Investigation on the Causes of Cost Overrun in Federal Road Projects in North Shewa Zone

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Abstract:- **Cost overrun was one of the contributing problems that has been published in different literatures, slows down the projects' progress and consequently leaves those projects in a great trouble way. This leads to seek an acute issue related to cost overrun in road construction projects and to fill this gap, the study was undertaken to investigate the causes of cost overrun in selected federal road projects in North Shewa Zone. To address the problems; case study method, mixed approaches, and purposive sampling technique have been employed. A questionnaire was designed and distributed to the employers, consultants, and contractors of the selected federal road project participants. To supplement the questionnaire; desk study, interview & observation was conducted. Consequently; analysis of data was processed using simple statistical approach, tabulating, categorizing, examining and SPSS method based on the chosen measurement scale. And, Likert's scale was used to gauge the causes & effects together with spearman's rank correlation coefficient to test correlation among parties. This study tries to justify whether cost overrun exists or not, identify what causes & their consequence effects. Accordingly, the study concludes that cost overrun as one of the major problems in the selected federal road projects in North Shewa Zone. Due to this, Errors in design, right of way problem, widening of road section in town, change in defined scope, lack of adequate site investigation, lack of proper planning, and contractor's financial problems were identified as the main cost overrun causes.**

Keywords: Cost Overrun, Causes, Road Project, North Shewa.

1.INTRODUCTION

Construction industry has an important contribution in the social and economic development of the country and for its achievement, cost is the most important consideration as well as one of the main significant parameters to measure the achievements of the construction project industries (Tejale, Khandekar, and Patil,2015). Besides to this, construction industries are challenged by several problems. In this, cost overrun is one of the major problems that affects the construction industry as a whole. Of those construction industries, road project construction sector is one of the parts of construction industry highly victim by cost overrun. For the purpose of this study, cost overrun is the cost difference between the original cost and the actual cost when the project is completed (Avotos ,1983). Accordingly, causes like Price fluctuations such as raw materials, stable manufacturing prices, high cost of equipment, low bid strategy and poor project managements consequently results cost overrun (Azhar et al, 2008).

According to Abhishek Bhargava (2010), inflation or increase in construction materials, poor planning and coordination, change orders due improved customer demand during construction and overcrowding are the major causes for in cost overrun. This indicates that cost overrun is one of the common problems observed in the construction sector particularly it would be high in road projects. This is because of road projects use too much amount of money as compared to other projects. That means, road project constructions have historically experienced cost overruns from the time of the decision to build has been taken by the client (Creedy and wong,2010). One of the basic reasons for cost overrun is that most contractors estimate prices based on their project approximations. Unfortunately, the prices change so quickly that the initial budget figures become completely unrealistic (Azhar et al, 2008). For this, extensive experiences and decision makings should be needed to develop a reasonable approximate estimation for the project cost and to modify the unit costs for quantities of materials, labor, location, and construction contingencies (Roachanakanan ,2005). The literature review indicates support for these views. This research attempts to investigate the causes of the cost overrun in the selected federal road projects in North Shewa zone through a scientific approach.

1.2 Statement of The Problem

One of the most contributing problem that has been published in different literatures were cost overrun. According to Creedy (2010), Cost overrun in construction is a worldwide phenomenon, and it slows down the projects' progress and consequently leaves those projects in a great trouble way. This implies that cost overrun is one of the challenges in road construction projects (Turkey,2011). So, it is important to investigate the causes to overcome those challenges.

According to Fetene Nega (2008), delay, Supplementary agreement, additional cost, the consultant viewed as incompetent by project owners, high cost of supervision and contract administration for consultants, delayed payments to contractors, the contractor suffer from budget short fall of the client, and Poor-quality workmanship were the main causes of cost overrun. This indicates that, the causes of cost overrun on road construction projects are various in numbers and these causes are not only hard to predict but it is also difficult to manage them. Besides to this, what the overseeing causes through informal observation in North Shewa zone federal road projects were rocky and mountainous surface area that needs large plants, equipment, machineries &

materials, poor management assistances and consultants, delay in completion of projects, and inaccurate cost estimations that consequently results cost overrun. This indicates that, cost overrun causes shall need a quick and appropriate study. On the other hand, based on the depth of the problem there is no sufficient study in order to investigate the causes of cost overrun and to reduce their effects in the selected federal road projects in North Shewa zone. As a matter of fact; from the literatures' view of points and informal over seeing conditions of cost overrun causes, the researcher identifies the following under listed gaps;

✓ Most of the literatures studied under construction cost overrun causes were focused on Public building, private building, residential building, commercial building, industrial and institutional Construction in comparison to road construction projects.

✓ Most of the construction projects still fail to meet the deadlines and also exceed initial estimated budget (specifically high in road construction projects as compared to others)

✓ Besides the depth of cost over run problem, still there is no sufficient research conducted on construction of road projects in the selected federal road projects in North Shewa zone

✓ Almost all of the literatures use questionnaire method as a sole data collecting method.

Due to those gaps, the researcher was initiated to conduct a study on investigating the causes of cost over run in the selected federal road projects in North Shewa zone.

1.3. Objectives

The general objective of this study is to investigate the causes of cost overrun in selected federal road projects in North Shewa Zone. To achieved the general objectives the following specific objectives were set:

✓ To identify the main causes of cost overrun in the selected federal road projects in North Shewa Zone

✓ To examine the consequential effects of cost overrun in the selected federal road projects in study site

✓ To analyze the frequency occurrences of cost overrun in the selected road projects in study area, and

✓ To make recommendations for reducing cost overrun in the selected federal road projects in the zone.

2.RESEARCH DESIGN AND METHODOLOGY

2.1. Research Design

a) The Study Area

The study area is located in North Shewa Zone which is found in the Amhara Regional state, federal road projects, in the central part of Ethiopia.

b) The Study Period

The study periods set for this research has been from November 2019 to August 2020

To achieved the objectives of this study, the researcher performs the following strategy as illustrated in figure 2.1.
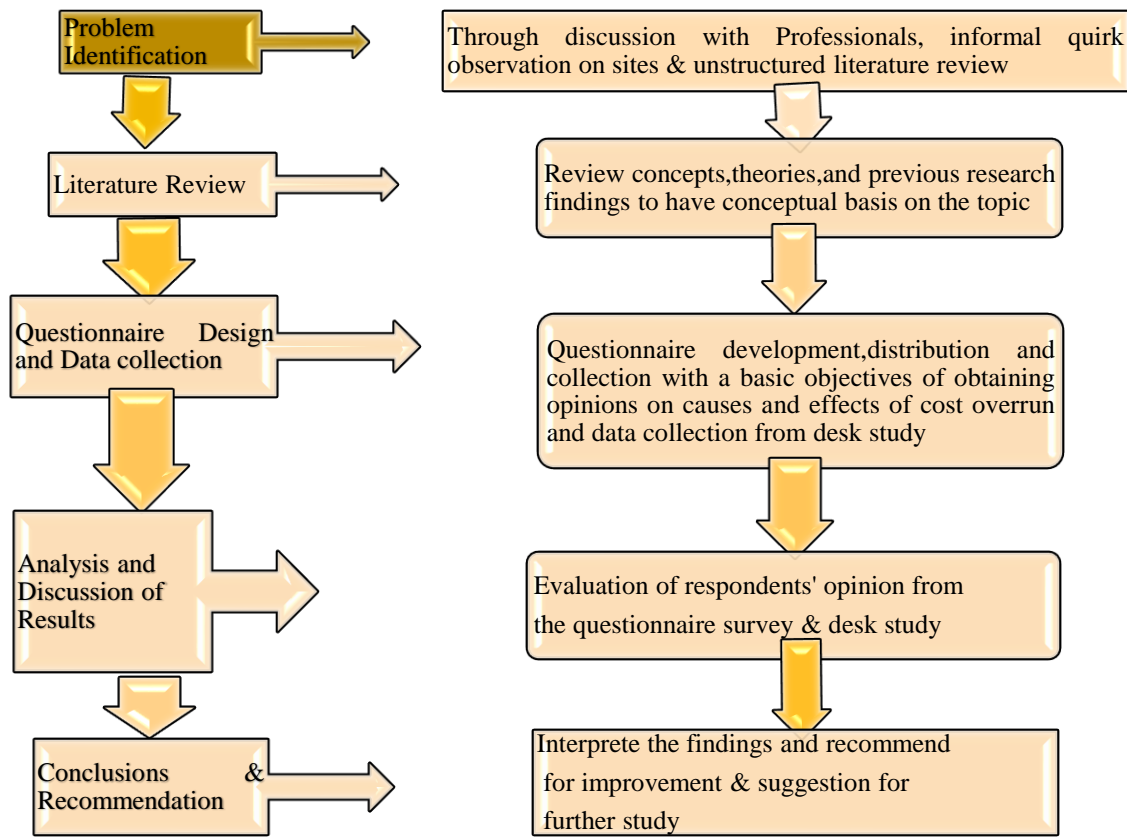
Figure 2. 1: Research Design Strategy Frame

