the Contractor responsible for carrying out the repairs is usually cheaper and more efficient than either the Employer repairing the defect itself or engaging a third party to repair the defect.

Delays in Construction Projects

When the project doesn't complete in accordance with given schedule or project completes lately than the prescribed schedule, it is known as project delay. Construction projects are full of risk and uncertainties. Delays can have negative economic consequences and can create bad image for a contractor. One of the indicators for measuring the efficiency of a contractor is time. Clients who are mindful of the benefits they are likely to recoup from their investments would not want to have anything to do with contractors who cannot meet project completion deadlines. Delay was defined as the overrun of time beyond planned schedule. Project delays can result in loss of revenue to clients and high overhead cost to contractors because of time extension. Construction project risk can be countless and may emerge from different sources. The origin of risk may include performance of parties to the contract, conditions on site, contractual relations, availability of resources for regular progress of construction activities on site, and involvement of other parties.

Have defined delays as the time during which some part of the construction has been extended or not performed due to unanticipated circumstances [10].

According to [11], delay is defined as occurrence of the cause addition to period of time necessary to construct the project during the life of a contract.

Delays in construction can be categorized into three, namely; excusable, non-excusable and concurrent.

Excusable Delay

According to [12], a delay that entitles the contractor to additional time for completion of the contract work, generally arising from causes beyond the contractor's control is excusable delay. Excusable delay may be classified further as excusable compensatory delays and excusable non-compensatory delays. Whether delay is classified as compensatory or non-compensatory depends primarily on the terms of the contract. An excusable delay can occur due to various factors, which can be classified into two categories: a) Beyond the control or without the fault of either party (Excusable non-compensatory) and b) Within the owner's or his representative's control (Excusable compensatory).

In the first case, the contractor is entitled to get extension of contract performance time while the later will allow the contractor both time extension and additional cost. When delays are excusable, the

contractors will neither be subject to liquidated damages nor can the contractor be terminated for default due to such delays. Liquidated damages constitute the specified amount that a contractor will to the owner for non-excused late completion. Whether the contractor can recover the delay cost for an excusable delay depends on whether the delay is compensatory or non-compensatory or whether it is concurrent with other delays. Examples of excusable delays caused by different factors are:

Delay caused by owner are: a) Failure to provide a project site; b) Late notice to proceed; c) Failure to provide proper financing; d) Failure to provide owner's furnished materials or components; and e) Interfering with or obstructing work on the project.

Delay caused by Architect/Engineer are: a) Defective plans and specifications; b) Failure to provide drawing on schedule; c) Delay in review or approval of shop drawings; d) Delay in change orders and e) Stop-work order.

Delay not caused by any party or participant are: a) Acts of God; b) Act of public enemy; c) Unusual delays in transportation, such as a freight embargo; d) Epidemics; e) Unusual weather conditions (force majeure) and f) Strikes

Delay Caused by Owner

a. Failure to provide a project site
b. Late notice to proceed
c. Failure to provide proper financing
d. Failure to provide owner furnished materials or components
e. Interfering with or obstructing work on the project

Delay Caused by Architect/Engineer

a. Defective plans and specifications
b. Failure to provide drawings on schedule
c. Delay in review or approval of shop drawings
d. Delay in change orders
e. Stop-work order

Excusable Non-Compensatory Delay

According to [13], a delay that entitles the contractor to additional time for completion of the contract work but no additional compensation is excusable non compensatory delay. Excusable non-compensatory delays are not caused by the owner, designer, contractor, subcontractor, suppliers, or other parties in the design and construction process. Because this delay is beyond the control of any of the parties, contract and case laws generally minimize the risk to all parties by a compromise:

'The contractor's late completion will be allowed equal to the amount of delay, but no additional compensation will be awarded. Most contracts contain written statements that deal specifically with this type of delay. Examples of non-compensatory delay are:

Delay not Caused by Any Party of Participant are: a) Acts of God; b) Act of public enemy; c) Usual delays in transportation, such as a freight embargo d) Epidemics; e) Unusual weather conditions (force majeure) and f) Strikes

Non-Excusable Delay

According to [12], a delay that does not entitle the contractor to either additional time for completion of the contract works or additional compensation is non-excusable delay. Such a delay may be non-excusable due to the contractor's failure to meet its contractual obligations or due to the terms of the contract.

