Assessment Of Factor Affecting Cost Estimate From The Perspective Of Stakeholder In Infrastructure Project

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Abstract:
This study's objective is to evaluate how erroneous cost estimates affect infrastructure projects from stakeholders' points of view in order to develop mitigation strategies. In this study the factor affecting cost estimation are determine by previous articles and research paper. There are total 47 variables of factors which are affecting cost estimation identify by previous study. The article and research paper analysed cost estimation literature and used structured questionnaires to collect empirical data. A quantitative approach is used to conduct the research study. Construction professionals were given a questionnaire, and the results showed that stakeholders believed employing a proper and planned risk management plan would enhance cost estimation. Data are collected by the stakeholders are analyzing by using ANOVA tool and they show most critical factors affecting cost estimation and variance in variables of factor from the perspective of the stakeholders. The study provide guidelines and mitigation to lesser their impact on project costs, project duration, underestimation, overestimation, bidding and tendering process and increase in accuracy of cost estimation.

Keywords: Cost estimate, Stakeholders, Infrastructure project, Accuracy, Underestimation, Overestimation
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1. Introduction

One of the most important and often used project management tools is project costing. The client may reject the contractor's higher bid as a result of overestimation. Whereas underestimating causes the contractor to lose money. In India, the Ministry of Statistics and Programs (MoSPI) has reported a 20% cost overrun in road project costs that were underestimated. Every construction project must be planned and completed with a realistic calculation of the costs involved. Numerous reports from the government and commercial companies have the study of cost estimate guidelines provides insight into existing cost estimation practises and the reasons for project cost overruns. In order to quickly, easily, and

accurately estimate comprehensive costs based on prior related study work, research focuses on identifying appropriate traits or factors that are readily available at an early stage. However the earlier in a project's life cycle it is, the less is known about the precise specifications of what must be built and the particulars of a site and how they will effect.

It is impossible to predict exact budget demands due to the complexity of projects, inherent volatility in financial performance of construction projects, funding for development, and monitoring and controlling of costs and timelines. The costs of the entire project are broken down in depth by accurate estimation. A precise estimate takes into consideration both anticipated and unforeseen costs while also guaranteeing that your profit margins are ideal. The key to forecasting and reducing project risk, cost overruns, and project delays is estimation. Cost estimation mistakes can lead to uncertainty in construction projects and even project collapse.
The primary goal of this research is to enhance the cost estimation method used in construction projects since it aids owners in making informed choices regarding project financing. The construction projects stand out because they are estimated before they are built (Arif et al. 2015). The estimating process is a crucial component of construction management (Abdal-Hadi, 2010). The method of cost estimating forecasts the value of carrying out tasks to meet the goals of the construction project within a predetermined time frame (Hatamleh et al. 2018). Because cost estimating is the only sure fire way to guarantee that projects stay on budget, it is an important element in the success of the construction sector (Alumbugu et al. 2014). The primary issue is how faulty cost estimates affect building projects because an inaccurate estimate would result in project failure in terms of time and money (Hatamleh et al. 2018). The contractor's excessive tender price as a result of the extreme cost is rejected by the client because it is too high (Enshassi et al. 2013). Yet, depending on the type of contract, underestimating expenses might cause a contractor to lose money and expose the owner to a number of problems (Avinash et al. 2018).

Challenges of cost estimation:

Fig: 1 Challenges of cost estimation

Source: ASCE journal (modification by author)

Quantifying cost impacts: An engineer may need to alter the design of a component to cut the cost by 20%;

Resource Constraints: Time limits many aspects of estimating, including data collection and validation, data quality and consistency, and many more;

Quality of data available: The kinds and amounts of data that estimators can gather are constrained by resource constraints. If there isn't enough time, estimators may use secondary data sources that have been modified from the original source. Secondary data, especially those with little supporting evidence, are not very helpful;

Large Number of organization involved: Estimators must be aware of the many different organisations and data sources used in data collection. A project's combined estimating becomes more complex when numerous contractors are engaged;

Consistency: After collecting the data over a lengthy period of time from numerous sources, analysts must make it consistent and comparable.