2.2 Research Approach

In this study, mixed approach has been used. This study uses both quantitative and qualitative approaches. The intention behind the selection of this approach is that; mixed approach has regained not just acceptability, but popularity in terms of validation results.

2.3. Sampling Population and Sampling Technique

2.3.1. Sampling Population

The sampling population was drawn from client (ERA), contractors, and consultants including professionals that are participated in the selected federal road projects of North Shewa Zone. The contractors included were all Category 1 and were either General Contractors (GC) or Road Contractors (RC). The list of contractors and consultants currently involved in the selected federal road projects were obtained from the Ethiopian Road Authority Head Office (ERAHO). Accordingly, the total sampling population was 214 (based on work experience, profession, current performance in the organization, and academic performances related to roads, costs, managements, and others).

2.3.2. Sampling Technique

In this study, purposive sampling technique has been used. Due to this, the total sampling population was 214 (based on work experience, profession, current performance in the organization, and academic performances related to roads, costs, managements, and others). The sample size needed was computed using the statistical equation Eq. (1and 2).
The formula used in sample size calculation is:

$$S_S = \frac{Z^2*(P)*(1-P)}{E^2}$$ …………………………….. Eq. (1)

Where: S_S= Sample size needed; Z= z value corresponding to the level of confidence or the standard normal distribution; P= percentage picking a choice expressed as decimal; and E= margin of error with confidence interval 5%
Correction for finite population

$$New \quad S_S = \frac{S_S}{1+\frac{S_S-1}{Pop}}$$ …………………………….. Eq. (2)

Where Pop=population

The z value corresponding to a level of confidence of 95% is 1.96 and the confidence interval (maximum error) was set to 0.05. For a given level of accuracy, p=0.5 for percentage picking a choice ex pressed as decimal using the worst-case percentage (50%). This helps in creating the most conservative (largest) estimate of sample size.

According to Eq. (1), the required sample size will be:

$S_S = \frac{(1.96)^2 * (0.5) * (1-0.5)}{(0.05)^2} = 385$ and the corrected new S_S value will be;

By using Eq. (2) the new S_S= (385)/ (1+ (384/214) = 138

Therefore, the total sample size determined was 138 from 214 total participants of the organization. The samples were selected by the researcher using purposive sampling technique. But the respondents were 99; of which 24 from owner, 36 from consulting offices, and 39 from contractors. The reason is that, respondents were busy with a field work. Also, some respondents were suffered in the covid-19, and the others doesn't fill out and turn back the questioners in time.

2.4. Sources of Data and Data Collection Instruments

2.4.1. Sources of Data

In order to attained the objectives of the study, the researcher have been used both primary and secondary data sources. However, each of the data sources were discussed in detail below:

a) Primary Data

The primary data were collected from the participants of the selected federal road projects. The participants were contractors, consulting firms, and client (ERA). As to the primary sources; contractors, consultants, and clients were involved in the questionnaire.

b) Secondary Data

In view of supporting the information gathered through primary sources, secondary data related to causes of cost overrun were collected from official documents of the selected federal road projects & companies, different published and unpublished books, journals & articles, road sector policies and strategies, design manuals, proclamations, statistical evidences, reports and other relevant materials.

2.4.2. Data Collection Instruments

For this study, the instruments or tools used to collect the relevant information were questionnaire, interview, observation, and desk study.

a) Questionnaire

In this study the major instrument used to collect the data was questionnaire, due to its convenience to collect adequate data or information from a large number of respondents. For the questionnaire survey, stratified random sampling technique have been used to select the respondents from the employer (ERA), consultants, and contractors. Furthermore, the questionnaires were constructed with both closed & open-ended items. Regarding cost overrun, the question begins to ask respondents about their agreement on whether cost overrun in the selected federal road project is a problem or not based on the following scale of measurements.

- ✓ Strongly agree
- ✓ Agree
- ✓ Neutral
- ✓ Disagree
- ✓ Strongly disagree.

After this the respondents were asked about the average extent of cost overrun occurred in road projects based on their experience, if they agree or strongly agree. Once these basic questions were answered by the respondents, they were also requested to write the most recurrent causes of cost overrun in road projects and indicate the level of impacts as well as the frequency of occurrences corresponding to each cause based on the following scale of measurements.

For level of impact:

1 = No impact

2= Low impact

3= Medium impact

4= High impact

5= Very high impact

For frequency of occurrences:

5-Certain =100% probability to happen

4-Relatively certain = 76% - 99%

3-More likely = 51% - 75%

2-Likely = 26% - 50%

1-Unlikely = 1% - 25%

The responses of the questionnaire were rated based on the five point contributing factors (from 1-5) of ordinal measurements to identify and rank the potential causes of cost overrun based on the level of impacts and frequency of occurrences. In this part, respondents were also requested to give suggestions that contributes to minimize the causes of cost overrun in road projects as well as methodology to handle the project cost.

For the effect of cost overrun part, respondents were requested to write the most recurrent effects of cost overrun in road construction projects and indicate the corresponding level of frequent effect based on the following scale of measurements.

Level of frequent effect:

1 = Least frequent effect

2= Low frequent effect

3= Medium frequent effect

4= High frequent effect

5= Very high frequent effect

The responses of the questionnaire were rated based on the five point contributing factors (from 1-5) of ordinal measurements to examine and rank the potential effects of cost overrun based on the level of frequent effects.

b) Interview

In order to gather an information on causes of cost overrun in the selected federal road projects, an interview has been carried out on a face-to-face basis. An interview is also a tool in which the interviewer or the researcher collects data from the interviewee, who provides the data. In this, an informal interview was used in the desk study part to fulfill some missing data in the archival documents.

c) Observation

The researcher has been used an observation to gather additional facts through a means of seeing the realities at the respective sites, offices, facilities, services, and constructing activities related to cost overrun in the selected road projects. This was employed to further strengthen the information collected through means of other data gathering instruments.

d) Desk study

Desk study has been carried out to obtain an actual data from the source documents which includes archival documents like completion report, progress report, payment certificates and contract documents to have contextual bases on causes of cost overrun in the selected federal road projects. This tool also helps to understand the relationship between the theories and actual practices in the selected federal road projects.

2.5. Methods of Data Analysis

In order to achieve the objectives of the study, effective data were sorted and then both descriptive and inferential statistics as well as SPSS (Statistical Product and Service solutions) software have been used to analyze the collected data from various sources. In the analysis of the questionnaire survey, "mean score" method have been adopted to determine the relative ranking of causes as well as effects of cost overrun based on the level of impacts and frequency of occurrences as well as the level of frequent effects (i.e. ranges from 1 to 5).

