

A Study on Cost Control using Delphi Techniques in Construction Projects

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Abstract

Construction project located in Ernakulum dist suffer from many problems and complex issues. Consequently the objective of this paper is to identify the varies factors affecting the performance of local construction projects and to elicit perception of their relative importance. A literature review were conducted to identify major problems. The techniques used for identify the problem is Delphi techniques. Using Delphi techniques the questionnaire survey was contacted.

Keywords: Delphi Technique, Questionnaire Survey

I. INTRODUCTION

A. General:

A major component of project success is the ability to manage the project cost effectively. Despite agreement among scholars and practitioners on the importance of managing the project cost, major project continue to experience excessive cost overrun .The purpose of this study is to investigate the issue of project cost control in construction projects and to understand the reasons behind cost overrun .The use of Delphi method is to identify the problems in controlling the project cost, suggest solutions to overcome these problems, and identifies lessons learned. The study includes a two or more-round semi structured questionnaire with two different project teams to compare and validate finding from one project team to another. Key findings from the study helped to shed some light on the complexity of the learning process itself, and to understand why lesson learned are not truly learned and mistake areas are repeated from past to future projects. The study include with specific practice and a set of recommendations that should be implemented by project team to help in managing the cost of construction project.

In construction, almost all clients are interested in obtaining fully functional facilities completed in time, cost, quality and scope. A builder who is able to construct within the estimated time and budget, to the right standards and scope is an excellent builder. Cost control is a process where the construction cost of the project is managed through the best methods and techniques so that the contractor does not suffer losses when carrying out the activities of the project. One of the aims of cost control is to construct at the cheapest possible costs consistent with the project objectives.

Most project managers and contractors find difficulty in controlling costs on their construction sites due to a number of problems which include poor project preparation, lapse in management and control, over budgeting, poor materials, labour shortages, increased cost of materials, delays in deliveries, wastage of materials, unexpected weather changes, insecurity and poor communication.

B. Need of Cost Control:

The purpose of cost control can be generally identified as follows:

- 1) To limit the client's expenditure to within the amount agreed. In simple terms this means that the tender sum and final account should approximately equate with the budget estimate.
- 2) To achieve a balanced design expenditure between the various elements of the buildings.
- 3) To provide the client with a value-for-money project. This will probably necessitate the consideration of a total-cost approach.

The client may stipulate the maximum initial cost expenditure or provide a detailed brief to the design team who will then determine the cost. Most schemes are a combination of these two extremes with the budget estimate.

II. LITERATURE SURVEY

C. Concept of Delphi Method:

The Delphi method is based on structural surveys and makes use of the intuitive available information of the participants, who are mainly experts. Therefore, it delivers qualitative as well as quantitative results and has beneath its explorative, predictive even normative elements. There is agreement that Delphi is an expert survey in two or more 'rounds' in which in the second and later rounds of the survey the results of the previous round are given as feedback. Therefore, the experts answer from the second round on under the influence of their colleagues' opinions. Thus, the Delphi method is a 'relatively strongly structured group communication process, in which matters, on which naturally unsure and incomplete knowledge is available, are judged upon by experts',

Wechsler characterises a 'Standard-Delphi-Method' in the following way: 'It is a survey which is steered by a monitor group, comprises several rounds of a group of experts, who are anonymous among each other and for whose subjective-intuitive progress a consensus is aimed at. After each survey round, a standard feedback about the statistical group judgement calculated from median and quartiles of single prognoses is given and if possible, the arguments and counterarguments of the extreme answers are fed back...' (Wechsler 1978, pp. 23f.). This sounds a bit complicated but the essentials are:

- 1) Delphi is an expert survey in two or more 'rounds'.
- 2) Starting from the second round, a feedback is given (about the results of previous rounds).
- 3) The same experts assess the same matters once more - influenced by the opinions of the other experts.
Characteristics of Delphi are therefore specified as (Häder/ Häder 1995):
- 4) Content of Delphi studies are always issues about which unsure respectively incomplete knowledge exists. Otherwise there are more efficient methods for decision making.
- 5) Delphi are judgement processes with unsure aspects. The persons involved in Delphi studies only give estimations.
- 6) For the participation experts are to be involved on the basis of their knowledge and experience are able to assess in a competent way. During the rounds, they have the opportunity to gather new information.
- 7) Especially the psychological process in connection with communication and less in the sense of mathematical models have to be stressed.
- 8) Delphi tries to make use of self-fulfilling and self-destroying prophecies in the sense of shaping or even 'creating' the future.
- 9) According to by Jared Bourgeois, Laura Pugmire, Keara Stevenson, Nathan Swanson, and Benjamin Swanson

