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Evaluation of Cost Variation in Public Broadcasting Buildings of Nepal: A Case of Nepal Television Building

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Abstract
Cost factor is one of the major factor or key performance indicator of any construction project. Like other projects in construction industry cost variation is the major concern of these projects. Consequently, the study's main goal is to assess and analyse the cost variance of the public broadcasting facilities that Nepal Television has put in place. Two Regional Buildings, One Central Buildings (Administration Building, Metro Building, Engineering and Program Building) and Nineteen Relay Stations projects have been studied for cost variation along with their causes. Data from Nepal Television, the response from client, contractor and consultant's representatives were the sources of primary data whereas published literature, reports, standard documents and journals were referred as secondary source of data. For secondary data, library text books about cost variations, Nepal Television publications, prevalent acts, and Nepalese regulations were also studied. From the study it is found that the final cost and the contracted cost were found to be highly correlated. Change in location/plan or scope, change in specification or materials, required improvement, lack of coordination at design stage, significant time difference, weather/environmental factors, are the main important causes of cost variation in projects of Public Broadcasting buildings by Nepal Television. Effective planning, scheduling, thorough contract administration, precise cost estimation, prompt design approval, promptly informing the relevant parties when unforeseen circumstances affect the programme, and a budget carry out/hold system that ensures timely financing availability were the top mitigating measures for the identified causes of variation from the interview.

Keywords
Cost Variations, Public Broadcasting Buildings, Causes of Cost variation, Final Costs, Contracted Costs

1. Introduction

Construction industry play a vital role in the development of the economic growth of a country as it gives opportunity for employment as well as infrastructure to the country and is recognized as one of the largest business worldwide. Construction Industry ultimately uplifts the living standard and maintains Quality of life of its residents. The growth in this business is an indicator of the development of the Country. It has been identified that approx. Thirty five percentage of government project is used for Construction sector and in return the GDP of Nepal is being contributed by 10 to 11 percent. Similarly about 60 percentages of the nation's development budget is spent through the use of Contractors [1]. Most of the population of Nepal relies on Agricultural works, however, it is estimated that the construction sector is creating employment opportunities to about one million people. Nepal being the developing country, infrastructural development plays the vital role in raising the economy of the country and infrastructural development projects solely rely on construction activities. Substantial amount of cash flow is generated from the construction materials, equipment's which ultimately enhances the economic activities and supports the social and economic development of the nation.

From 50595 NPR million in 2017 to 55121 NPR million in 2018, Nepal's GDP from construction increased. From 2001 to 2018, Nepal's GDP from construction amounted to an average of 36923.28 NPR million, with a peak of 55121 NPR million in 2018 and a record low of 27225.05 NPR million in 2001. Figure mentions historical GDP data from the building industry in Nepal (Figure 1).

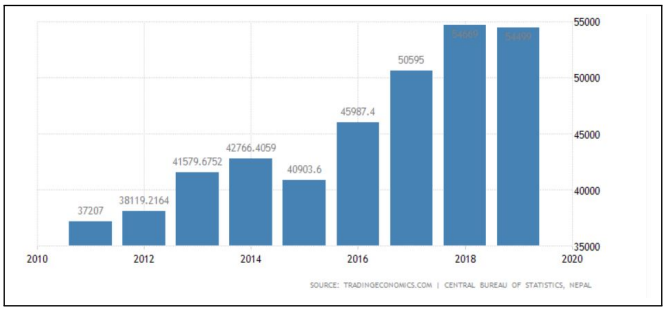

Figure 1: GDP contribution of construction industry in Nepal (Source: Central Bureau of Statistics Nepal)

The construction industry can be distinguished from other economic sectors by its unique features. It is dispersed, vulnerable to shifting conditions like those in politics and the environment, and has an exceptionally high failure rate for businesses. The construction industry can be distinguished from other economic sectors by its unique features. It is dispersed, vulnerable to shifting conditions like those in politics and the environment, and has an exceptionally high failure rate for businesses [2]. The performance and success of a project are measured using the iron triangle: cost, time, and quality [3]. Generally speaking, a project's success is determined by its completion within the allotted budget, time, and quality parameters. Any flaws in those parts cause the contract to fail, which can lead to deviations in time and expenses as well as occasionally contract termination.