The mean score (MS) for each cost overrun causes as well as effects were calculated by using the following formula.

$$MS = \frac{\Sigma(f*s)}{N} \quad \text{.. Eq. (3)}$$

Where: MS = Mean score; f = frequency of response for each score; S= score given to each factor (1 to 5); and N= Total number of responses for each factor

Furthermore, the cumulative of the mean score of the two (i.e. frequency of occurrence and

Rating scale on causes of cost overrun) was calculated to determine the overall ranking based on the two criteria. Accordingly, for overall ranking of the factors for the purpose of this study equation (3) becomes:

$$CMS = MSR * MSI \quad \text{.. Eq. (4)}$$

Where: CMS= Cumulative Mean score; MSf= Mean score for frequency of occurrence and MSi= Mean score of the impact

Based on the mean score ranks of cost overrun causes as well as effects, the three groups (i.e. clients versus consultants, consultants versus contractors, and contractors versus clients) are tested for correlation. The purpose of a correlation test is to see the differences in ranking between two groups of respondents and to evaluate their consensus of opinions.

The ranking correlation coefficient ranges from -1 to +1. A correlation coefficient of 1 indicates a perfect linear correlation i.e. good or strong correlations while -1 indicates negative correlation implying high ranking in one group is associated with low ranking on the other. Correlation coefficient value near to zero indicates little or no correlation. This correlation coefficient is used to measure and compare the association between the rankings of two parties, while ignoring the ranking of the third one.

In this, the spearman's rank correlation coefficient (ρ) is used for measuring the agreement or difference in ranking between two groups of respondents scoring for each factor (i.e. clients versus consultants, clients versus contractors, and consultants versus contractors) is applied; because of its advantages of not requiring the assumption of normality or homogeneity of variances. It is also used to show the degree of agreement between the different parties involved in the survey: contractors, clients, and consultants.

The Spearman rank correlation coefficient (ρ)for any two groups of ranking is given by the following formula (Chapman, 2002):

$$\rho = \left\{ 1 - \left[\frac{6\,\Sigma(d^2)}{n(n^2-1)} \right] \right\} \quad \text{... Eq. (5)}$$

Where: ρ = Spearman rank correlation coefficient(rho); d = difference between ranks given by two parties or respondents for each factor and n = number of pairs of values in the data set.

Procedure for hypothesis testing:

1. Define the null hypothesis (H_0) and the alternative hypothesis (HA)

2. Choose a value for ρ(i.e. choose the significance level)

3. Calculate the value of the test statistic, ρ

4. Compare the calculated value with a table of the critical values of the test statistic.

5. If the calculated value of the test statistic is less than the critical value from the table, accept the null hypothesis (H_0). If the calculated value of the test statistic is greater than or equal to the critical value obtained from the table, then reject the null hypothesis (H_0) and accept the alternative hypothesis (HA).

3. ANALYSIS AND DISCUSSION OF RESULTS

3.1. Analysis & Discussion of Results from Desk Study

In the desk study survey seven road projects including the client (ERA), two consulting firms (for 3 contractors and 4 road projects), and five class one general & road contractors in the selected federal road projects in North Shewa Zone were surveyed. Accordingly, the causes as well as effects of cost over run have been analyzed and discussed below.

3.1.2 Causes of Cost Overrun from Desk Study Results

Based on the data obtained in the desk study; out of the seven road projects three of them were completed, and the remaining four road projects were not completed due to delay in payment, design changes, increase in material cost (material price fluctuation), unexpected weather condition, and time schedule. The completion report of the project shows that the main reasons for cost overruns were widening of road section at major towns, right of way problem, design change, due to additional drainage systems, due to employer's failure to remove obstruction on time, and revised unit rate for inflation. The analysis of desk study also shows that the rate of cost overrun ranges from the minimum of 32.24% to the maximum of 67.52% of the contract amount of the road project. This clearly indicates that the rate of cost overrun was high in the selected federal road projects in North Shewa Zone district. Table3.1 and figure 3.1 shows the detail analysis of cost over run causes.

Table 3. 1: Cost overrun of the selected federal road projects from desk study

Source: Ethiopian Road Authority Head Office (Projects' Progress and completion report)

| Project Name	Description of work	Contractor's Name	Total length (km)	Construction period	Contract amount (ETB)	Actual amount (ETB)	Cost overruns (%)	Status
1.Mehalmeda-Alemketema	Design and Construction	Gemshu Beyene Construction PLC	47.64	2016 to 2019	715,292,775.75	1,140,724,684.84	67.52	Completed
2. Ankober – Dulecha	Design and Construction	Sunshine Construction PLC	40.00	2018 to 2020	649,388,576.62	858,761,475.50	32.24	Completed
3.Dulecha - Awash Arba	Design and Construction	Ethiopian Construction Works Corporation (ECWC)	53.13	2016 to 2019	493,519,819.68	717,244,619.75	45.35	Completed
4. Debre Birhan – Ankober	Design and Construction	Sunshine Construction PLC	42.00	2017 to 2020	1,083,570,868.24		-	Not Completed
5.Ataye- Mehal Meda	Design and Construction	Yencomad Construction PLC	60.68	2015 to 2019	1,352,642,535.82	-	-	Not Completed
6.Tarmaber - Meleya –Molale	Construction	Defense Construction Enterprise	118.87	2018 to 2021	1,906,200,296.75	-	-	Not Completed
7.Alemketema – Degolo	Construction	Gemshu Beyene Construction Plc	85.00	2017 to 2020	1,280,770,840.15	-	-	Not Completed
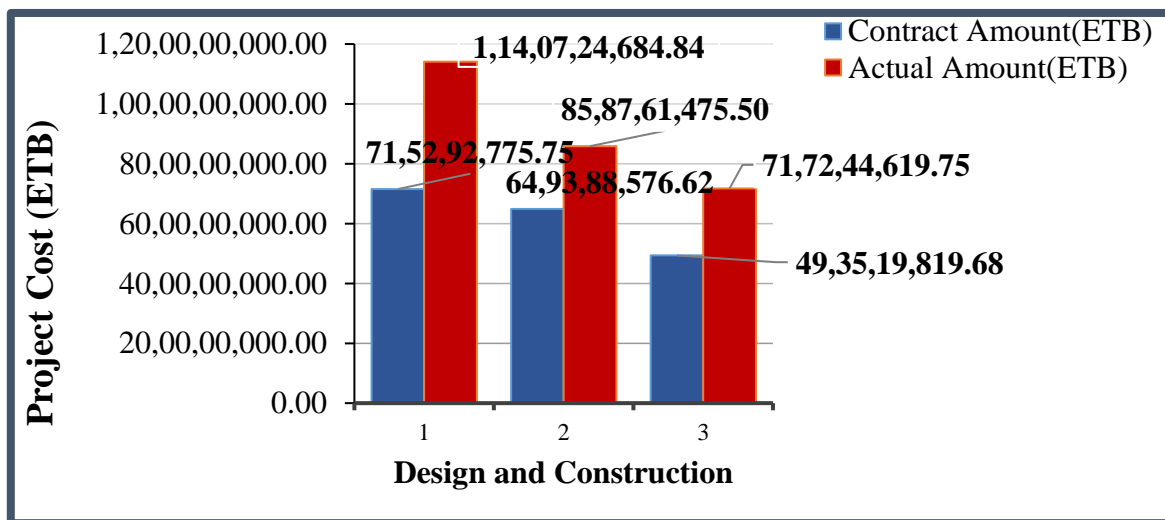
Figure 3. 1: Results of cost overrun amount in the selected federal road projects from desk study

Furthermore, the desk study shows that most of the causes such as right of way problem, design change, scope changes, design problems and unforeseen ground conditions were problems due to improper planning as well as clarity of documents used in the process and poor planning.

3.1.3 Effects of Cost Overrun from Desk Study Results

The results obtained from the desk study show that, majority of the selected federal road projects in North Shewa Zone district were delayed and incurred an additional cost other than the contract amount and disagreement among stakeholders, and adversarial relationships among the project participants were some of the effects of cost overrun. In addition, all stakeholders participated in the road project were affected by problem of cost overrun. Problem of cost overrun doesn't affect only all stakeholders that are involved directly in road construction projects, but it also affects the construction industries as a whole and consequently it proceeds to affect the national economy of the country. Furthermore, cost overrun problem requires an additional budget that in turn affects the financial resources of the country, and results a negative way to the rate of the national growth of the country.