The Delphi method is a combination of qualitative and quantitative processes that draws mainly upon the opinions of identified experts to develop theories and projections for the future. A group of experts is drawn from several disciplines and professions. A multiple-round survey system is administered to this group over an extended period of time. The goal of this method is to reach a consensus among the group by the end of this multiple-round questionnaire process. The uniqueness of Delphi lies in its reliability, given the variableness of human opinion, and in its ability to be administered remotely and without direct participant interaction. It is best used for a fairly simple assessment of new products and developments, but it is one of the most complex methodologies available.

According to Anita Ceric

Delphi method was used to investigate this important finding in greater detail. The focus was placed on the monitoring process itself, which is central to risk minimization during construction. The exploratory survey was considered to be the first round of the Delphi method, which requires a number of iterations, and two additional rounds were then conducted. The same survey technique was used throughout.

According to Muhammad Imran Yousuf

The Delphi technique, by definition, is a group process involving an interaction between the researcher and a group of identified experts on a specified topic, usually through a series of questionnaires. Delphi has been used to gain a consensus regarding future trends and projections using a systematic process of information gathering. The technique is useful where the opinions and judgments of experts and practitioners are necessary. It is especially appropriate when it is not possible to convene experts in one meeting..

III. RESEARCH METHODOLOGY

A. Step 1: Identify Problem:

The first step toward implementing the Delphi method is to organize the process in a very specific and thorough manner. Questionnaires should be designed, administrative processes determined, and total costs evaluated before starting the actual procedures. When a complete outline for the process is finished, the expert-selection process can begin.

B. Step 2; Select Experts:

The size of the project being completed will determine the number of expert panels the Delphi Method requires, but each panel should consist of approximately 5 to 18 members. The size of the panel is ultimately determined by the needs and budget of those administering the process. A simple random sampling of respondents is not adequate to form this panel. Unlike traditional statistical surveying, the goal is not to select a representative sample of the population. The whole premise behind the Delphi theory is that the panel members are in fact experts in their field in order to yield more accurate results. The criteria that qualifies an individual as a panel "expert" is determined by those administering the process.

C. Step 3; Administer Questionnaire:

Once the expert selection process is finished, a questionnaire is distributed to each panel member for completion. The members are encouraged to draw upon their experiences, and use any historical data, research, or other available resources to help in answering the posed questions. However, panel experts should not consult others regarding questionnaire material, in part to avoid accidental contact with other members of the panel.

D. Step 4; Evaluate Responses:

The first questionnaire may be open-ended questions or closed ended questions related to the issue being researched. The experts give their opinion and return the questionnaire to the panel director. The panel director then reviews the responses and uses this information to develop more specific questions to be used in the second questionnaire.

E. Step 5; Redistribute Questionnaire:

The second questionnaire has two major parts: first, the results and responses from the first questionnaire are presented in an orderly format (such as a list or table). The experts rank the result items to establish priorities, and are allowed to review their responses in light of the opinions of other experts, add comments, and change their responses if desired. Second, the new questions formulated by the panel director are posed to the panel. Panel members then return the answers to these questions, along with any revisions to their previous answers, to the panel director. It is in this questionnaire that they are able to explain the reasoning behind their responses. The panel director once again processes this information and prepares the third questionnaire. The third and all subsequent questionnaires contain three major parts. First, they include the answers to all previous questions, along with some statistical data so experts can view how their responses related to those of other panel members. Second, they include comments and reasoning that panel members included with their answers. Third, they provide an opportunity for experts to review and revise any of their previous answers. Once again, panel members fill out the questionnaire and return it to the panel director.

F. Step 6; Interpret Results:

This process continues until a consensus is reached by the group. Usually a minimum of three questionnaires is needed to reach a consensus, but the number of questionnaires could be five or more.