A cost deviation is simply the difference, after all modifications to the original contract, between the project's final cost and the agreed upon amount. A cost deviation occurs when unanticipated expenses surpass or fall short of the agreed-upon amount because the real cost was underestimated or overestimated during the budgeting process. One of the biggest issues facing both developed and developing nations is cost overruns. [4]. The tendency is more pronounced in developing nations, where cost overruns can occasionally surpass 100% of the project's estimated cost. Cost deviation is the most prevalent undesirable entity in the construction industry. The building sector in Nepal is likewise not an exception. [5]. Compared to smaller, shorter-term projects, large-scale, long-term projects have substantially higher cost and schedule overruns [6].

Nepal Television also plays a vital role in construction of public broadcasting service development.It began with a few hours of transmission in January 1985. Currently covers more than 72% of the population and more than 50% of Nepal's landmass on a terrestrial level. With its central office and mother station located in Kathmandu, 19 transmitting relay stations, a tower, two regional broadcasting buildings, and a nationwide network of transmitting relay stations, NTV is the only channel that most rural residents can access for free, provided they have basic antennas. Through satellite, viewers can access NTV Plus, NTV News, NTV Kohalpur, and NTV Itahari from anywhere in the globe. Nepal Television is a government agency that builds its own infrastructure from the ground up.[7]. A significant portion of construction in Nepal is focused on building construction. Using information from Nepal Television, this study shows the statistical relationship between the contracted and actual costs of tower projects and relay stations. The study is based on a sample of 19 transmitting relay stations, towers, and central office and mother station in Nepal's capital city, as well as two regional broadcasting building construction projects. The study also examines the reasons behind project cost overruns.

2. Literature Review

2.1 Cost Variations

Cost variation is defined as the difference between the original cost estimate in contract for specific project the actual cost after the completion of that project [8]. In global construction, it was found that 9 out of 10 projects had cost overrun [9]. A cost overrun is a major problem in both developed and developing countries [4]. A research on the cost deviation was conducted in the construction projects found some common factors that are weather condition, change in material rates, inaccurate estimation of cost, complexity of projects, contractors less experience about the site geography, contractor less experience about the project non-familiarity with local regulations [10]. He also studied the cost overrun in high risk construction projects of Indonesia. He pointed out four main factors that affect the cost overrun in construction projects that are increase in material cost, incorrect management of quantity take-off, productivity of labor increase of labor wages in markets.

2.2 Causes of Cost Variations

Many investigations have been carried out to determine the reasons behind the variance in construction project costs. According to contractors, citeenshassi2009delays found that the following were the main contributing factors to cost overruns in building construction projects in the Gaza Strip: a lack of materials in the markets, a lack of construction materials on site, a delay in material delivery, cash issues during construction, and poor site management. In Kuwait, [11] carried out research. They came to the conclusion that the primary factors influencing cost overruns are order changes, owners' financial limitations, and owners' inexperience. In order to determine the primary factors influencing cost overruns in construction projects in Indonesia, [12] carried out a study. They came to the conclusion that the main reasons for cost overruns are inflationary increases in material costs, inaccurate material estimating, and project complexity. [13] concluded that the most factors affecting the cost overrun of construction projects in India are: conflict among project participants, ignorance lack of knowledge, presence of poor project specific attributes nonexistence of cooperation.

As per [12] main causes of increase in cost deviation in UK construction projects were: Project risk uncertainty includes: inaccuracies in estimating project duration; non-performance by subcontractors' designated suppliers; complexity of work; disagreements among project participants; discrepancies in contract documentation; contract specification interpretation; price inflation; financing payment for finished work; inadequate training and experience for the project manager; reliance on imported materials; inadequate planning; unstable interest rates; fluctuations in currency or exchange rates; weak regulatory control; and unstable government policies. According to [14], material cost increases brought on by inflation and labour cost increases resulting from environmental restrictions were the top three reasons for cost overruns in Vietnam. Likewise, [15] concluded that cost escalation of construction projects of Zambia are caused by factors such as inclement weather, scope changes, environmnet protection mitigation costs, schedule delay, strikes, technical challenges inflaton. According to [16], there are three primary causes of cost overruns in public sector construction projects in Nigeria: "fluctuations in material, labour, plant costs, construction delays, inadequate pre-planning."

