

EVALUATION OF RISK FACTORS CAUSING COST OVERRUN IN CONSTRUCTION INDUSTRY USING IMPI AND AHP TECHNIQUE

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Abstract- This Study is aim to analyze the Risk factors which are mostly responsible for cost overrun in construction. Cost overrun is a very common phenomenon and is nearly related to nearly all projects in the construction industry. In this paper different type of cost are enlisted and because of the impact of cost overrun. A questionnaire for the survey has been organized by author based common elements that were taken from response of on line survey form. The survey is taken from the members who worried in construction industries particularly contractor, site engineer, task supervisor, architects and diverse different respondent associated with construction projects/enterprise. conducted survey to find out effected ranking of collected data and then IMPI & AHP method for calculation. By using methods, determine the ranking of risk factors and find out the influence of cost overrun. Risk factors can be reduced of construction project by using these methods so our project will be under the safe and economic condition.

Keywords- AHP technique, IMPI Technique, Cost Overruns, Construction Industry, construction cost.

I. Introduction

Cost is the fundamental issue for any creation venture. Over the years, there have been improvements in the management of production projects; but, the problem of cost overrun remains difficult in the Construction industry. To avoid construction cost overrun, first actual and most vital step is to perceive and understand the causes and elements liable for that. The creation industry is covering a fast growth across global. As the industry is dynamic in nature; because of this aspect the development tasks are in all probably going to have a feature potential for risk factor of cost overrun and it depends upon the dimensions of Project, time completion, postpone etc. The technique of analytical hierarchy system (AHP) and important index (IMPI) which gives the relative significance of those elements. The issue of cost overrun, particularly in the construction business, is an overall wonder, and its belongings are regularly a source of friction between proprietors (particularly government proprietors), project chiefs and contractual workers regarding project cost variation subsequent to the proprietor's choice to build. In spite of the fact that, in principle, it may be normal that cost overruns have same probability of happening from cost under runs, Risk factors have a substantially higher recurrence. development is especially influenced by this, with projects generally encountering critical construction risk factors.

In Construction industry, it is the probability of the event of a distinct occasion or blend of occasions which happen during the procedure of construction. construction includes numerous factors, and usually hard to decide circumstances and end results, dependence and connections. Therefore, those risks having a huge part in basic decision making and may influence the execution of a Project. Risk is the introduction to the outcomes of uncertainty. As a result, subjective analytical methods that rely on historical data and the experiences of people and organizations have been utilized to survey the effect of construction risk and uncertainty. Hence, Risk evaluation is a procedure that intends to distinguish and determine Risks affected upon by a Project.

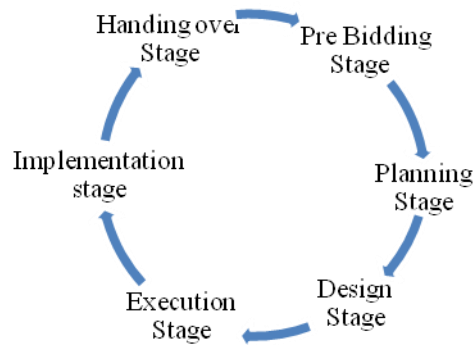


Figure 1. Life Cycle of the Construction Project

A Construction project is covered with different risks in every one of the phases of the project cycle of the task are shown in figure 1. In this way, Risk Management should be focused in construction work, regardless project size to the assure fulfill the accomplishment of project objectives. Risks have been explained as uncertain future occasion by construction administrators and researchers thus they worked to control deliberately through risk management and investigation technique since beginning period of 1990's. **Ajator Uchenna et. al. (2017)** carried out an observational assessment of the impact of risk factors on cost execution of projects at conveyance. The study determined that these components must be thoroughly surveyed in the light of the individual projects. It recommends among others, the requirement for a takeoff from the utilization of conventional approach of rate chance alteration factor to a more comprehensive risk administration framework. **Dziadosz et. al. (2015)** This study enriches the decision-making method and presents additional arguments, which help to pick the ultimate variation of a construction assignment using the Multi-Aspects techniques. This article explains three various techniques of the risk factor evaluation in addition to highlighting their effects, benefits and primary areas of application (selection or pre-estimation). **G. D. Creedy (2010)** decided issue of why construction projects overrun their anticipated costs. It recognizes the owner risk factors that add to primary cost overrun and afterward utilizes factor examination, master elicitation, and the nominal group procedure to set groups of significance positioned proprietor risks.