IV. RESULT AND DISCUSSION

From the survey it was found that the increase in cost has been a major problem faced by the construction sector especially the projects having long durations. The responses regarding how the cost affects the company during first phase questionnaire survey are shown in figure

A. First Phase Questionnaire Survey:

First phase questionnaire consist of 27 questions which directly or indirectly affect the cost on construction project they are;

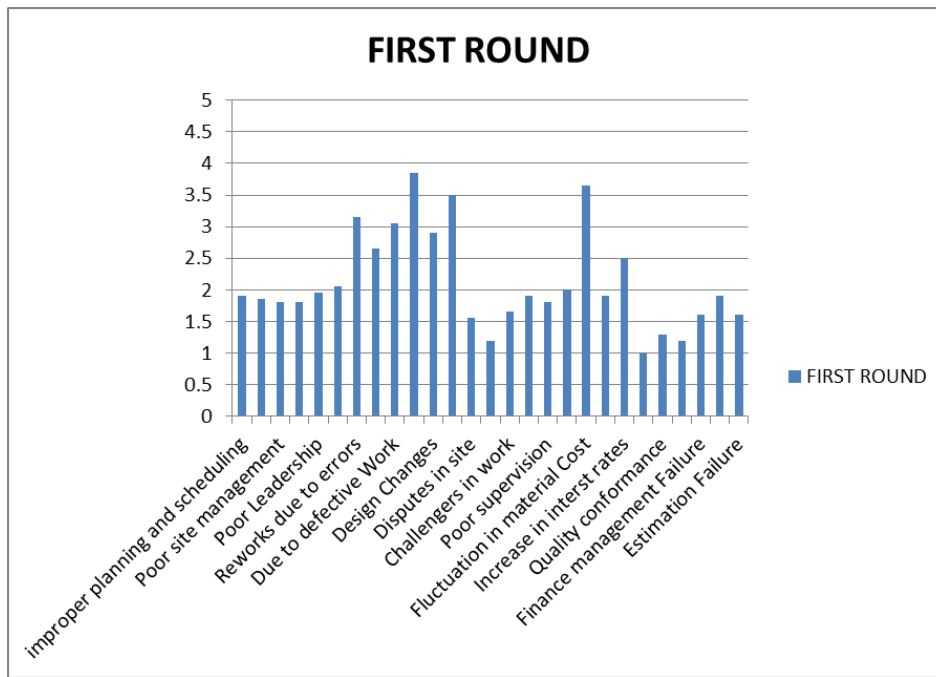


Fig. 1: Analysis Of First Phase Survey Response

B. Second Phase Questionnaire Survey:

From first phase questionnaire it is found that several items have not much influence on the increase in the cost of construction project they are removed in second phase