3.2. Analysis & Discussion of Results from Questionnaire Survey

In this study, the causes of cost overrun from the questionnaire survey were identified based on the respondents' understanding and their point of views on cost overrun causes in the selected federal road projects in North Shewa Zone. As a general information from the questionnaire survey related to cost overrun causes as well as effects, and rate of occurrences have been analyzed and discussed in detail.

3.2.1. Analysis of Questionnaire Response Rate

A total of 138 questionnaires was distributed to the three groups of respondents in the selected federal road project. Out of the 138 questionnaires,99 questionnaires were collected which comprises 24 from client (ERA), 36 from consultants and 39 from contractors. This gives a total response rate of 72% as shown in table 3.2 and figure 3.2 below.

a) The Client (ERA)

In this, a total of 30 questionnaires were distributed to the various staff members of the client (ERA) that are involved in the selected federal road projects and out of which 24 questionnaires were collected. This represents 80% of the questionnaire were returned from the employer.

b) The Consultants

Here, a total of 48 questionnaires were distributed to the staff members of consultants and 36 questionnaires were returned for analysis. This represents 75% of the questionnaire were returned from the consultants.

c) The Contractors

In the contractors' side, a total of 60 questionnaires were distributed and 39 questionnaires were collected from them which represents 65% were returned from contractors.

Thus, an overall response rate of 72% was achieved. This is significant for the purpose of validating the thesis results. The details of questionnaire survey response level and its response rate are summarized in the table below.

Table 3. 2 : Overall questionnaire survey response level

Respondents Category	Questionnaire Distributed	Questionnaire Returned	Percent	Cumulative	Percentage Response Rate
Client (ERA)	30	24	24.24	24.24%	80%
Consultant	48	36	36.36	60.60%	75%
Contractors	60	39	39.40	100%	65%
Total	138	99	100		72%

Furthermore, figure 3.2 shows that; among 99 questionnaire respondents 24(24.24%) were clients, 36(36.36%) were consultants, and 39(39.40%) were contractors. Therefore, most of the respondents were contractors.
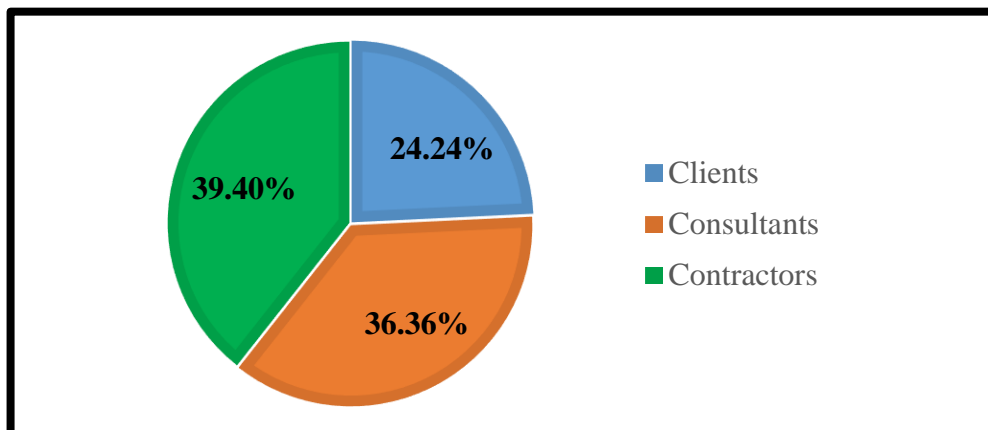

Figure 3. 2 : Respondents' Response Rate

3.2.2. Analysis for the Quality of Respondents

a) Experience of Companies in the Road Construction Projects

In this study, well experienced respondents from the selected federal road projects were directly involved in the questionnaire survey activities. Of those respondents, 66.67% of respondents were from the organizations that have been more than 10 years of

experience, while; 33.33% of respondents were from the organization that have been from 5 -10 years of experience in the road project sector as shown in table 3.3. below.

Table 3. 3: Experience of Companies in Road Construction Projects

b)

Experience of the Company	Employer	Consultants	Contractors	Total	Percentage
Less than 5 years	0	0	0	0	0.00%
5 to 10 years	0	1	2	3	33.33%
Above 10 years	1	2	3	6	66.67%
Total	**1**	**3**	**5**	**9**	**100%**

Educational Qualification of Respondents

The purpose of this part was to know the educational capability of respondents to undertake the work. Regarding the educational qualification, the survey result shows that 15% of the respondents have MSc. Degree and the rest 85% of the respondents have BSc. Degree as shown in table 3.4 or figure 3.3. The percentage distribution of the various respondents indicates that the majority of the questionnaires was completed directly by professionals involved in the road construction sector. The survey also shows that it was well represented by better qualified professionals in the road construction management and these groups of respondents are expected to have plenty of knowledge on the subject matter.

Table 3. 4: Educational Qualification of Respondents

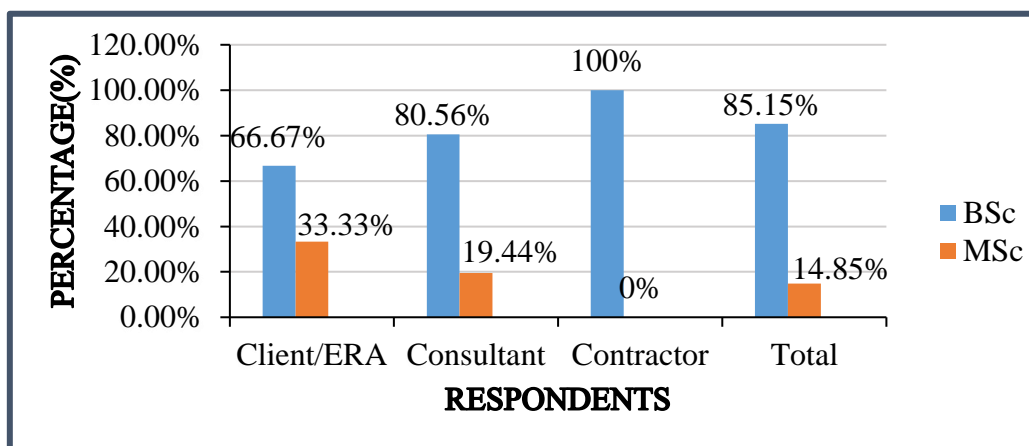| Respondents	Educational Qualification				
	BSc	MSc	Total	Percentage of BSc	Percentage of MSc
Client (ERA)	16	8	24	66.67%	33.33%
Consultant	29	7	36	80.56%	19.44%
Contractors	39	0	39	100.00%	0.00%
Total	**84**	**15**	**99**	**85.15%**	**14.85%**

Figure 3. 3: Educational Qualification of Respondents

c) Position of Respondents in the Organization

Regarding the position of respondents in the organization, the survey result shows that 11% of the respondents have been participated in the top management level, 18% of the respondents have been participated in the middle management level, and the rest 71% of the respondents have been participated in the other positions.