2. Literature review:

It is possible to approach cost estimation and comparative economic analysis from a variety of angles, including cost-effectiveness and budget impact analysis. A number of variables affect the viewpoints employed in an economic evaluation, including the main goal, the therapeutic or social setting, and the decision-makers and other interested parties who will use the data (Neumann P 2016). Early-stage cost estimating is essential for supporting the owners' choices. (Zhi et al. 2014). Once it is determined that the project is feasible, the owner engages a design firm to lay down the precise requirements and level of construction for the project. The design team will now produce a preliminary project estimate (Akintoye 2000). This type of estimating is known as a conceptual estimation. Once the owner has asked contractors to submit bids, the contractors submit their detailed bid estimate. The contractor should provide the most accurate and affordable price because he wants to secure the job. The contractor should apply the complete cost estimating approach because it is the most accurate way to get an exact cost estimate. The thorough estimation seeks to determine the project's actual execution costs (Phuwadol 2010). The unpredictability associated with estimations, their foundation, design, logistics, project stakeholders' core relationships, and priorities and objectives all contribute to the uncertainty (Chapman et al. 2003). Due to the increased interest among stakeholders, from project owners and suppliers to end users and facility managers, accurate cost budget estimation is a difficult task.

The criteria that affect accuracy in that order of importance were determined to be the diversity of lowest bids, the source of cost data used in estimating, the inherent inaccuracy linked to the estimating approach, and the suitability of cost data. It was recommended that having a single source of cost data and past cost information from projects where quantity surveyors had prior expertise would likely increase the accuracy of cost estimates.

The success of various infrastructure development projects depends on their early completion within the specific budgetary plan, with the right tone, and in a secure environment. In many developing nations like India, the infrastructure development industry has identified price and time escalation as their most significant issue. There is no shortage of media coverage of an instance of significant delays and unjustified cost increases in infrastructure projects. The minority of projects, though, are finished on time and on budget (Hemanta, 2010). Based on the literature review, a list of 59 criteria was created. A survey questionnaire was distributed to 450 industry professionals in the building sector. Using the RII, we ordered these variables. The

research revealed that the project team's skill, the client's financial capability, and the estimation team's level of experience are the three most important factors. The author conducted research on the elements influencing Ghana's road cost estimates (Akinradewo et al, 2020). To successfully execute any construction project, a precise construction cost estimate is crucial. Also, it might be seen as the primary driver of the project's early success (Savas, 2016). The cost estimate is created and put to use for a variety of tasks, such as feasibility studies, the tendering process, and the construction process. For project contractors, estimators, and owners, forecasting prices and building costs are crucial processes (Elfahham, 2019)

3. Research methodology:

The fundamental issue with faulty cost estimates and how they affect construction projects is the study's goal of getting an accurate cost estimate. So, the research technique used to frame and carry out this investigation is presented in this part.

In conducting the research, research data are collected using structured questionnaire survey by online (goggle form) and collecting by offline form. The questionnaire form is divided in different types of factor affecting cost estimation. There are 47 types of factors which affect to the cost estimation in construction project. The questionnaire survey is collected from the four stakeholders which are included site engineer, architecture, owner and contractor. Evaluated Sample size is 105 responses based on that the total 100 number of response are collected from the stakeholders. In which 25 responses are collected by o field interview and others responses are taken by the online mode of questionnaire. Each stakeholder (site engineer, owner, architecture, owner) have 25 number of response are collected. Which are analyze by the ANOVA (analysis of variance) test in excel.

For questionnaire survey of factors affecting cost estimation we assume that 90% confidence level for that z value is 1.645, P=20%, and we assume that the margin of error is 5% so,

$n= (20*(100-20)*1.645^2)/0.05^2$

$n= 105.28$

Here, the sample size is getting 105.28 for our survey is a part of an ongoing research work on "Assessment of factor affecting cost estimate from the perspective of stakeholders" .

4. Data collection:

4.1 Data processing:

The study's questionnaire was created to produce statistics for quantitative data. The respondents were asked to rate the significance of the various variables relating to factors affecting cost estimation on a five-point Likert scale, with 1 denoting very high importance, 2 denoting high significance, 3 denoting medium significance, 4 denoting low significance, and 5 denoting very low significance. In order to produce responses to the research questions, analysis of the data entailed closely connected procedures carried out in a way that summarised and organised the data that had been gathered. Excel was used to enter and analyse data on the computer. The measures of central tendency utilising mean value were employed to analyse the research data.

4.2 List of factors:

Many researchers have been conducted on the variables affecting the precision of cost estimates for construction projects. The researchers used a variety of methodologies to identify the factors that were most crucial to the cost estimate's accuracy.