The main causes of I, II, III, and IV rank for reasons of cost overrun in construction on the Gaza Strip are, according to [17], fluctuations in the cost of construction materials, delays in construction, and unsettlement of the local currency in relation to the value of the dollar.Similar to what [18] found, the main causes of cost variation in construction projects in Turkey are: rising material prices; rapid inflation; contractors finding it harder to produce goods at official prices; delays brought on by changes in design specifications; financial issues with the project; and underestimating project costs at the time of budget creation.The factors influencing the precision of cost estimation in Saudi Arabian construction projects have been determined by [19]. They discovered that the primary influencing factors in cost deviation in construction projects are the project characteristics. According to [20], one of the

top six critical factors influencing the precision of a pre-tender cost estimate in Nigerian construction projects is the intricacy of the construction process.[21] carried out a survey to look into differences in estimates for public projects in the UAE. They claimed that these differences could be explained by the fact that government agencies typically budget for feasibility estimates based on single unit estimating, or cost per square foot, regardless of the projects' specific risks or the complexity of each building type's construction.

3. Research Methodology

Both a quantitative and a qualitative method are used in this investigation. The relationship between the contracted cost and the actual/final expenditure was established using a quantitative approach. Finding the association between one independent variable and another dependent variable within a population is the primary objective of quantitative research studies. The statistical, mathematical, or numerical examination of data obtained by surveys, polls, questionnaires, or by utilizing computer techniques to modify pre-existing statistical data is the focus of the quantitative approach, which emphasizes objective measurements. The goal of quantitative research is to collect numerical data, generalize it to other populations, or provide an explanation for a specific phenomenon. Numbers, reasoning, and objectivity are the main topics of quantitative research. This method, as opposed to divergent reasoning, concentrates on convergent reasoning using comprehensive and immutable numerical data. The contracted and actual cost data used in this study.

Exploratory research is the main type of qualitative study. It is employed to comprehend fundamental motives, beliefs, and justifications. It sheds light on the issue at hand or aids in the formulation of concepts or theories for prospective quantitative study. Qualitative research is also utilized to go deeper into the issue and identify patterns in attitudes and mental processes. There are several ways to acquire qualitative data, including semi-structured and unstructured approaches. Individual interviews, focus groups (discussions in groups), and participation/observations are a few popular techniques. In most cases, the sample size is limited, therefore respondents are chosen to meet a certain quota. A questionnaire survey was conducted to determine the reasons behind the research's cost divergence. Analysis was done on qualitative information obtained from respondents who were employees, contractors, and consultants. The applied exploratory and descriptive co-relational types of research were applied to this study. Because the research was motivated by real-world issues and conclusions regarding cost deviation or not, it is applied exploratory. Because it attempts to establish a link between the contracted amount and the actual cost of construction in Nepal Television's public broadcasting building construction projects, it is also descriptive and correlational.Statistical analysis was conducted using MS-Excel and other applications to examine the data collected for the study.

4. Results and Discussion

In order to determine the reasons for the cost variance in the Public Broadcasting building under Nepal Television, a questionnaire was created and distributed. Major contractors and employers involved in the creation of the public broadcasting building received the questionnaire. A total of 51 questionnaires, both general and particular in terms of the sample size for each stakeholder, were given to the stakeholders in order to increase the breadth of the analysis.Every piece of information was examined for cost variation, and the specifics of any cost variation in relation to the contracted cost are shown. It was heartening that the participants' average response rate was nearly 100%. From the study of 24 Public Broadcasting Building projects it has been observed that almost all projects suffered from cost variation.Using the Cronbach's alpha test, the questionnaire responses from NTV's clients and contractors were examined for dependability. Christmann (2006) robust. According to the test, the client response's alpha value for cost variation variables was 0.84 (greater than 0.8), the contractor overrun variables' alpha value was 0.95 (greater than 0.90), the consultant variation variables' alpha value was 0.84 (greater than 0.90), and the overall category variation's alpha value was 0.93 (greater than 0.90). Since every response had a Cronbach's alpha value more than 0.90, the reliability of the respondent's response was guaranteed.

Table 1: Comparison of causes of cost variation between case study and questionnaires

Causes from Case Study	Causes from Questionnaires	Rank
Change in location /plan or scope	Change in location /plan or scope	1
Change in Spec. or material	Required Improvement	2
Lack of coordination at design stage	Significant time difference	3
Weather / environmental factor	Lack of coordination at design stage	4
Required Improvement	Weather / environmental factor	5

From the Table 1, there are four similar causes from case study and questionnaires and one dissimilar cause. The similar causes from the case study and questionnaires are change in location/plan or scope which is rank 1 in both cases, lack of coordination at design stage which is rank as 3 from case study and 4 from questionnaires, weather/ environmental factor which is rank as 4 from case study and 5 from questionnaires, and required improvement which is rank as 5 from case study and 2 from questionnaires. The dissimilar cause is Change in specification or material from case study which is rank as 2 and Significant Time difference from questionnaires which is rank as 3.