II. Classification of Cost

In the construction work mainly two type of cost:

- (1) Direct cost
- (2) Indirect cost.

A. Direct cost:

Material cost, Apparatus cost, Planning cost, Worker cost etc. In material cost such as cement, steel, sand, aggregate, brick, wood, stone etc. Direct buying value and hiring cost of various kind of equipment. In layout price like as costs of structure and structural engineer.

B. Indirect cost:

Accident, replacement of equipment and material, expenses for criminal counsel, gradual down the work loss of purchaser's confidence, Insurance premium enhance, through the years necessitated, centers of clean up and restore, productive time misplaced via injured people and fellow people, paintings man's repayment work, administrative works with associated with twist of fate, decrease in morale which may affects productiveness^[10].

Direct cost is appropriate in cost estimation of construction work however the indirect price is not always desirable in cost estimation so; the main purpose of cost overrun is indirect cost. Effect of cost overrun is reducing by using reduce the uncertain actions like as injuries in construction site. Safety precisions are taking by the contractors, sub-contractors and worker. So, reduce the coincidence in construction site.

In construction projects finances are either overrun or either under run. When project financial managements are good then construction projects budgets towards the cost under run and when financial management are poor then construction projects resources regarding the cost overruns.

Construction projects budgets over runs or under runs are known by ratio of the original cost and actual cost and condition given the both equation.

$$\text{Cost Overrun} = \frac{\text{Original Cost}}{\text{Actual Cost}} > 1$$

$$\text{Cost Under run} = \frac{\text{Original Cost}}{\text{Actual Cost}} < 1$$

III. Research Methodology

For accomplishing out the intention of this paper two methods are used; first one method used is Importance index (IMPI) that is used to find out the relative importance of all the factors. Other one is analytical hierarchy method (AHP) which is used to calculate the Risk factors in construction. Performed survey to find out effected ranking of amassed statistics and then IMPI & AHP approach for calculation. By using methods, Determined the ranking of risk factors and find out the effect of cost overrun. Risk factors can be reduced of construction project by using these methods so our project will be under the safe and economic condition.

- **Important Index (IMPI)**

The data accumulated to choose the most powerful factors on project management of the task is done through a study by explorative surveys to the respondent required in day by day exercises of construction firms in Madhyapradesh. The examination procedure for think about contains two stages. The main stage incorporated a literature study and questionnaires. The second stage consists arrangement of review in light of different approach used for offering situating to reasons for Risk factors in construction works. In this technique Importance Index (IMPI) is figured as a piece of frequency and severity. This research methodology is done in two stages. The first stage incorporated a literature search and meeting. The factors were derived through books, articles, web and worldwide project administration diaries.

Table 1: IMPI Calculation Formulas

| Sr. no. | Factors | Formula |
|---------|------------------------|---|
| 1 | IMPORTANCE INDEX(IMPI) | $IMPI = (F.I. * S.I.) / 100$ |
| 2 | FREQUENCY INDEX(F.I.) | $F.I. = \sum a \frac{n}{N} * \frac{100}{5}$ |
| | | Where, a, is the constant expression weight given to each responses n, is the frequency of responses N, is the total no. of responses |
| 3 | SEVRITY INDEX(S.I.) | $S.I. = \sum a \frac{n}{N} * \frac{100}{5}$ a, is the constant expression weight given to each responses n, is the frequency of responses N, is the total no. of responses |

- **AHP (analytic hierarchy process)**

The analytic hierarchy technique used to collect or arrange (structured) method for organizing (properly ordered) for difficult or complex selection. By using AHP the relative importance of each issue can be find out with the intention to assist in ranking those factors. Before starting the process, a model for the analysis have to be prepared which consist the main Risk factors causes as first category and the other consists of subcategories. Six main Risk factors as main category are included in the first level of hierarchy and the remaining sub-categories i.e. sub-factors in the other level. The decision-making process can take place, as the hierarchy structure is established.

This analysis is used for Risk factors in construction project due to cost overrun as shown in table 2.