Table: 1 Factor affecting cost estimation

Table: 1 Factor affecting cost estimation

SR No.	Factors	Variables of factor affecting cost estimation
1	Cost estimation factors	Cost of insurance
		Transportation cost
		Bureaucracy in tendering method
		Cost of labour
		Cost of machinery
		Fluctuation of prices of materials
		High interest rates by bankers
		High machinery maintenance cost
		Long period between design and time of tendering
2	Construction items	Contract management
		Contractual procedure
		Duration of contract period
		Frequent changes in design
3	Environmental factors	Awarding the contract to the lowest bidder
		Manipulation of suppliers
		Economic instability
		Effects of weather
		Government policies
		Inadequate production of raw materials by the country
		Number of projects going at the same time
		Poor productivity
		Project location
		Social and cultural impacts
4	construction parties	Disputes on site
		Lack of coordination between designers and contractors
		Poor planning
		Previous experience of the contractor
		Relationship between managers and labor
5	financing factors	Fluctuation in the currency exchange rate
		Financial status of the contractor
		Financial status of the owner
6	Project characteristics	Availability of power & Water in site
		Site conditions
		Vandalism and site security
		Type of contract
		Specification
		Experience of field staff
		Labour and equipment required
		Use old equipment
		Productivity of labor and Equipment
		Adoption of material from the owner
		State of market
7	Finance issue	Currency exchange
		Uncertainty of taxes
		Inflation factor
		Availability of management and finance plans
		Method use in determine contingency
8	Estimation project	Availability of productivity standards
		Experience of estimating team
		Numbers of competitors
		Time between project announcement and bid opening average

4.3 Occupation of respondents:

The selected respondent' s occupations are in the job, service, owner, businessmen, and contractor. The majority, namely 50% of the respondent' s occupation are job or service, 25% are owner or businessmen, 25% are contractor.

Occupation of respondents	N	% Percentage
Job/Service	50	50%
Owner/Businessmen	25	25%
Contractor	25	25%

Fig: 2 Occupation percentage

4.4 Experience of respondents:

The findings show that 37% of respondents had experience of less than five years, 85 have experience of more than twenty years, and the remaining respondents have experience in between..

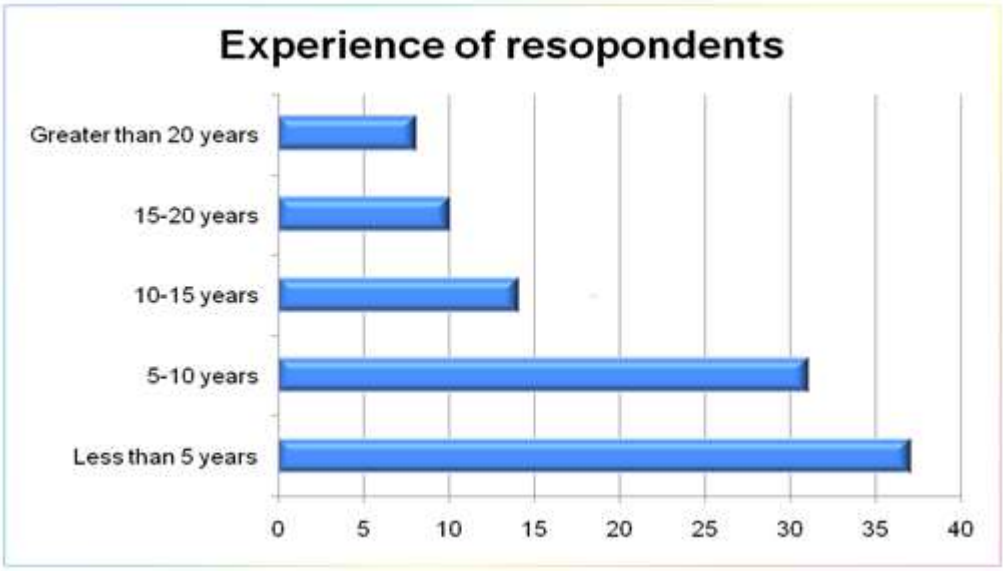


Fig: 3 Experience of respondents

5. Analysis of variance (ANOVA):

In 1920, RA Fisher developed the analysis of variance ANOVA. Analysis of variance, or ANOVA, is a potent technique for showing the differences between two or more means or components

when statistical tests are used. It also demonstrates how to compare the means of various populations repeatedly. The ANOVA test contrasts two types of variations: those that exist within each sample and those that exist between the sample averages. In this study analysis of variance is apply on the responses of the questionnaire survey with the different stakeholders perspective view and analyze the critical factors affecting cost estimation. Also, the variances between the factors are identified in this research by ANOVA.