Table 3. 5: Position of Respondents in the Organization

Respondent position	Employer	Consultant	Contractor	Employer Percentage	Consultant Percentage	Contractor Percentage	Average Percentage
Top Management	1	6	5	4%	17%	13%	11%
Middle Management	2	6	11	8%	17%	28%	18%
Other	21	24	23	88%	66%	59%	71%
Total	**24**	**36**	**39**	**100%**	**100%**	**100%**	**100%**

As shown in table 3.5 above, the smallest mean percentage of respondents' position in the organization is top management (11%) that are directly involved in the administrative including contract management and also the middle management (18%) includes those participants in relation to both administrative as well as management of contractual issues. It is believed that the result from the survey is relatively accurate and reflects the prevailing actual situation in the selected federal road projects with respect to the cost overrun causes.

d) *Experience of Respondents in the Road Construction Projects*

As shown in table 3.6 below; out of the 99 respondents,52.53% of the respondents had less than 5 years of working experience, 38.38% had 5 to 10 years of working experience and 9.09% had more than 10 years of working experience. Furthermore, out of the 24 respondents on the client side; 83.33% of the respondents had less than 5 years of working experience, 16.67% had 5 to 10 years of working experience, and there are no respondents having a working experience from 10 to 15 years. Out of the 36 respondents on the consultant side; 80.55% of the respondents had less 5 years of working experience, 16.67% had 5 to 10 years of working experience and 2.78% had more than 10 years of working experience. Out of the 39 respondents on the contractor side;7.69% of the respondents had less 5 years of working experience, 71.80% had 5 to 10 years of working experience, and 20.51% had above 10 years of working experience.

Table 3. 6: Experience of Respondents in the Road Construction Projects

No	Experience	Client	%	Consultants	%	Contractors	%	Total	%
1	Less than 5 years	20	83.33	29	80.55	3	7.69	52	52.53
2	5 to 10 years	4	16.67	6	16.67	28	71.80	38	38.38
3	Above 10 years	0	0.00	1	2.78	8	20.51	9	9.09
	Total	**24**	**100**	**36**	**100**	**39**	**100**	**99**	**100**

3.2.3. *Existence, Extent and Occurrences of Cost Overrun Analysis*

a) **Analysis of the Existence of Cost overrun**

In the second part of the questionnaire survey, first respondents were requested to give a response on whether cost overrun problem exists in the selected federal road projects or not. The result obtained from the respondents shows that cost overrun is one of the major problems in the selected federal road projects in North Shewa Zone. As it is indicated in Figure 3.4 below 93.07 % of the respondents for this study confirms that cost overrun as one of the major problems in the selected federal road projects of North Shewa Zone and the remaining 5.94% as well as 0.99% were neutral as well as disagree respectively. From the total of 99(100 %) respondents, 31(30.70%) of the respondents were strongly agree about the existence of cost over run problems in the federal road projects, 63(62.37%) of the respondents were agree on cost overrun is a major problem in the selected federal road projects of North Shewa Zone,4(5.94%) of the respondents were neutral,1(0.99%) of the respondent were disagree, and there were no respondents that were strongly disagree on whether cost overrun is a problem in the selected federal road projects or not. This was also done in the problem identification stage.
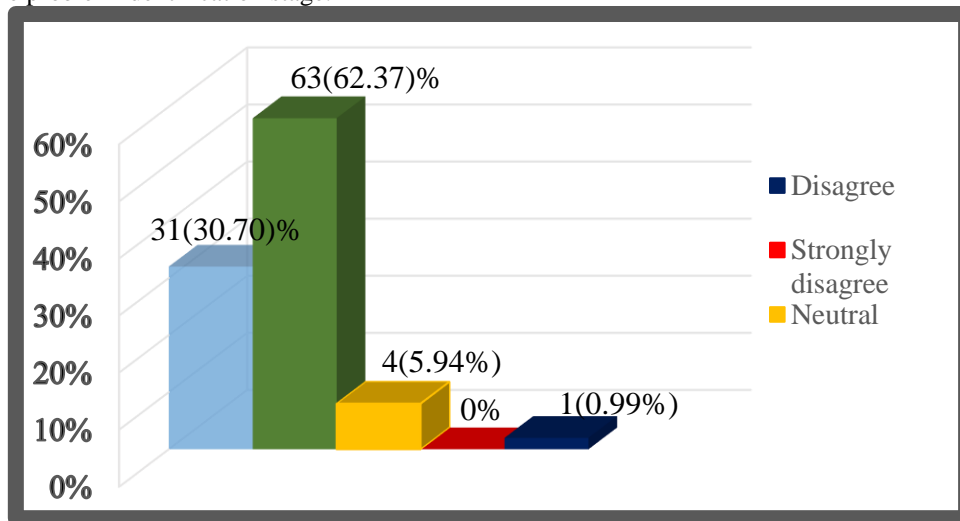

Figure 3. 4: Respondents response on whether Cost overrun is a problem or not in the selected federal road projects

b) *Analysis of the Extent of Cost overrun problem*

The survey results of the respondents indicate that the average extent of cost over run in the selected federal road projects in North Shewa Zone district were 60%. From the desk study, the extent of cost overrun was done by comparing the actual amount of the project with that of the corresponding contract amount of the selected federal road projects. Based on this point of view, the desk study result shows that almost all of the completed projects were affected by cost overrun problems. Moreover, the data obtained from the desk study indicated that the average initial contract amount was 619.4 million Ethiopian birrs, while the average actual amount of those projects were 905.6 million Ethiopian birrs with an average cost overrun of 286.2 million Ethiopian birr or 46.21% of the contract amount.
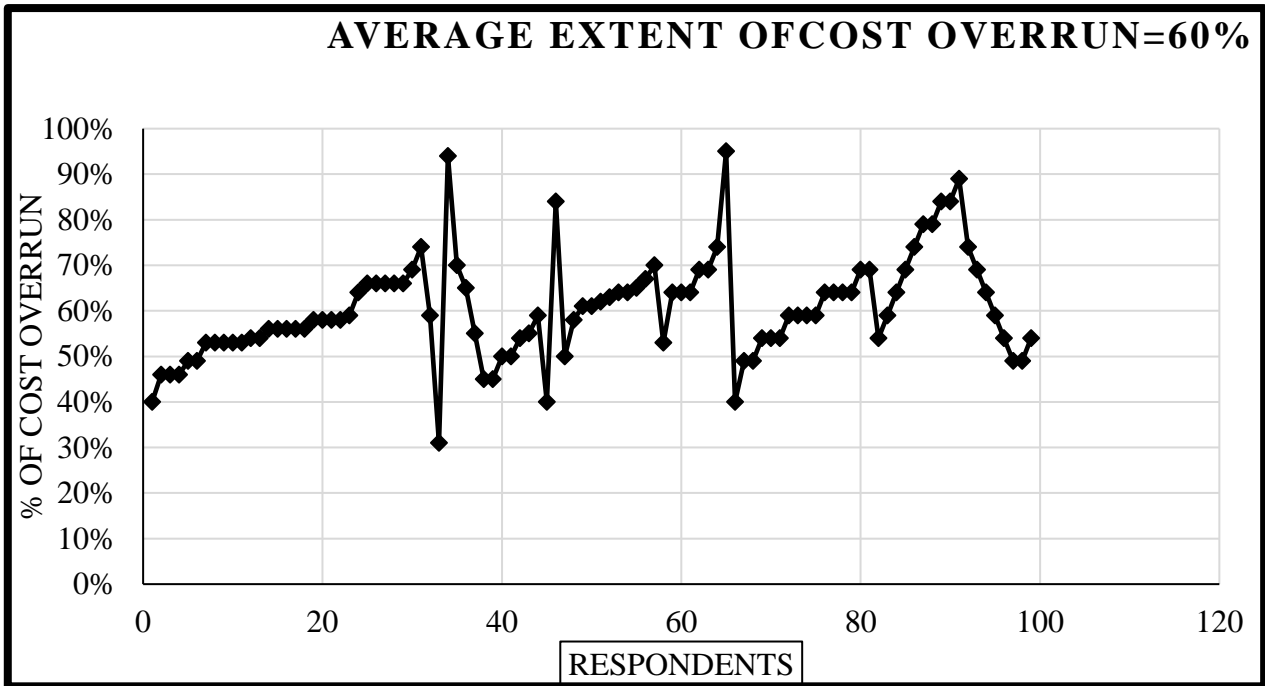
Figure 3. 5: Average extent of cost overrun from respondents' experience