A non-excusable delay is within the contractor's control and could have been avoided. This type of delay does not allow the contractor to recover any additional time or cost. Conversely, such delay could be compensable to the owner in the form of liquidated or actual damages paid by the contractor for late completion or increased cost to accelerate the work. Furthermore, the non-excusable delay may constitute a breach of the construction contract by the contractor and may justify the termination of the construction contract.

The owner normally is in a difficult position to identify the non-excusable delays at the early stages because he seldom maintains the construction schedule with sufficient detail to pinpoint the contractor's delay. This type of delay, therefore, is identified when the dispute arises. A contractor, on the other hand, is more likely to maintain the detailed schedule, so he is in a better position to monitor job progress and identify delays, which are attributable to the owner. Examples of non-excusable delay are:

Delay Caused by Contractor are: a) Slow mobilization; b) Inadequate labour force; c) Strike caused by unfair labour practice; d) Poor workmanship **e)** Late delivery of materials and components and f) Failure to coordinate multiple sub-contractors

Concurrent Delay

According to [12], the concurrence of two or more delays arising from inadequate causes and affecting a project during the same or overlapping time periods is concurrent delay.

Concurrent delays are two or more delays that occur at least to some degree simultaneously. As used in construction law, the term refers to the situation when there is more than one delay occurring at the same time, each of which, if it had occurred alone, would have affected the project completion date.

Courts determine the legal impact of concurrent delays by examining the responsibility for the concurrent delays and determining whether the parties are seeking compensation or an extension to time. The concurrent delay can be more than one type of delay. With respect to contractor recovery for concurrent delays, the delays must be solely the owner's responsibility. Similarly, if the owner can clearly distinguish the contractor's responsibility for concurrent delays, the owner can collect liquidated damages. In general, when excusable and non-excusable delays are concurrent, the contractor ought to be entitled an extension of construction time. In case of concurrent compensatory and non-compensatory delays, the contractor should be entitled to a time extension but not to damages. For the contractor to collect damages, the owner would have to cause all compensatory delays.

Excusable + Non-Excusable = Time extension; Concurrent (Compensatory + Non-compensatory) = Time extension only; All compensatory delay solely by owner = Compensation +Time extension

If the concurrent delay consists of delays attributed to both the owner and contractor, some cases hold that neither can recover damages for the other's act. Some endeavour should be made to apportion the concurrent delays between parties. Inadequate documentation may, however, make apportionment impossible. If concurrent delays cannot be apportioned, neither the owner nor the contractor can recover delay damages.

Cost Overrun in Construction Projects

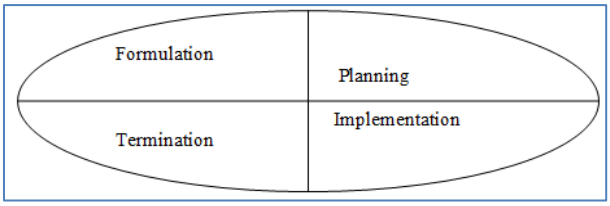
An instance in which the provision of contracted goods or services are claimed to require more financial resources than was originally agreed between a project sponsor and a contractor is called cost overrun. The amount by which an initial cost exceeds the baseline or approved costs is cost overrun. Also, the difference between the original cost and the actual cost when project is completed is cost overrun.

For the purpose of this research cost overrun is defined as the difference between the final actual cost of a construction project at completion and the contract amount, agreed by and between the client (the project owner) and the contractor during signing of the contract.

Project Development Process

Project Life Cycle

A project has fixed life span. It has beginning and end points. The life span of project is divided into different phases. Each phase defines specific deliverables. The phases are arranged in a sequence. The phases are collectively known as life cycle. The various phases in the life cycle of a project are:



Formulation Phase: This is conception phase. It identifies the project. It involves preliminary planning of the project. The basic tasks in this phase consist of is Project Identification: It is the conception stage. Projects are born with felt need and creative ideas. It identifies the project. The sources of ideas can be, Situation Survey: Changes and developments in political-legal, economic, socioeconomic, social cultural and technical forces in the environment are surveyed, Internal Sources: They can be vision, mission, goals, strategies and plans of the organization. Opportunities and threats identified by the management and employees can also provide project ideas, External Sources: They can be client requirements, donor priorities, competitor's activities, legal provisions and interest of politicians. They can provide project ideas. Ideas are carefully screened in terms of objectives, constraints and resources capabilities before they are selected as projects.

