

Causes of Delay and Cost Overruns in A Domestic and Commercial Natural Gas supplying Company and Its Analysis Using Research Methodology

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ABSTRACT: The project is considered successful if it is done within estimated cost and time but delay and cost overruns are commonly observed in ant construction projects thus the underground natural gas supplying projects are not an exception.

The purpose of this analysis is to identify and evaluate the relative importance of the significant factors contributing to delay and cost overruns in gas supply projects. And ranking these factors with their criticality for execution of project. In order to find this methodology carried out is the questionnaire survey, the respondents of this survey are responsible personnel from project managers, engineers, and contractors involved in actual project planning and executing of domestic and commercial gas supply. The results of the study revealed the main causes of delay and cost overruns in such projects included: monthly payment difficulties; poor contractor management; delay in material procurement; poor technical performances; and escalation of material prices, etc. Hence, effective project planning, controlling and monitoring should be established to enhance project performance in order to minimize or avoid delay and cost overrun in gas pipeline laying projects.

Further same questionnaire survey if implemented by employees within organization it can be used for the performance evaluation of overall project and for the contractors working for the company.

Keywords: Cost Overrun, Chi-Square Test, Delay, Factor Ranking, Project Performance Evaluation

I. INTRODUCTION

A successful project means that the project has accomplished its technical performance, maintained its schedule, and remained within budgetary costs. But this will happen only if they are planned accordingly and monitored throughout the project duration that is included in monitoring and controlling phase of a project. Starting from pre-construction activities to commissioning of work the contractors plays crucial role [1]. Delay and cost overrun in any phases of project are major signifying factors of weak performance. This paper identifies and examines causes of both in construction industry keeping in mind the Natural Gas supplying industry. The range of factors considered here are from the technical, management planning, costing, materials, financial and social environment. In preliminary survey I have found that majority of work is done by contractors is suffering from delays and extension of contracts. 75% contract works are delayed and only 25% are found working in budgetary cost. These pipe line laying works generally are of longer duration so to keep on tracking the project is really massive work, in order to help these industries here are few methodologies are applied on the survey data which will find critical factors which are needed to be monitored during project period and that will definitely help in reducing delays and cost overruns.

II. NATURAL GAS SUPPLYING INDUSTRY WITH PROJECT MANAGEMENT & CONSTRUCTION (PMC) CONTRACTS

The Gas supplying industry for both domestic and industrial purpose work with following activities involved in it:

1. Conducting geographical survey for carrying out excavation work for laying of gas carrying pipe line of medium and low pressure.
2. This survey is carried out in order to determine suitability of land for laying gas pipeline which determines road type, existing power supplying cables, optical and other such cables and finding our route through ground.
3. The contractor is given work contract depending upon his qualification to perform the work and bid value he quoted against company estimates. These contractors also do sub-contracting and they are paid with completion of percentage work by Owner Company.
4. Then carrying out excavation work, flushing testing and commissioning are carried out as per specifications mentioned in company's code of practice.
5. The influencing factors or constraints to this work can be internal or external factors as, poor technical performance due to unavailability of material and equipment. Poor planning, rainy season, unavailability of skilled labours as plumbers are not trained to work at heights which causes halting of work at many sites.

In order to identify which are those factors affect extensively and determine their impact to work this survey is carried out.

III. AIM AND OBJECTIVE

The survey factors are found out by observing day to day working conditions and constraint causing factors in company. This is to define and analyse factors influencing work, causing delays and cost overrun in gas pipeline industry. Identifying most critical factors in order to treat them with their relative importance.

IV. METHODOLOGY

In order to evaluate and analyze the causes of delay and cost overrun in groundwater projects, a wide range of personnel involved in various departments from company were targeted. Personnel were randomly selected from project managers, contractors, project engineers and construction managers. A questionnaire of 27 factors was carefully designed from previous preliminary investigations

It is organised in rating scale as per factors influencing project as, very low = 1, low = 2, moderate = 3, high = 4, very high = 5.

The questionnaire was directed towards three groups in the company listed as:

- i. Planning managers and engineers
- ii. Project managers and Execution Engineers
- iii. Contractors

In numbers nearly 10 – 15 people were asked to give rating for factors and calculations are carried out from received respondents.