c) Analysis the Occurrences of Cost overrun problem

In order to investigate the level of occurrences of cost overrun causes in the selected federal road projects, responses of the respondents have been analyzed as shown in figure 4.6. Accordingly; the survey result shows that the level of occurrences of cost overrun in the selected federal road projects have been considered. In view of this; 33(33.3%) of the respondents give the frequency occurrences of cost overrun problem as most frequent,55(55.6%) of the respondents give the frequency occurrences of cost overrun problem as frequent,11(11.1%) of the respondents' give cost overrun problem as least frequent, and no respondents level cost overrun problem as no frequent. Thus, most of the respondents' level the frequency occurrences of cost overrun problem in the selected federal road projects as frequent.
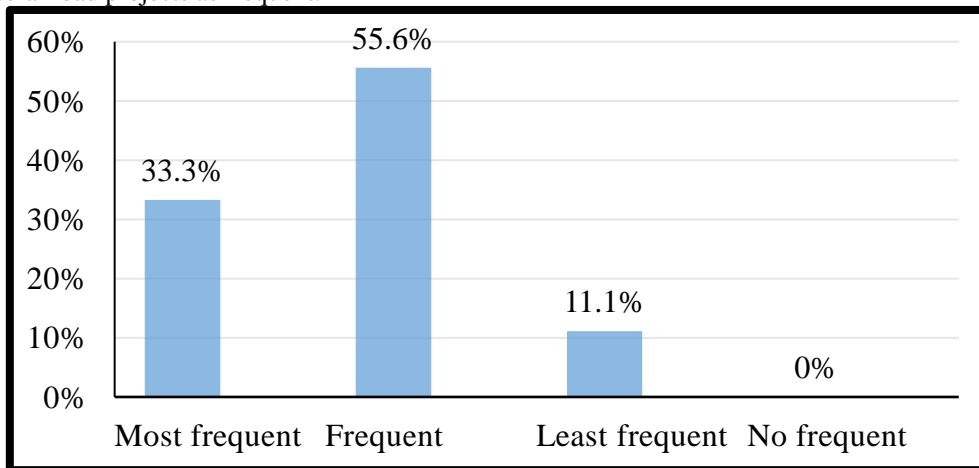

Figure 3. 6: Frequency rate of occurrences of Cost overrun problem in the selected federal road projects in North Shewa Zone

3.2.4. Analysis of Cost Overrun Causes from Questionnaire Survey
a) Causes of Cost overrun from Clients' View

Based on clients' point of view, the questionnaire survey result shows that design error/faulty design were the first cause of cost overruns with a cumulative mean score of 0.14. Design error were considered as one of major cause for cost overrun in the selected federal road projects. Right of way problem and Short period of bidding (i.e.3-months in the standard) were ranked as the second causes of cost overruns with a cumulative mean score of 0.14. The third causes of cost over run ranked by clients were alignment change due to archeological sites as well as additional requests from local peoples & administrators a cumulative mean score of 0.12. Table 4.7 shows the remaining cost overrun causes from the clients' point of view with their corresponding cumulative mean score in detail.

Table 3. 7: Summary of Cost Overrun causes and their ranks by Clients

No	Potential Causes of cost overrun in road projects	Number of Respondents (n)	Level of impact (i)	Frequency Occurrence (f)	MSi	MSf	CMS	Rank
1	Design error/faulty design	2	5	4	0.42	0.33	0.140	1
2	Unexpected weather condition	1	2	1	0.10	0.04	0.004	11
3	Increase of parking lane due to standard	1	3	2	0.12	0.10	0.010	10
4	Widening of road section	2	4	3	0.33	0.25	0.100	4
5	Variation order	1	4	3	0.17	0.12	0.020	8
6	Change in defined scope	2	3	3	0.25	0.25	0.062	5
7	Wrong method of cost estimation	1	4	4	0.17	0.17	0.03	7
8	Alignment change due to archeological sites	2	4	4	0.33	0.33	0.12	3
9	Lack of proper site investigation during design stage	1	4	4	0.17	0.17	0.03	7
10	Construction of additional culvert due to standard	2	4	4	0.33	0.33	0.12	3
11	Right of way problem	2	5	4	0.42	0.33	0.14	2
12	Short period of bidding (3-months in the standard)	2	4	5	0.33	0.42	0.14	2
13	Design update and additional quantity	2	3	3	0.25	0.25	0.06	6
14	Additional requests from local peoples & administrators	2	4	4	0.33	0.33	0.12	3
15	Increase in quantities due to unforeseen site conditions like landslides	1	4	3	0.17	0.12	0.02	9

b) Causes of Cost overrun from Consultants' View

According to the consultants' point of view, right of way problem due to standard were the first causes of cost overrun with a cumulative mean score of 0.25. The second causes of cost overrun ranked by consultant were fluctuation of material prices with a cumulative mean score of 0.19. similarly, the remaining causes of cost overrun with their corresponding cumulative mean score were listed in table 3.8 based on the view of consultants.

Table 3. 8: Summary of Cost Overrun causes and their ranks by Consultants

No	Potential Causes of cost overrun in road projects	Number of Respondents (n)	Level of impact (i)	Frequency Occurrence (f)	MSi	MSf	CMS	Rank
1	Right of way problem due to standard	4	5	4	0.56	0.44	0.25	1
2	Design update and additional quantity during construction	3	5	4	0.42	0.33	0.14	3
3	Lack of adequate investigation during design stage	2	5	5	0.28	0.28	0.08	4
4	Widening of road section in town & Construction of bridge	2	4	3	0.22	0.17	0.04	7
5	Disagreement between client, consultant, & contractor	2	3	3	0.17	0.17	0.03	8
6	Design inconsistency	2	3	3	0.17	0.17	0.03	8
7	Fluctuation of material prices	4	4	4	0.44	0.44	0.19	2
8	Additional costs due to variation of works, and inaccurate quantity estimate	2	4	4	0.22	0.22	0.05	6
9	In adequate contract documents	2	4	4	0.22	0.22	0.05	6
10	Poor cost control & poor project management	2	4	4	0.22	0.22	0.05	6
11	Extension of culverts due to standard	2	5	4	0.28	0.22	0.06	5
12	lack of proper planning	2	4	5	0.22	0.28	0.06	5
13	Cost increment due to extended period of performance	2	3	3	0.17	0.17	0.03	8
14	Change of scope	2	3	4	0.17	0.22	0.04	7
15	Sampling and testing	3	4	3	0.33	0.25	0.08	4

c) Causes of Cost overrun from Contractors' View

From the contractors' point of view, market inflation in the cost of construction material the first cost overrun cause with a mean score of 0.21. The second causes of cost overrun ranked by contractors were unpredictable weather conditions with a cumulative mean score of 0.14. similarly, the remaining causes of cost overrun with their corresponding cumulative mean score were analyzed in table 4.9 based on the contractors' view of point.

Table 3. 9: Summary of Cost Overrun causes and their ranks by Contractors

No	Potential Causes of cost overrun in road projects	Number of Respondents (n)	Level of impact (i)	Frequency Occurrence (f)	MSi	MSf	CMS	Rank
1	Market Inflation in the cost of construction material	4	5	4	0.51	0.41	0.21	1
2	Design change and additional quantity during construction	3	5	4	0.38	0.31	0.12	3
3	Unpredictable weather conditions	3	5	5	0.38	0.38	0.14	2
4	Delay in payments by Client	3	4	3	0.31	0.23	0.07	4
5	Disagreement between client, consultant, & contractor	2	3	3	0.15	0.15	0.02	8
6	Widening of road section at major towns not provided in the contract document	3	3	3	0.23	0.23	0.05	5
7	Lack of proper Planning	2	4	4	0.21	0.21	0.04	6
8	Disruption of progress (by right of way problem)	2	4	4	0.21	0.21	0.04	6
9	Ambiguity or inadequate quality of contract documents	2	4	4	0.21	0.21	0.04	6
10	Change in defined scope	3	4	4	0.21	0.21	0.04	6
11	Inaccurate quantity estimates or excess quantity during tender design	3	5	4	0.38	0.31	0.12	3
12	Alignment change due to archeological site	2	4	5	0.21	0.26	0.05	5
13	Late removal of obstruction & poor planning	2	3	3	0.15	0.15	0.02	8
14	Cost associated with testing of samples not provided in the bidding document	2	3	4	0.15	0.21	0.03	7
15	Contractor's financial problem	3	4	3	0.31	0.23	0.07	4

3.2.5. Analysis of Cost Overrun Effects from Questionnaire Survey
a) Effects of cost overrun from point view of clients, consultants, and contractors

In this, respondents are requested to write the potential effects of cost overrun and indicate the corresponding level of frequent effect in the selected federal road projects of North Shewa Zone. Accordingly, the analysis result of the respondents' response on the consequential effects of cost overrun and their corresponding rank were summarized in table 3.10 below.