Project Formulation: The project formulation task defines the parameters of the identified project. It is concerned with statement of work and project proposal. It develops by a) Objectives and outputs of the projects and b) Preliminary estimates of schedules, costs and other resources required

Planning Phase: This phase plans resources utilization, prepares detail plans estimates time and costs and establish quality standard. The basic tasks in planning phase of the projects are i) Feasibility Study: it helps to determine whether the project can be implemented or not. Feasibility study should be based on accurate information analysis, marketing analysis, economic analysis, environmental analysis etc ii) Appraisal: It is the evaluation of the projects ability to succeed. It is based on revisiting the findings of the feasibility analysis. It addresses a) Ability of the project to achieve its objectives; and b) Comparability of the project with other projects in terms of investments cost benefit, job creation, profit etc, Project Approval: The project selected through appraisal should be formally approved by competent authorities. Approval involves, a) Finalization of funding proposals, agreement and contract documents b) Allocation of resources to the project and appropriate regulation for the project , Design : It is concerned with: a) Preparation of blue prints of engineering design and specification for construction facilities, equipment etc and b) Preparation of detail implementation plan and work schedule.

The Design tasks are a) Establish operating plans and performance standards; b) Allocate role and responsibilities; c) Determine activities and resources and d) Set down work schedules

Implementation Phase: under this basic task are: **a)** Implementation**; b)** Control

Implementation: It involves setting up projects organization and getting together the project team. Implementation phase of the project involves huge amount of investment including mobilization. The activities are a) Tasks are allocated to team members; b) Decisions are made about the procurement of equipment, resources and services; c) Management of information systems is set up; d) The project manager motivates and leads the projects team; e) A time sequence schedule for implementation is followed and f) Project plans are perused and adjustments are done as needed

Control: It involves supervision and control of project performance to provide feedback for the correction, a) Various techniques such as Critical path method (CPM), Programme Evaluation and Review Technique (PERT) and other network analysis techniques are used for planning and control purposes. And b) Monitoring of project performance is done continuously from starting to the end of the construction work. Monitoring refers to timely gathering of information during project implementation to measure project performance and reporting it to the project authority and stakeholders who wish to know. It is a means to improve implementation through the identification of problems and taking of possible corrective actions to track the project in accordance with the predetermined quality standard.

Termination Phase: The project is completed and handed over to the customer during this phase. The basic tasks of this phase are a) Project Evaluation and b) Project Handover Project Evaluation: measures the efforts and impacts of the projects. It can be carried out during the project implementation and also after project completion to improve future project planning and management.

Project Handover: Project handover begins when the project work is finished. It involves a) Handing over the completed project to the client or to another organization. The project organization is dismantled. The project is commissioned; b) Resources are allocated to other projects or departments; c) Permanent project records are finalized and d) Project accounts are closed. Project is terminated. Most project life cycle tend to progress slowly at the start, quicken their momentum towards the middle and drop their momentum towards the end [13].

Role of Key Project Participants

In the process of construction, three main parties are involved. They are the owner or client or employer who owns the project and pays for the construction on the hope of getting benefit from the project. Consultant or Engineer who designs the project and then supervises the work during construction phase of the project and works as an agent of owner on behalf of owner or client and the contractor who builds the project for the owner as per the terms and conditions of the contract.

Owner/Employer/Client: Employer generates the ideas of the project. He owns it and pays for the construction on the hope of getting benefit from that. Employer enters into an agreement with the contractor, appoints engineer, accepts bonds and guarantees, and pays the running and final running bills to the contract. Maintain contract with the engineer, grant extension of time, approves extra cost/variation order, accepts and take over the work, issue final completion certificates and bids farewell to the contractor and engineer.