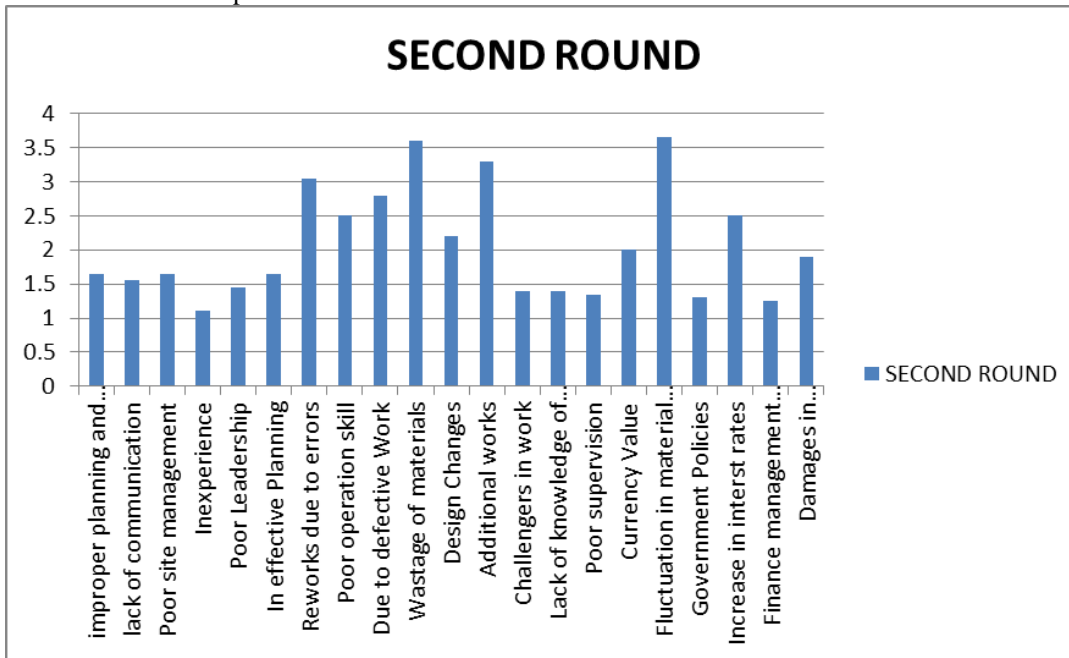


Figure 2: Analysis of Second Phase Survey Response

C. Third Phase Questionnaire Survey:

From first and second phase questionnaire it is found that selected persons deviated from their response while they compare the response of first and second questionnaire analysis. Its mainly due to the mode of operation of working on a particular site. So again filtered.

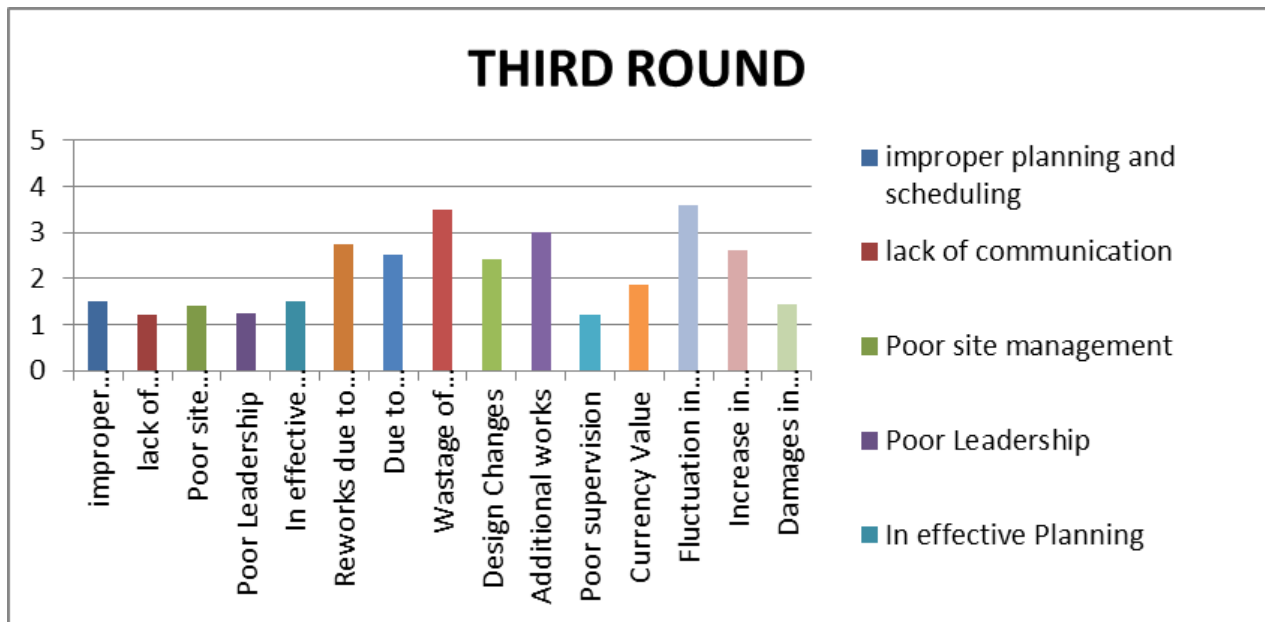


Fig. 3: Analysis of Third Phase Survey Response

In fourth phase questionnaire consist of 10 major factors which led to increase in the cost of construction projects.