Table 2: analytic hierarchy process formula used

| Sr. no. | Factors | Formula |
|---------|-------------------|--|
| 1. | Consistency index | $CI = \frac{\lambda_{max} - n}{n - 1}$ Where, λ_{max} is maximum Eigen value. N is number of comparisons |
| 2. | Consistency ratio | $CR = \frac{CI}{RI}$ Where, RI random consistency index |

IV. Data Analysis

In this study Survey form design with the help of google form in which consists questionnaires for study. Then survey form attached to the email id and link generated so the generated link shared online of the members who involved in construction industries mainly contractor, site engineer, project manager, architects and various other respondent related to construction projects/industry. After that response collected from the survey form and total 29 response received and then response import in excel sheet and calculation process performed on the collected data by using IMPI and AHP technique.

- **Calculation performed on the collected Data with the help of IMPI technique**

Table 3 shows the major factor and sub factors with their percentage of IMPI and Rankings.

Table 3: IMPI Calculation of Collected Data

| S. no. | FACTOR | IMPI % | RANK | |
|--------|--|--|-------|----|
| | MAJOR FACTOR | SUB FACTOR | | |
| 1 | Construction project major Risk factors | Design and Quality | 31.31 | 1 |
| 2 | | Geographical and Market | 25.54 | 4 |
| 3 | | Economic and Financial | 23.24 | 8 |
| 4 | | Government and Politics | 21.27 | 12 |
| 5 | | Cultural and social | 12.96 | 26 |
| 6 | | Inexperience | 18.06 | 14 |
| 7 | Design and Quality | Defective Design | 22.99 | 10 |
| 8 | | Design change & modification | 24.94 | 6 |
| 9 | | Quality variation of site | 28.41 | 2 |
| 10 | | Change in materials price specifications during construction | 24.96 | 5 |
| 11 | Geographical and Market | Competition from other similar | 15.96 | 19 |
| 12 | | Increase in labor price | 16.90 | 18 |
| 13 | | Increase in materials price | 23.24 | 8 |
| 14 | | Weather conditions | 15.73 | 21 |
| 15 | | Environmental failure (flood , Earthquake etc) | 15.77 | 20 |
| 16 | Economic and financial | Financial Type | 15.16 | 22 |
| 17 | | Tax or movement Restrictions | 14.87 | 24 |
| 18 | | Payment risk | 17.55 | 16 |
| 19 | | Currency exchange rate | 6.60 | 35 |
| 20 | | Fluctuations of interest rate | 9.50 | 32 |
| 21 | Political and Government Policy | Loss incurred due to corruption and bribery | 12.13 | 28 |
| 22 | | Instability of government | 13.14 | 25 |
| 23 | | Change of Regulation law | 18.00 | 15 |
| 24 | | Immaturity unreliability of legal system | 15.05 | 23 |
| 25 | | Depending on importance of major power | 12.74 | 27 |
| 26 | | Tension / conflict / terrorism | 11.72 | 29 |

| | | | | |
|----|----------------------------|--|-------|----|
| 27 | Cultural and social | Cultural differences | 8.31 | 34 |
| 28 | | Work place & safety & health | 11.14 | 30 |
| 29 | | Cultural and social [Religion sentiment] | 9.86 | 31 |
| 30 | | Different cultural event | 8.48 | 33 |
| 31 | Inexperience person | Previous experience in similar projects | 17.37 | 17 |
| 32 | | Improper project planning and budgeting | 25.82 | 3 |
| 33 | | Improper time allocation | 21.31 | 11 |
| 34 | | Lack of technical skill | 24.10 | 7 |
| 35 | | Improper coordination | 18.52 | 13 |

As per above study of Risk factors with the help of IMPI technique Final results made and shows with the help of graphs.