V. DATA ANALYSIS

The procedure used in analyzing the results was aimed at establishing the relative importance of the various factors responsible for project delay and cost overruns.

The score for each factor is calculated by summing up scores assigned to it by respondents. Therefore, the level of importance as indicated by the planning and project managers, engineers and contractors were used to measure the relative weight of each factor. The relative weight was computed using the following equation:

$$RIW = \frac{\sum_{i=1}^5 a_i n_i}{\sum_{j=1}^N X_j} \quad (1)$$

Where:

X_j = sum of the j^{th} factor;

j = factors 1, 2, 3, 4 . . . N;

N = total number of factors (29);

a_i = constant expressing the weight given to the i^{th} response: $i = 1, 2, 3, 4, 5$

For 'very high' $a_1 = 5$, 'high' $a_2 = 4$, 'medium' $a_3 = 3$, 'low' $a_4 = 2$, 'very low' $a_5 = 1$

n_i = variable expressing the frequency of the i^{th} response

n_1 = frequency of 'very high' response, n_2 = frequency of 'high' response, n_3 = frequency of 'medium' response

n_4 = frequency of 'low' response, n_5 = frequency of 'very low' response.

To determine whether there is degree of agreement among the three groups with respect to their rankings of the factors, Kendall's Coefficient of Concordance was used. The Kendall's Coefficient of Concordance says that the degree of agreement on a zero to one scale is:

$$W = \frac{12S}{m^2 N(N^2 - 1)} \quad (2)$$

Where;

$$S = \sum_{i=1}^N (R - A)^2$$

R = sum of ranks

A = sum of ranks / N

The calculated Kendall's coefficient is 0.7542.

In order to know whether there is disagreement or agreement between the three groups on ranking the factors, a test of hypothesis is needed.

Null hypothesis: H_0 : Disagreement in rankings among the three groups.

Alternative hypothesis: H_1 : Agreement in rankings among the three groups.

Since $n = 29$ is too large for the table of critical values of Kendall's, chi-square approximation of the sampling distribution of W is computed with Eq. (3)

$$\chi^2 = m(N - 1) W \tag{3}$$

The calculated Chi-square is $\chi^2 = 63.353151$, using critical table for $n = 29$ and $\alpha = 0.05$ is 42.557.

Since computed value χ^2 is greater than critical table value thus the null hypothesis H_0 is rejected and alternative hypothesis H_1 is accepted.

Therefore, concluded that there is a significant degree of agreement between the three groups with respect to how they rank the factors.

VI. SURVEY RESULTS AND ANALYSIS

The questionnaire was analyzed from project managers, engineers and contractors perspective. In order to identify the most important factors that influence time and cost overruns in gas supplying projects, the items were ranked in the various groups. On the basis of ranking of the factors by the various groups it was possible to identify the most important factors that influenced project time and cost overruns. A summary of all the factors causing delays and cost overruns in projects in relative importance weights, ranking by the groups, and overall ranking as identified by all groups is shown in the Table 1.

The five most important factors agreed by all 3 groups are safety management at site, Quality of project manager, Mobilization of manpower, Management of multiple contracts (in MGL), Plumber unavailability for work at height.

Contractor ranked the monthly payment difficulties from agencies for completed works first whereas the planning and execution people ranked it seventh and third. This problem may be due to the existing culture in the construction industry.

The second most important factor attributing to the cause of delay and cost overruns in gas supply projects is Quality of project manager. Quality of project manager was ranked first by contractors, second by planning managers and engineers (see Table 1). This can be attributed to the way contracts are awarded. Most cases, projects are awarded to the lowest bidder. Some of the lowest bidders may lack management skills and less attention is paid to contractor's plan, cost control, overall site management, and resource allocation.

Then third factor is mobilization of manpower this is being ranked one by contractors and execution people while planning people ranked it seventh. Management of multiple contracts is being forth significant factor and individually contractors ranked it first, the planning people ranked it second and projects that is execution people ranked it third.

Next comes plumber unavailability is ranked first critical factor by contractors, third by project execution people and seventh by planning people.

This analysis shows different perspective of factors ranking given by people with different backgrounds. Other factors that emerged clearly as not very important, but of interest, are bad weather and geological conditions. These are the natural factors also the geological condition are the most difficult and unknown factors because they cannot be controlled.