For the fulfillment of objective 2, the mitigating measures of top ten causes from questionnaires and case study were interviewed from the two key personnel of the NTV office. The mitigating measures were listed according to rank of the causes from questionnaires and case study. First the causes

Table 2: Mitigating measures of top causes of variation

SN	Causes Of Variation	Rank		Interview	
		Questionnaires Survey	Case Study	Mitigate (Yes/No)	Mitigating Measures
1	Change in plan or scope of work by clients (as Addition, Omission and Alteration)	1	1	Yes	Effective planning, scheduling, Comprehensive contract administration
2	Change in schedule by client	2	9		Effective planning, scheduling
3	Required Improvement of the site Structures	3	5		Accurate cost estimate
4	Significant time difference	4	6	Yes	Quick design approval, Quickly informed the relevant parties when unforeseen circumstances affect the program
5	Budget Constraint	5	8	Yes	Budget Carry Out/Hold system, Ensuring the timely availability of finance
6	Lack of coordination at design stage	6	3	Yes	Effective coordination communication,
7	Change in design /alignment	7	12	Yes	Controlling design change, Producing design, document
8	Design/ Estimate error omission	8	12		Appointment of architect, engineer and competent site project manager, Developing project program based on experienced planner
9	Schedule delay (Time overrun)	8	6		Effective planning, scheduling, Enough number of labor, Hire competent labor, incentive scheme
10	Weather /environmental factor	10	4		Effective planning, scheduling, work schedule as per season/weather
11	Change in Specification or material	15	2	Yes	Effective planning, scheduling, Comprehensive contract administration
12	Force Majeure	37	10		Proper Adjustment between client, contractor as per PPA, PPR Nepal Law

were ticked if the causes can be totally mitigated or not, however the mitigating measures were listed for all top ten causes of variation from questionnaires and case study. Table 2 shows the mitigating measures derived from the interview.

5. Conclusion and Recommendation

This research has been carried out with the objective to evaluate the cost variation of public broadcasting buildings implemented by Nepal Television. Mixed approach was applied for the research by collecting the primary data through questionnaire survey (Employers, Contractors Consultant group), key informants interview record of Nepal Television, Library, Journals, books, research paper, internet were referred as secondary data.

5.1 Conclusions

5.1.1 Objective 1: To Identify the Factors Causing Variation in the NTV Projects under NG

- Out of 24 public broadcasting buildings projects, it has been observed that 23 projects were suffered from cost variation which is more than 90%.
- On an average the cost variation varies from 0% to 14.24% with the average variation of 8.40% which indicates cost variations are the significant problems of public broadcasting building projects implemented by Nepal Television (NTV).
- Contract cost of the project is highly correlated with the final cost of construction of public broadcasting buildings implemented by NTV. The correlation coefficient for contracted cost final cost was found to be 0.999.
- The factors causing variation were change in location/plan or scope, lack of coordination at design stage, weather/environmental factor, required improvement, found in both from case study and questionnaires.

5.1.2 Objective 2: To Analyze the Causes of Variation Recommend Measures to Mitigate or Minimize Variation to the Acceptable Limit.

- From case study, change in location/plan or scope, change in specification or material, lack of coordination at design stage, weather/environmental factor required improvement were ranked as 1,2,3,4 and 5 respectively.
- From questionnaires, change in location/plan or scope, required improvement, significant time difference, lack of coordination at design stage weather/environmental factor were ranked as 1,2,3,4 and 5 respectively.
- The similar causes from case study questionnaires were change in location/plan or scope, required improvement,

lack of coordination at design stage weather/environmental factor. The dissimilar cause was change in specification or material from case study whereas significant time difference was from questionnaires.

- The mitigating measures of top ten causes of variation from both case study questionnaires were interviewed listed. Top mitigating measures from the interview were effective planning scheduling, comprehensive contract administration, effective planning scheduling, accurate cost estimate, quick design approval, quickly informed the relevant parties when unforeseen circumstances affect the program, budget Carry Out/Hold system ensuring the timely availability of finance

5.2 Recommendations for Future Research

- Similar study should be conducted for Public institution of Nepal such as the department of road, irrigation water supply sanitation projects.
- Similar research on evaluation of time variation with respect to contracted time can be done on public broadcasting buildings implemented by NTV.
- Research on applicability of final cost contracted cost can be checked.

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