Contractor: Contractor builds the physical facility for the owner designed by the engineer. The contractor executes the work taking full responsibility of quality, timely completion and safety of the work. He sets out the work, carries out tests, care of works, rectifies the defect, insure for the workmen, work and materials, insure the equipments, insure the third party liability, takes responsibility for the health and safety of the workers, complete the work as per design and specifications, conducts test on the works, handover the project. After handling over the project, the contractor is also responsible for maintenance of defects during the defect liability period.

Engineer/ Consultant: The consultants functions as the bridge between the employer and the contractor for the execution and successful completion of the project. The consultant or engineer works on behalf of client. Therefore, consultant or engineer is responsible for overall enforcement of the contract document. The engineer works as the agent of the employer but functions as an independent and impartial body between the employer and the contractor. Consultant recommends the employer for remedial measures in case of default in accordance with the conditions of the contract and helps the contractor to achieve schedule and quality of works. The engineer is the one who administer the project and ensure proper implementation of contract document [14].

Causes of Delays

A project may be delayed due to large number of reasons (factors). The factors may be classified into [15]: The factors are listed below: Under the client administration and organizational factors are slow decision-making process by the client administration; b)

Inefficient flow of information from along client department; c) Lack of field and expertise by the administration staff; d) Lots of formal bureaucratic procedure in the client organization; d) Inflexibility towards design in the client's organization; e) Insufficient prequalification procedure by client which result in the selection of incompetent contractors; f) No or small time extension associated with change orders associated by the client; g) Poor job control over clients site supervision staff; g) Poor coordination with other regulatory and governmental agencies.

Under the client field supervision factors are a) Slow site inspection procedures from client's supervision staff a) Understaffing in the clients organization; b) Unfamiliarity or lack of knowledge by the client's supervision staff towards new construction methods, materials and techniques; c) Lack of application of construction management tools and techniques by the clients project and site staff; d) Limited authority is given to the clients project/site personnel to approve necessary design changes; e) Slow payment procedure adopted by the clients departments; f) Clients supervision staff is apprehensive in making decision (favoritism towards the contractor)

Under the contractor related factors are a) Lack of experience and familiarity with this type of construction work; b) Frequent construction error committed by the contractor; c) Misinterpretation of drawing and specifications; d) Late construction mobilization ; e) Poor planning and site management; d) Hire of incompetent sub-contractor; e) Frequent error in shop drawing.

Under the design related factors are a) Poor coordination between various types of design and drawings; b) Errors in the design drawings; c) Slow review and approval of shop drawing by the designer; d) Poor or no constructability consideration during design; e) Design drawing doesn't match with the specifications; f) Inaccurate estimate of the project scope; g) Unsuitable or overdesign practice by the client which requires extensive time duration for construction; h) Frequent design changes requested by the client during construction.

Under the project management related factors are a) Poor planning, scheduling and control by the contractor; b) No application of the construction management procedure on the part of the client contributes to the late detection of the construction problems; c) Poor judgement and inexperience in estimating construction procedures by contractor; d) Unrealistic program schedule submitted by the contractor; e) Contractor's staff not properly trained in professional construction management technique; f) Poor coordination between contractor's construction program and that of sub-contractor; g) Difficulty in finding the required manpower in the market; h) Poor skilled manpower at construction site due to lower wage payment; i) Fluctuation in the productivity levels of man powers of different ethnic groups; j) Difficulty in work during summer, winter, rainy and festival seasons

Under the quality related factors are a) Strict application of quality control criteria by the client; b) Unavailability of the required construction material in the local market; c) Delay in the testing of the construction materials; d) Unexpected geotechnical conditions found during construction; e) Poor construction performance by the sub-contractors.

Under the contractual condition related factors are a) Risk allocation shifts mainly towards the contractors as reflected by the lump sum contract clauses; b) No financial incentives for finishing the work ahead of the schedule; c) Liquidated damage are not high enough to make contractors more responsible towards completing the project on time; d) Poor contract negotiation during tendering which results in incompetent relationship between client and contractor; e) Tradition type of contract hampers the specified in the contract ; f) Unrealistic project construction duration as specified in the contract.