RESPONDENTS RATINGS FOR CONTRACTOR PERFORMANCE	Planning		Project		Contractors		Overall Rank
	RIW	Rank	RIW	Rank	RIW	Rank	
Safety management at site	0.467	1	0.3	3	0.17	1	1
Delivery of contractual targets	0.433	2	0.3	3	0.07	24	7
Effective Planning and scheduling	0.333	17	0.27	8	0.07	24	12
Proper cost estimates	0.333	17	0.1	29	0.07	24	29
Effective liaisoning	0.367	11	0.23	10	0.03	29	17
Effective use of ground level information	0.267	23	0.2	16	0.1	12	23
Quality of construction	0.433	2	0.2	16	0.13	10	9
Cash flow management during contract period	0.367	11	0.2	16	0.1	12	12
Quality of construction equipment and plants	0.367	11	0.17	21	0.1	12	17
Mobilization of manpower	0.4	7	0.33	1	0.17	1	3
Quality of project manager	0.433	2	0.33	1	0.17	1	2
Material Management	0.267	23	0.17	21	0.1	12	26
Decision making at site	0.367	11	0.2	16	0.1	12	12

Management of multiple contracts (in MGL)	0.433	2	0.3	3	0.17	1	3
Day to day site management	0.333	17	0.23	10	0.07	24	17
Effective customer complaint management	0.433	2	0.2	16	0.1	12	10
RATINGS FOR OVERALL PROJECT PERFORMNCE							
Delays in work approval	0.367	11	0.13	27	0.17	1	12
Delays in inspection and testing of work	0.267	23	0.23	10	0.07	24	23
Plumber unavailability for work at height	0.4	7	0.3	3	0.17	1	5
Monthly payment difficulties	0.4	7	0.3	3	0.17	1	5
Contractor's financial difficulties	0.367	11	0.27	8	0.17	1	7
If Lowest value bid selected	0.4	7	0.13	27	0.17	1	11
Material procurement	0.267	23	0.17	21	0.1	12	26
Late delivery of materials and equipment	0.333	17	0.23	10	0.1	12	12
Escalation of material prices	0.333	17	0.17	21	0.1	12	20
Difficulties in obtaining construction materials at official current prices	0.3	22	0.17	21	0.13	10	20
Underground problems (Electricity/ other cables)	0.267	23	0.17	21	0.1	12	26
Bad weather conditions	0.233	29	0.23	10	0.1	12	23
Unexpected geological (earth)conditions	0.267	23	0.23	10	0.1	12	20

Table 1: Factor Ranking

RESULTS AND CONCLUSION

The survey is carried out within the company located in Mumbai area supplying natural gas for domestic and industrial applications. The focus is on finding the critical factors and ranking them those causing delays and cost overrun in projects. The major conclusions drawn from this are as follows:

- It is observed that all three groups gave different ranking to factors individually as per their views but if we see the overall responses we can say that all are trying to point at most critical factors such as safety, quality of project managers, mobilization of manpower, multiple contract management such factors show similar influence from all three groups on their work.
- Remaining factors such as Proper cost estimates, Material procurement, Underground problems, Effective use of ground level information they show influence on each individual's work and those factors can be controlled at certain level individually. Those are not showing criticality on overall project.
- Many factors listed here are concentrating on proper project management that is planning, scheduling, monitoring and executing the projects it means that all the factors can be treated well while working that can reduce the delay and cost overrun of any project.
- Proper preplanning activities, following the schedules, cash flows during execution, continuous monitoring are key factors to be followed in order to get desired results from any project.
- Paper includes factors those can be used for performance evaluation of overall project and for contractors also. Company can develop their software system in order to get responses from their people and can use the results as learning for future projects.

RECOMMENDATIONS

- In order to improve contractors' managerial skills there is need for continuous work-training programs for personnel in the industry to update their knowledge and be familiar with project management techniques and processes.
- Developing effective and efficient technical performances in the gas supplying industry through different types of training programs. The training should cover project planning, scheduling, time and cost control, and the information systems.
- Appropriate funding levels should always be determined at the planning stage of the project so that regular payment should be paid to contractors for work done.
- More use of technology can reduce time required to carry out technical works such as inspections, tastings etc.
- Construction material can be made available nearby the working sites, effective contingencies should be considered to cover the effects of escalating material prices.

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