Table 3. 10: Summary of Cost Overrun Effects as ranked by clients, consultants, and contractors

No	Potential effects of cost overrun in road projects	Clients		Consultants		Contractors		Average	
		MS	Rank	MS	Rank	MS	Rank	AMS	Rank
1	Delay in completion time of the project	0.42	1	0.56	1	0.51	1	0.50	1
2	Increase in project cost	0.17	4	0.19	5	0.31	2	0.22	6
3	Reduce number of bidders	0.12	6	0.22	4	0.31	2	0.22	6
4	Delay in logistic supply	0.12	6	0.17	6	0.23	4	0.17	10
5	Drop-in construction activities	0.17	4	0.22	4	0.21	5	0.20	7
6	Bad reputation to the contract parties	0.25	3	0.17	6	0.23	4	0.22	6
7	Adversarial relationship among project participants or parties	0.12	6	0.33	2	0.15	6	0.20	7
8	Loss of confidence on consultants and professionals	0.33	2	0.22	4	0.21	5	0.25	5
9	Losses of credibility to highway organization	0.25	3	0.17	6	0.15	6	0.19	8
10	Decrease in productivity (directly or indirectly)	0.33	2	0.22	4	0.31	2	0.29	3
11	Inconsistent budget	0.13	5	0.17	6	0.23	4	0.18	9
12	For professionals -inability to deliver value to clients	0.33	2	0.22	4	0.21	5	0.25	5
13	Discourages sponsors to invest in the road project	0.33	2	0.22	4	0.21	5	0.25	5
14	Less returns on investment for client	0.25	3	0.28	3	0.25	3	0.26	4
15	Loss of profit to the contractor	0.33	2	0.33	2	0.31	2	0.32	2

3.2.6. Methods to Handle the Project Cost from Questionnaire Survey
According to the questionnaire survey results, project costs have been handled through the following underlisted methods;
i. Unit of Accommodation Method
It is a that can be used at the beginning stage of construction projects to handle the costs. It is the most commonly used method.
ii. Elemental cost plan method
Elemental cost plan method is prepared from the designer's preliminary drawings. It is a list of the elements of a construction work such as substructure, superstructure, major item works, floor works, roof works, and others.

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iii.   Approximate quantity method

It is a method in which approximate quantities are applied for estimating the costs.

iv.   Analytical estimating method

It is a method for determining unit rates through examining individual resources and the amounts needed for each unit of work. In this, unit rates are calculated by using;

✓ Historical rates based on productivity data from similar projects
✓ Historical rates based on data in standard price books
✓ Built-up rates from an analysis of labor, materials and construction equipment for each item and cost at current rates.

v.   Operational estimating method

This method is a form of analytical estimating method in which all the resources needed for the construction are considered together. It is the most recommended method for estimating civil engineering works that requires the estimator to build up the cost of the operation.

Furthermore, the questionnaire survey result shows that; the final cost of the project may be different from the forecast due to the underlisted reasons;

➢ The nature of the workplace in terms of weather, ground conditions, resource prices and other uncertainties
➢ The effect of competition in the market
➢ The extent of repairs in a maintenance contract can be difficult to foresee
➢ The amount of design information availability
➢ The amount and quality of historical data availability
➢ The performance of the design team
➢ The estimator's skill and method used
➢ Changes introduced by the client

3.2.7. Tests for Agreements on The Causes and Effects of Cost Overrun Among Stakeholders

This test helps to investigate whether there is agreement or not on the attitudes of stakeholders towards the causes as well as the effects of cost overrun in the selected federal road projects in North Shewa Zone. Hence, in this section respondents' response have been tested for correlation using Spearman's rank correlation coefficients (ρ), to see if there is difference in ranking between two groups of respondents; these are Clients versus Consultants, Consultants versus Contractors, and Contractors versus clients on the causes as well as effects of cost overrun in the selected federal road projects in North Shewa Zone. Hypothesis test is important to avoid being deceived by chance occurrences. The tests also important to evaluate whether consensus of opinions exist among respondents or not.

✓ The Null Hypothesis (H_0): There is no agreement in the ranking of causes of cost overrun between two groups of respondents, and
✓ The Alternative Hypothesis (HA): There is agreement in the ranking of causes of cost overrun between two groups of respondents.
✓ The spearman's correlation coefficient (ρ) is calculated using Equation (5). In order to decide whether to accept or reject the null hypothesis, $\rho = 0.05$ were used. In this; with 95% confidence interval, the level of significance $\alpha = 1$-confidence level $= 0.05$ were used and then $\rho = 0.05$ have been used.

If the calculated value rho (ρ) is greater than the critical value(p), then H_0 is rejected, i.e. there is evidence of a statistically significant agreement between the groups. If the calculated value rho (ρ)is less than the critical value(p), then H_0 is accepted, i.e. there is no evidence of a statistically significant agreement between the two groups.

Accordingly, table 3.11 and table 3.12 shown below indicates the summary of correlation test on the ranking of causes as well as effects of cost overrun in the selected federal road projects.

a)   Correlation test on the ranking of causes of cost overrun

Correlation test was done for the causes of cost overrun, and the summary of the results were shown in table 3.11 below.

Table 3. 11: Summary of correlation coefficient test ranking of cost overrun causes

Respondents	$\rho = \{1-[\frac{6\sum(d^2)}{n(n^2-1)}]\}$	Critical Value of ρ	Significance for $\rho < 0.05$	Reject/don't reject H_0
Client Vs Consultant	0.596	0.4464	significant	reject H_0
Consultant Vs contractor	0.925	0.4464	significant	reject H_0
Contractor Vs Client	0.459	0.4464	Significant	reject H_0

As shown in table 3.11, with a significance level of 95%, the calculated value of ρ for all the three group cases are greater than the critical values of ρ, so the hypothesis such that there is no significant agreement between the respondents is rejected i.e. the null hypothesis is rejected. Besides this, it can be concluded that there is strong correlation between the attitudes of the respondents in all the three groups and hence the null hypothesis should be rejected and the alternative hypothesis shall be accepted. This means that most of the respondents have the same perception about the causes of cost overrun.

b)   Correlation test on the ranking of effects of cost overrun

In this, correlation test was done for the effects of cost overrun, and the summary of the results were shown in Table 3.12 below.

Table 3. 12: Summary of correlation coefficient test ranking of cost overrun effects

Respondents	$\rho = \{1 - [\frac{6\sum(d^2)}{n(n^2-1)}]\}$	Critical Value of ρ	Significance for $\rho < 0.05$	Reject/don't reject H_0
Client Vs Consultant	0.9000	0.4464	significant	reject H_0
Consultant Vs contractor	0.9125	0.4464	significant	reject H_0
Contractor Vs Client	0.8875	0.4464	Significant	reject H_0

As shown in table 3.12, with a significance level of 95% ($\rho = 0.05$), the calculated value of ρ for all the three group cases are greater than the critical values of ρ, so the hypothesis that there is no significant agreement between the respondents is rejected i.e. the null hypothesis is rejected. Besides this, it can be concluded that there is strong correlation between the attitudes of the respondents in all of the three groups and hence the null hypothesis should be rejected and the alternative hypothesis shall be accepted. This means that most of the respondents have the same perception of about the effects of cost overrun.