Under the external factors is a) Delay in disbursement of fund by financial institutions b) Political instability/interference to the project; c) Change in foreign currency exchange rate; d) Natural calamities and other holistic conditions.

RESEARCH METHODOLOGY

Introduction

This chapter comprises of the method of design that was used to conduct the research. It is a quantitative research in which the data was collected using questionnaires. The population was made of clients, contractors and consultants who were selected by random sampling and convenience sampling technique. Information can be either primary or secondary data. Primary data refers to information collected for the specific purpose at hand. On the other hand, secondary data refers to information that already existed to be used for another purpose. Secondary data has been in the form of books, journals and articles from the internet. Our measuring instrument to assess primary data was written questionnaire. The research methodology chosen for this study comprised of intensive literature review, mail questionnaire to road construction project related stakeholders and analysis of data from their response.

Study Area

The study is focused on identifying the main causes and impact of delays of the completed SNRTP, upgrading of road projects in the districts under Gandaki Province. The lists of those completed projects are as follows.

Table-2: SNRTP Projects in Gandaki Province

S.N.	District	Name of roads
1.	Kaski	Sarankot- Kaskikot - Naudanda Road
		Lamachour - Machhapuchre - Karuwa Road
		Chhorepatan-Kristi-Nirmalpokhari-Bharatpokhari Road
2.	Syangja	Badkhola Taksar Dulegauda Road
		Rangkhola- Biruwa Road
		Waling Huwas Road
3.	Tanahun	Dulegauda-Sankhe-Raipur Road (Dhorbarahi Marga)
4.	Nawal Parasi (Eastern part)	Daldale-Munde-Kumsot Road(Ch-5+225-11+300) (Munde-Kumsot Section)
		Daldale-Munde-Kumsot Road (Ch-0+450-5+225) (Daldale-Munde Section)
5.	Lamjung*	NA
6.	Gorkha*	NA

*Upgrading roads are not implemented in the districts, Source (Survey,2018)

Research design

The descriptive method of research was applied to meet the above stated objectives and the survey technique was used to collect necessary information. The study was based on primary data through pre-structured questionnaire and secondary data which are taken mainly from the extension of time reports and causes of time extension illustrated in the approved reports, with the help of contract ledger sheet and checklist as prepared in the districts. Questionnaire survey was done to know the perception of client, consultant and contractor regarding the identification and causes of delays of the road projects.

Data Source and Collection

The data collected through primary and secondary data collection method. Random sampling was done among 55 respondents from core project related stakeholders. Secondary data was collected from the contract document, payment certificates, approved time extension reports, contract ledger, and variation of the completed road projects. This information collected from these project documents were studied thoroughly in identifying the recurrent problems related to delays of the road projects.

Questionnaire Survey

Owing to the similar nature of upgrading of road projects implemented under SNRTP at different districts of Gandaki Province, a survey by questionnaire was found appropriate in addition to the desk study. The questionnaire was carefully designed in light of getting high response rate from respondents. Ninety causes of delay were identified, categorized to eight major groups.

The answer for the structured part of the questionnaire is based on ***Likert's-scale*** of five ordinal measures of agreement towards each statement (from 1 to 5) as shown in the following sections. The reasons for adopting this simple scale are: To provide simplicity for the respondent to answer, and to make evaluation of collected data easier

Population and Sample size

There are nine number of completed upgrading of road projects under Gandaki Province implemented through SNRTP project. The population size for the study was nine number of completed upgrading of road projects and since all the population are considered for the study of purpose sample size is equal to the total population.

Respondents were selected as core project related personnel by whom we can get the real responses as they feel the actual evidences as they faced the problems in the field during implementation. Altogether 55 numbers of core respondents from 4 districts were taken for delivering questionnaire to get real responses from them which includes Consultants (16), four from each district, 27 respondents from contractors (Project Manager; PM, Engineer and Site Supervisor) and 12 respondents from client (Project Coordinator-Chief District Engineer; CDE, Project Manager; PM ie an Engineer appointed by CDE, Site In charge-Junior Engineer) respectively.