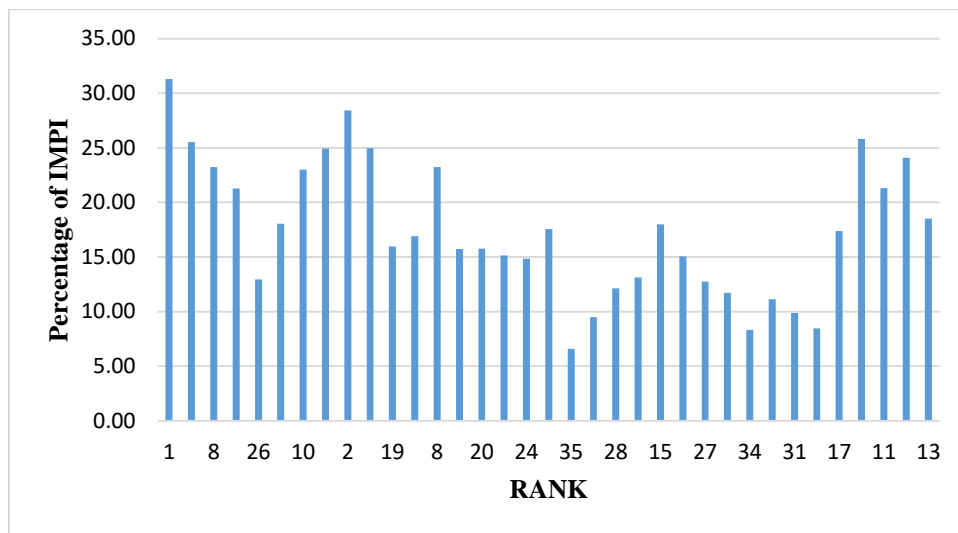


Figure 2: Comparison between Percentage of IMPI and Rank with the sub factors

- **Calculation performed on the collected Data with the help of AHP Technique**

AHP Calculation shows Major factor and sub factors with their Priority and Rankings.

Table 4: Construction project major Risk factors

| Sub Factors | Priority | Rank |
|-------------------------|----------|------|
| Design and quality | 0.463771 | 1 |
| Geographical and market | 0.175858 | 2 |
| Economic and financial | 0.141949 | 3 |
| Government and politics | 0.103982 | 4 |
| Culture and social | 0.050061 | 6 |
| Inexperience | 0.064378 | 5 |

Table 5: Design and Quality

| Sub Factors | Priority | Rank |
|---|----------|------|
| Defective Design | 0.34137 | 2 |
| Design change & modification | 0.443937 | 1 |
| Quality variation of site | 0.136834 | 3 |
| Change in materials type specifications during construction | 0.077859 | 4 |

Table 6: Geographical and Market

| Sub Factors | Priority | Rank |
|---|----------|------|
| Competition from other similar | 0.269286 | 2 |
| Increase in labor price | 0.172825 | 3 |
| Increase in materials type | 0.342159 | 1 |
| Weather conditions | 0.155513 | 4 |
| Environmental failure (flood earthquake) | 0.060218 | 5 |

Table 7: Economic and Financial

| Sub Factors | Priority | Rank |
|-------------------------------|----------|------|
| Financial type | 0.38215 | 1 |
| Tax or movement | 0.217445 | 3 |
| Payment risk | 0.31776 | 2 |
| Fluctuations of interest rate | 0.082645 | 4 |

Table 8: Political and Government Policy

| Sub Factors | Priority | Rank |
|---|----------|------|
| Less incurred due to corruption and bias | 0.220177 | 2 |
| Instability of government | 0.220177 | 2 |
| Change of regulation law | 0.227226 | 1 |
| Immaturity unrated butt of legal system b | 0.087433 | 3 |
| Depending on important big major power | 0.111299 | 2 |
| Tension , conflict , terrorism | 0.133688 | 1 |

Table 9: Cultural and social

| Sub Factors | Priority | Rank |
|----------------------------|----------|------|
| Cultural differences | 0.348449 | 2 |
| Work place and safety | 0.448936 | 1 |
| Religion sentiment | 0.101307 | 3 |
| Difference cultural events | 0.101307 | 3 |

Table 10: Inexperience person

| Sub factors | Priority | Rank |
|---|----------|------|
| Previous experience in similar projects | 0.223979 | 2 |
| Improper project planning and budgeting | 0.373584 | 1 |
| Improper time allocation | 0.10256 | 5 |
| Lack of technical skill | 0.182996 | 3 |
| Improper coordination | 0.11688 | 4 |

Table 11: Global Ranking

| Factors | Priority | Rank |
|---|----------|------|
| Design changes | 0.247795 | 2 |
| Improper project planning and budgeting | 0.272416 | 1 |
| Financial type | 0.207105 | 3 |
| Increase in materials Price | 0.126874 | 4 |
| Change of regulation law | 0.069035 | 6 |
| Work place and safety | 0.076774 | 5 |

V. Conclusion:

Thus, this as per above study following conclusions are made.

- This study concluded that the risk factor which are responsible for the cost Overrun.
- In this study Risk Factor are characterized which are as Design and Quality, geographical and market, Economics and financial, Government & Politics, Culture and Social on Experience, they are sub factor also consider.
- Using IMPI and AHP Multi-Criteria decision making and sub category to determination of rank of the Risk Factor.
- Depending Upon the Rank of risk factor to paper Solution to mitigate So, That the Lost Overrun to Reduce.

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