4. CONCLUSIONS

From the results of desk study and questionnaire survey the analysis, the following conclusions are drawn;

➢ According to the result obtained from the questionnaire survey, 90.07% of the respondents agreed on cost overrun as one of the major problems in the selected federal road projects in North Shewa Zone which contributes for delay in the completion of the project and dispute between contractors and the employer during the implementation of the road project. Out of 90.07%, 30.70% of the respondents were strongly agreed and the remaining 62.37% of the respondents were simply agreed on cost overrun as a major problem in the selected federal road projects of North Shewa Zone. The result of the desk study also strengthens this finding as the rate of cost overrun ranges from the minimum of 32.24% to the maximum of 67.52% of the contract amount of the road project. This clearly indicates that the rate of cost overrun was high in the selected federal road projects.

➢ The survey results of the respondents indicate that the average extent of cost over run in the selected federal road projects in North Shewa Zone district were 60%. From the desk study, the extent of cost overrun was done by comparing the actual amount of the project with that of the corresponding contract amount of the selected federal road projects. Based on this, the desk study result indicated that the average initial contract amount was 619.4 million Ethiopian birrs, while the average actual amount of those projects was 905.6 million Ethiopian birrs with an average cost overrun of 286.2 million Ethiopian birr or 46.21% of the contract amount.

➢ Therefore, cost overrun was one of the major problems in the selected federal road projects and its average extent was 60% (survey results) as well as 46.21% of the contract amount.

1) Identification of cost overrun causes

➢ To achieve this, respondents were requested to write the potential causes of cost overrun and their corresponding level of impacts and frequencies of occurrences based on their experiences. Besides this, the result showed that, right of way problem, change in defined scope, lack of proper planning, lack of contractor's proper evaluations of tender documents at tendering phase and contractor's financial problems are the most significant causes of cost over run in the selected federal road projects in North Shewa Zone.

➢ Therefore, design error/faulty design, right of way problem, widening of road section in town, change in defined scope, lack of adequate site investigation during design stage, lack of proper planning, and contractor's financial problems are the main causes of cost overrun in the selected federal road projects in North Shewa Zone

2) Examine the effects of cost overrun

➢ Regarding to the effects of cost overrun, decrease in productivity, delay in completion time of the project, increase in project cost, discourages sponsors to invest in the road construction project, loss of profit to the contractor, and disruption of work were the most significant effects of cost overrun in the selected federal road projects in North Shewa Zone. The result of the desk study also strengthens this finding as dispute among stakeholders, adversarial relationships among the project participants, loss of confidence on consultants and professionals were also the effects of cost overrun.

➢ Therefore, decrease in productivity, delay in completion time of the project, increase in project cost, discourages sponsors to invest in the road construction project, loss of profit to the contractor, dispute among stakeholders, loss of confidence on consultants and professionals were the most significant effects of cost overrun in the selected federal road projects in North Shewa Zone

3) Analyzing the frequency occurrences of cost overrun

➢ The questionnaire survey result indicates that,33.3% of the respondents have been analyzed cost overrun problem as most frequent,55.6% of the respondents analyzed cost overrun problem as frequent, and the remaining 11.1% of the respondents' simply rate cost overrun problem as the least frequent, and no respondents level cost overrun problem as no frequent. This indicates that 88.9% of the respondents conclude on cost overrun as one of the most frequently occurred problem, and the remaining11.1%were simply least frequent.

➢ Therefore, the frequency occurrences of cost overrun problem was high in the selected federal road projects in North Shewa Zone

4. RECOMMENDATIONS

Following the findings and the conclusions of the study, the under listed recommendations were forwarded:

5.1. Recommendations for Employer (ERA)

Employer (ERA) is one of the stakeholders that invests money for the realization of federal road projects, and it is the key role player starting from conception up to operation of the road project. Due to this, the following advises are forwarded;

➢ The employer should give sufficient time for bid documents such as technical specifications, drawings, bill of quantities and designing of the project and revising it in a precise manner. Because any discrepancy in the bid document may lead to disputes among the project stakeholders and so delay in the completion of the project. This helps to avoid errors and omissions in designing & planning that consequentially reduces cost overrun

➢ The employer should give attention on the right of way problem. Before starting the construction works, the client should fulfill all the necessary requirements for delivering the site because failure to deliver the site results cost overrun.

➢ The employer should determine the required duration of the project and impose realistic duration to avoid delay in completion of the project.

➢ The employer should have well experienced technical staff that could be able to manage the different stages of the road project and could be able to follow the performance percentages of the road project, and also able to make comparison between the planned with that of the actual performances of the road project.

➢ The employer should give payment to the contractor on time because it reduces the contractors' financial problem, and so minimizes cost overrun.

➢ The employer should give balanced weight to the contractors' performance before awarding contracts to contractors. This includes evaluating their past performance corresponding to accomplishing projects based on the required cost, time, and quality. On the other hand, low pricing should be the next step for low tender success of contractors.

5. 2. Recommendations for Consultants

Consultants are the main participants in the construction of road projects that translates the employer's thought or idea into realization. Based on this, the following recommendations are forwarded;

➢ Consultants should adopt an efficient information distribution system to guard against communication gaps, to give responses quickly as possible to the contractors' and clients' request that consequentially reduces cost overrun.

➢ Consultants should have strong relationships with clients and contractors to eliminate design errors and also to provide opportunity for modification that consequently reduces cost overrun.

➢ Consultants should establish a system that makes designers to be accountable for their design that might enable good designers to be motivated and the poor designers to take care and learn out from their mistakes.

➢ Consultants should consult properly in addressing the issue of right of way, widening of road section, alignment changes, extension of culverts and change in defined scopes based on public or local authorities request and consequently reduces cost overrun.

➢ Consultants should prepare adequate, concise, and comprehensive documents including drawings, specifications and contract conditions. Because incompleteness or insufficient of those documents leads to inaccurate cost estimate that results cost overrun.

5.3. Recommendations for Contractors

Contractors are the main participants that executes the real road project. Besides this, the following recommendations are forwarded;

➢ Contractors should have a proper planning and good site management system in the different activities of the road project to avoid any mistakes that may lead to the rework of activities and so results cost overrun.

➢ Contractors should strengthen their association with different stakeholders to handle cost overrun causes. Contractors should use an advance payment properly to avoid their financial problems.

➢ Contractors should allocate expertise and contract engineers to handle any claim related issues and to administer the projects properly.

➢ Contractors should use advance payments properly to avoid their financial problems.

➢ During the tendering stage, contractors should evaluate the tender documents properly. This helps them to avoid lack of proper evaluations of tender documents that consequentially reduces cost overrun.

➢ Contractors should allocate adequate and balanced consideration to the tendering, budgeting and cost controlling processes. That means, contractors should be aware and considerate all the processes. The reason is that, if costs are not estimated accurately in the tendering stage, projects will not result in satisfactory performance with respect of profit. And also, if costs are not properly budgeted and controlled during the construction stage, financial outcome can be terrible to the contractors.

5.4. Recommendations for Government

Government have an important role especially in public road projects. Due to this, the following recommendations are forwarded to the government authorities;

➢ Government should finance the required budget on time to avoid delay in payment, and delay completion of the road project that consequently reduces cost overrun.

- ➢ Government should create a system that could inspire investors especially in the production of construction materials to be produced locally and so enough construction materials are available in the local market, and this helps to reduce price fluctuations of materials.
- ➢ Government should give capacity building for professionals and companies on the road construction sector to develop their performance related to cost overrun.
- ➢ Government should create opportunities for local contractors and consultants to work with international contractors and consultants to share experiences and adopt new technologies.
- ➢ Government should work jointly with clients, consultants, contractors, and professionals to modify and prepare the cost estimating manuals as well as standards periodically that comprises information on resource prices, material consumption standards, labor and equipment productivity standards. Because these are a major cause that leads to inaccurate cost estimates, and consequently results cost overrun if they are not modified periodically or based on current condition.

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