The table for the distribution of employee of client, consultant and contractor of different projects in SNRTP in the Gandaki province are shown as below:

Table-3: List of Respondents in the Study area

Project Districts	Number of project	Client	Consultant	Contractor	Total
Kaski	Three	3	4	9	16
Syangja	Three	3	4	9	16
Tanahun	One	3	4	3	10
Nawalparasi	Two	3	4	6	13
				Total	55

Sample Size Calculation

Sample size, "ss" for infinite population is calculated as follows $SS = \frac{Z^2*(p)*(1-p)}{c^2}$

Where: Z= Z value (e.g.1.96 for 95% confidence level), P= Percentage of chances that questionnaire depicts the causes of delay, expressed as decimal (0.5 used for sample size needed), C= confidence interval, expressed as decimal (e.g. 0.05=±5) = $1.96^2*0.5*0.5/0.05^2$ =384.16, Sample size for finite population is calculated using correlation as follows, New ss = SS/ [1 + [(SS − 1)/Pop], Where pop= population = 384.16/ [1 + [(384.16 − 1)/55] = 48.22

From the above calculation, it was found that minimum size of sample required was 48.22 and the data obtained from the questionnaire response was 55 in number which is just sufficient.

METHOD OF DATA ANALYSIS

The collected data/perception from construction related respondents was studied/ analysed critically to determine the various causes of actual delay in projects. The software tools were used for the analysis are mainly using SPSS. After the data was collected was edited for completeness, homogeneity, and accuracy. The data was analysed to find frequency distributions, means, standard deviation, variance, reliability analysis.

Both descriptive and inferential statistics shall be used in data analysis. Statistical test and methods as listed below shall be done in analysis.

Relative Importance Index (RII)

The data will be processed to determine Relative Importance Index (RII) of various causes of delay factors which was used by Sambas Ivan, M. and Soon, Y.W. [16]. The same method will be used in this study with various categories (Client related, Consultant related, Contractor related, Designer related, Labour related, Materials related, Equipment related, Externals related). In this case, four-point *Likert scale* will be adopted which ranges from 1 (not important) to 5 (extremely important) and transformed to RII for each factor using the equation below. Equation (1) will be used to compute the RII for all the causes of delay factors.

Relative Importance Index, $RII = \Sigma W/A*N$ …… (1)

Relative importance index ranges between 0 to 1 i.e. ($0 \leq RII \leq 1$), higher value indicates more importance for that cause of delay. Where W = weighting given to each factor by the respondents which ranges from 1 to 5 where '1' is 'not important','2' is ' some important', '3' is 'important' , '4' is 'Neutral' and '5' is 'extremely important', A = highest weight (i.e. 5 in this case), and N = total number of respondents. After RII has been found from client's, consultant's and contractor's view individually then it will be ranked to top 20^{th} position which will be considered as most critical factors contributing the delay of road projects. Similarly overall RII and rank will be traced out for the uniformity of the outputs. For Each & every top 20 causes of delay, Overall RII will be calculated in excel format by using the simple formula as below;

Overall RII= (RII*nos of clients +RII* nos of consultants +RII* nos of contractors)/ (Total nos of respondents (here 55nos)

Reliability Analysis using Cronbach's Alpha

Cronbach's (alpha) is used as a (lower bound) estimate of the reliability of a psychometric test. It has been proposed that alpha can be viewed as the expected correlation of two tests that measure the same construct. By using this definition, it is implicitly assumed that the average correlation of a set of items is an accurate estimate of the average correlation of all items that pertain to a certain construct.

From the reliability analysis, it can be determined that the extent to which the items in questionnaires are related to each other, can get an overall index of the repeatability or internal consistency of the scale as a whole. Alpha (Cronbach) model is used in this research to measure reliability.

The computation of Cronbach's Alpha is based on the number of items on the survey (K) and the ratios of the average inter- item covariance to the average item variance.

Suppose that we measure a quality which is a sum of 'K' components (K item or test etc): $X=Y_1+Y_2+Y_3+\ldots\ldots Y_k$.

Cronbach's Alpha is defined as, $\alpha = K/(K-1)\left(\frac{\sum i=1\ \sigma yi2}{(\ \sigma xi2\ )}\right)$

Where, σ_x^2 is the variance of the observed test scores and σ_y^2 is the variance of the sum of the total items.