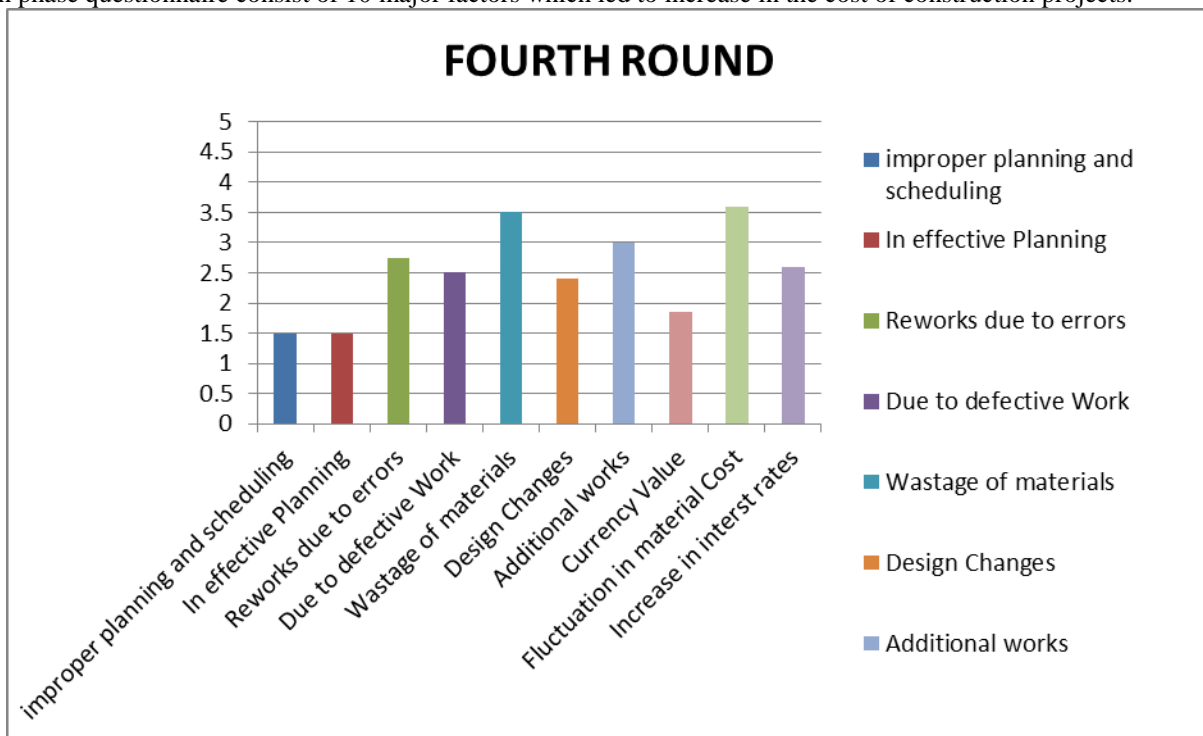


Fig. 4: Analysis Of Fourth Phase Survey Response

From the third and fourth analysis of questionnaire it is found that the results are almost similar so their is no need for further filtration of questionnaire

D. Analysis of Results:

Data collected from the survey was analysed using descriptive statistical techniques. An advanced and accurate analysis method was needed to arrange the large body of data in a systematic, fast and reliable way. For this purpose the computer software Excel was chosen as the best options available. The respondents were asked to rate the causes cost increases with respect to their frequency and severity weight. The scales provided ranged from 1 to 5 as shown in Table 1. The quantitative measures of the frequency and the severity were obtained using the same scale that was assigned to them.

Table - 1
Frequency Index Table

Sl.No	QUESTIONS	SCALE					Total	Frequency index	Rank
		Very Low	Low	Moderate	High	Very High			
		1	2	3	4	5			
1	Improper planning and schedule	10	10	-	-	-	30	30	8
2	Ineffective Planning	11	8	1	-	-	30	30	8
3	Reworks due to errors	1	8	6	5	-	55	55	4
4	Due to defective work	2	11	5	2	-	47	47	7
5	Wastage of materials	-	2	5	11	1	64	64	1
6	Design Changes	-	12	8	-	-	48	48	6
7	Additional Works	-	6	8	6	-	60	60	3
8	Currency Value	9	7	2	2	-	37	37	10
9	Fluctuation in material cost	-	-	9	10	1	72	72	2
10	Increase in interest Rates	2	8	6	4	-	52	52	5

V. CONCLUSION

The reason for the increase in cost is also depend upon the type of contractor and the mode of operation. From the survey it is understood the variation of response for the same questionnaire is mainly due to this reason.

4.1 Type of contractors and the reason for the increase in cost on construction project

A. Item Rate Contract (Including Materials):

In this type of contracts the contractors are required to quote rates for individual items of work on the basis of schedule of quantities given by the department. This schedule indicates full nomenclature of the items as per sanctioned estimate and estimated quantities. This system is followed in central public works department (CPWD) and railway department.