Rule of thumb for results

A rule of thumb for interpreting for dichotomous questions (i.e. question with 2 possible answers) or Likert scale question is

Cronbach's Alpha	Internal consistency
$\alpha \geq 0.90$	Excellent
$0.90 > \alpha \geq 0.80$	Good
$0.80 > \alpha \geq 0.70$	Acceptable
$0.70 > \alpha \geq 0.60$	Questionable
$0.60 > \alpha \geq 0.50$	Poor
$0.5 > \alpha$	Unacceptable

RESULT AND DISCUSSION

The result obtained from data analysis and approved reports of extension of time (EoT), it has been found that, the process behind the approval of EoT, the contractor first request to the clients for the extension of time with relevant events, included with their supporting document.

The responses from client's, consultant's and contractor's representatives are different from each other's. So, the overall or combination of opinions that has been calculated statistically has been used to get the final or overall result. From the analysis; it was found that Weather, climatic condition & rain effects (unfavourable condition) on construction activities is ranked as first in respect of the view of client (RII=0.950), consultant (RII=0.888) and in overall (RII=0.898) is ranked as 1st. The cause of delay falls under 2nd rank from the point of view of contractor (RII=0.896). So, to minimize or avoid the cause of delay, It should be better practiced to do the contract just after the unusual/ monsoon and festive season. Generally, the contractors often do not mobilize the resources during the season and allow the work in full phase after the contract has been signed to reduce the time initially without misuse of mobilization amount.

Delay in decision in relocation of services occupy the 2nd rank from client's (RII=0.896), contractor's (RII=0.896) and overall (RII= 0.886) view but falls under 3rd rank from the point of view of consultant (RII=0.863). Generally, the translocation of electric pole, water tap stand, temples, private and public structures is the key concern during the construction phase. For the relocation services, the budgetary item should be included in the planning phase.

Long chain of Hierarchical decision-making process and slowness in decision-making process is ranked as 3rd in overall view (RII=0.885) as well as in consultant's view (RII=0.863), whereas the cause lies 4th rank in client's views (RII=0.875) and 1st rank in contractor view (RII=0.904). Due to long-chain of decision-making system, the operation of the project was delayed. The delay in decision making, delay due to long hierarchical decision-making process in for every step should be strictly eliminated. Such timely and slow decision-making process should be minimized by making legal provision not shifting the decision-making responsibility towards others provided the authorized person has been allocated more competent and capable enough.

Poor estimation of project time (i.e. unrealistic time schedule imposed in contract) quantities of material and determination of quarry site required before contracting is ranked as 4th in overall (RII=0.884) as well as consultants view (RII=0.850) , whereas the cause lies 1st and 3rd in contractors (RII=0.904) and clients view (RII=0.883) respectively. It was found that there were no any scientific methods used in the estimation of time period for the construction works. Due to which all the sampled sub-projects were gone through variation of time and cost. For the proper estimation of time, breakdown analysis of each activities of the whole project is prerequisite for timely completion of the project. So, during preparation of DPR, the efficient and adequate project team (engineer, geologist, hydrologist, sociologist, environmentalist, and surveyor) should allow sufficient time to prepare project briefs and other feasibility studies as it will reduce the contribution of inaccurate cost and time estimation, unforeseen site conditions, changes in design, Mistakes and discrepancies made in design documents of the road project.

Land acquisition/donation is ranked as 4th in overall (RII=0.884); the cause lies 2nd rank in consultant view (RII=0.875), whereas the cause falls collectively under 3rd rank in contractors (RII=0.889) and clients views (RII=0.883). Pre-executing preparation of project like (land acquisition, obtaining approval from environment department, utility relocation) should be completed before the construction of project or management of such facility should be cleared, who is responsible for such facility. The amount of Rs 5000 per person of land owner allocated for the land acquisition process in SNRTP projects is not adequate. The process of land acquisition through voluntary land donation should be reviewed. Conflicts between joint-ownership of the project is ranked 5th position in overall views (RII=0.872) as well as in consultant view (RII=0.844), whereas the cause lies in 2nd and 6th position in views of contractor (RII=0.896) and client (RII=0.854) respectively. Coordination between the concern different line agencies of the government is needed for the effective wayout for the timely completion of the projects.