1) Wastage of Materials:

Wastage of material will directly increase the construction cost. Large quantity of materials will loss as wastage during construction process, if we minimise the wastage we can save above 20% of the cost than we expected

2) Fluctuation in Material Cost:

As noted fluctuation in material cost can act to increase the original estimates of construction costs. Fluctuation in material cost may have been taken into account in the original estimates, but if the rate of inflation increases above the predicted level during the construction period, then the original cost estimate will be exceeded. Obviously any other factor that delays a project will expose the project to the risk of further inflationary cost increases. Inflation may not be the only cause of price rises. Political or technological factors may affect one or more element of costs.

3) Defective Work:

Once the contractor realizes that work is defective, he must demolish it and repair. The work is on the critical path for the project and as a result directly delays the completion of the project. In order to fix the problem, the general contractor must demolish the defective work,. After this, he must allow time for the repair work. The extra work requires additional hours, material, and equipment to install. In total, the defective work will increase the project cost by .10%

4) Poor Project Management:

The role of the project manager or project management team is probably the most important element in containing the costs of a project. It is often true that a poor project with a good project manager will be completed satisfactorily. But even a good project, if combined with poor project management, will almost always face serious difficulties. A poor project management structure will have an impact at all stages of the construction process leading to:

- 1) A lack of planning and coordination;
- 2) Poor communication between members of the project team and the project sponsor;
- 3) Failure to identify problems and institute necessary design and programming changes;
- 4) A lack of control over time and cost inputs

5) Exchange Rates:

The exchange rate is particularly relevant if contracting services or other elements of the project are being purchased from other Member States or from outside. If exchange rates change beyond the level predicted by the project sponsor (and the companies

providing the services) then the cost of the project can increase. It can of course operate in the opposite way where the project sponsor takes advantage of a strengthening of his own currency.

B. Labour Contract:

In this the tenderer undertakes contract for the labour portion. All materials for the construction are arranged and supplied at the site of work by the owner or department. The labour contractor engages labour and gets the work done according to the specifications. The contract is on item rate basis for labour portion only. The contractor is paid for the quantities of work done on measurement of the different items of work at the agreed rate in the contract agreement. Contractor uses his own tools for working, but plants and machineries are arranged by the department. Scaffolding, centering and shuttering etc. has to be arranged by the department normally but if provided in the agreement may have to be arranged by the contractor.

1) Reason For The Increase In The Rate Of Construction Cost:

a) Defective Work:

Once the contractor realizes that work is defective, he must demolish it and repair. The work is on the critical path for the project and as a result directly delays the completion of the project. In order to fix the problem, the general contractor must demolish the defective work,. After this, he must allow time for the repair work. The extra work requires additional hours, material, and equipment to install. In total, the defective work will increase the project cost by .10%.

b) Poor Project Management:

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- 4) A lack of control over time and cost inputs

c) Improper Planning and Scheduling:

Planning and scheduling of construction projects is the important part of the project management. The planning process commence at the proposal stage of the project. Project planning functions are to establish project activities, their logical relationships and interrelationships to each other, and the sequence in which they are to be accomplished. The process of assigning activities duration and scheduling . An effective Project plan and schedule lays a strong baseline for the project execution. The lack of planning and scheduling will led to the wastage of labour management, thus increase the cost of construction.

C. Lump-Sum Contract:

In this type of contract, tenders are required to quote a fixed sum for execution of the complete work according to the drawings, designs, and specifications supplied to them with the tender within the specified time. Payment of items of work involved for any additions and alterations not covered by the original work is done according to the departmental schedule of rates.

1) Reason For The Increase In The Rate Of Construction Cost:

a) Design Changes:

The change of Design scenario is perhaps one of the most common in construction management. In this scenario, a new design is developed after part of the design has already been implemented. For eg; After the fourth floor steel has gone up, the construction crew is informed that there has been a redesign on the third floor. This means that almost all of the steel on the fourth floor already in place has to come down as well as some of the steel on the third floor. As a result lot of time ,material and labour are also increases thus design changes increases the cost of construction.

b) Estimation Failure:

In lump-sum contract the measurements are taken before the work start and the fixed rates are determined on basics of this estimation if any failure in the estimation will led increase in cost as expected.

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