Civil unrest/public strikes is ranked as 6th in overall (RII=0.869) as well as consultant (RII=0.813) views, whereas the cause lies 1st and 5th position in contractor (RII=0.904) and client (RII=0.867) views respectively.

Poor communication and coordination between the participants of the construction project (owners, contractors & sub-contractors, designers, consultants,

workers and suppliers) observed is ranked as 7th in overall (RII=0.836), whereas the cause lies 2nd, 9th and 5th position in clients (RII=0.896), consultants (RII=0.781), and contractor (RII=0.843) view. "Frequent/monthly management meetings" with the stakeholders of implementing team are recommended by the research analysis. Their inter team and intra team meetings between the contraction, employer and consultant is necessary for smooth operation of the project to exterminate the violence of lack of communication among the parties. Sharing about the problems and good practices, feelings among the construction entrepreneurs leads timely solution.

Delay in approving overall designs, shop drawing, sample tested materials and major changes in the work with variation order is ranked as 8th in overall (RII=0.825), whereas it lies 3rd , 7th and 6th position in clients (RII=0.883), consultants (RII=0.800) and contractors (RII=0.815) view respectively.

Mistakes and discrepancies made in design documents leads to frequent revisions of drawings/designs is ranked as 9th in overall (RII=0.823) as well as contractor view (RII=0.796), whereas the cause lies 2nd and 6th in clients (RII= 0.896) and consultants (RII=0.813) views respectively.

Similarly, Consultant's reluctance for change and their inflexibilities is ranked as 15th, in overall view (RII=0.722) which is least out of 20th ranks, whereas the cause collectively lies in 11th position in clients (RII=0.729) and contractors (RII=0.785) view. But it lies in 13th position in view of consultant (RII=0.609).

There are remedial measures that are also sorted out to the top twenty rankings. "Allocation of competent project manager" is the most important method of mitigating delay. Allocation of competent, experienced and dedicated project manager makes the whole contract management efficient to handle from its preparation stage to termination. Most of the issues shall be solved through the manager in time because he/she may have skill for idea of upcoming problem and solving mechanism too.

Poor contract managements and poor contract administration are the weakest part of the construction project management. The timely update of latest contract document, incorporating the required criteria in them, making the strong and vivid requirements, making timely decision according to contract are the requisite for the better contract handling process.

And also the local beneficiaries shall be tied up to the project progress by participatory approach by assuring them the appropriate benefit after project success only to reduce future civil unrest/public strikes. The local administration like rural municipality, municipality, and other beneficiaries should be strong and cooperative to the project if incase there is undue demand of local groups arise.

CONCLUSION

From this research, it is found the road projects under SNRTP in the Gandaki Province are extended maximum 114% and minimum 24% and not timely completed. The reasons behind were as unusual monsoon and other climatic condition, strikes, fuel crises, earthquakes and aftershocks, variation in quantities, election, national festivals. These most of the causes falls 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 longer period of extension. Contract agreement being in unappropriated time in May, June and July indicates the initial active of pre-monsoon in Nepal and the months September and October are festive season in Nepal, which cannot mobilize at site. Most of Detail Project Report (DPR) contains only roadway works and its structures, but its others component that is relocation of service which could not be neglected for the successful completion of project like social problems, disseminating the information's to beneficiaries, quarry site for material required has to be finalized during DPR preparation work so that no hindrances and confusion will create during implementation. The way of shifting the responsibility of decision making to other or higher level has to be minimized. The appointed project chief, should have a full authority to make every decision in the project unless there is a variation in the project and he should be punished for inaction or avoidance of his action. On the basis of performance, donor provided the additional funding to projects, however due to different causes of delay during the project period, donor enthusiasm for funding towards the projects has been diminished. The causes of delays are also attributed to the action or inaction of the employer himself. It is employer first duty for smooth execution of project and then only other parties like the consultant and contractor will have their role. The project appraising work, procuring the consulting works, and procuring the contractors, monitoring and controlling their works, project executions, and implementations are the major works of employer in the project.

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