6. Results and discussion:

6.1 Analysis by ANOVA single factor:

Table 2 Analysis of all stakeholders by anova single factor

Anova: Single Factor

SUMMARY

Groups	Count	Sum	Average	Variance
Cost of insurance	100	281	2.81	0.8221
Transportation cost	100	272	2.72	1.0925
Bureaucracyin tendering method	100	312	3.12	1.0562
Cost of labour	100	269	2.69	1.0039
Cost of machinery	100	260	2.6	1.1919
Fluctuation of prices of materials	100	215	2.15	0.9975
High interest rates by bankers	100	300	3	0.9495
High machinery maintenance cost	100	295	2.95	1.1591
Long period between design and time of tendering	100	314	3.14	1.3943
Contract management	100	293	2.93	0.9344
Contractual procedure	100	295	2.95	0.9773
Duration of contract period	100	295	2.95	1.0783
Frequent changes in design	100	202	2.02	1.0703
Awarding the contract to the lowest bidder	100	279	2.79	1.0969
Manipulation of suppliers	100	308	3.08	0.8824
Economic instability	100	309	3.09	1.1130
Effects of weather	100	333	3.33	1.2738
Inadequate production of raw materials bythe country	100	312	3.12	1.1168
Number of projects going at the same time	100	324	3.24	0.9519
Disputes on site	100	295	2.95	0.8561
Lack of coordination between designers and contractors	100	225	2.25	0.8359
Poor planning	100	256	2.56	1.2792
Previous experience of the contractor	100	319	3.19	0.8827
Fluctuation in the currencyexchange rate	100	204	2.04	0.7863
Financial status of the contractor	100	293	2.93	0.9344
Financial status of the owner	100	289	2.89	1.1898
Availability of power & Water in site	100	304	3.04	1.1903
Site conditions	100	289	2.89	1.0686
Vandalism and site security	100	340	3.4	0.9697
Type of contract	100	304	3.04	1.2711
Specification	100	240	2.4	1.8182
Experience of field staff	100	249	2.49	1.1413
Labour and equipment required	100	300	3	1.0101
Use old equipment	100	316	3.16	1.2267
Productivity of labor and Equipment	100	314	3.14	1.2125
Adoption of material from the owner	100	318	3.18	1.1390
State of market	100	202	2.02	1.0905
Currencyexchange	100	304	3.04	0.7055
Uncertainty of taxes	100	315	3.15	0.9369
Inflation factor	100	204	2.04	1.0489
Availability of management and finance plans	100	319	3.19	1.0039
Method use in determine contingency	100	303	3.03	1.1809
Availability of productivity standards	100	313	3.13	0.6799
Experience of estimating team	100	230	2.3	0.9798
Numbers of competitors	100	287	2.87	1.6698
Time between project announcement and bid opening average	100	315	3.15	1.6237
Number of competitors	100	338	3.38	1.2077

6.2 Analysis of all stakeholders:

There are total 100 responses are collected through questionnaire survey. And 25 responses are collected from the each stakeholder (owner, site engineer, architecture, and contractor). In all over analysis of stakeholders we show the results give in below table:

Table 3 Result of anova analysis of all stakeholders

ANOVA						
Source of Variation	***SS***	***df***	***MS***	***F***	***P-value***	***F crit***
Between Groups	668.884	46	14.541	13.37	1.293E-93	1.369
Within Groups	5059.05	4653	1.087			
Total	5727.93	4699				

Here, F critical value (1.369) is less than F calculated value (13.37). So null hypothesis is rejected and alternative null hypothesis is accepted. And the entire factors have some difference between them.

6.2.1 Top ten critical factor affecting cost estimation perspective of all stakeholders:

Here, according to all stakeholders the top 10 critical and impact full factors are shown below the table.

Table 4 Top ten factor affecting cost estimation with respect to the entire stakeholder

SUMMARY				
No.	***Groups***	***Count***	***Sum***	***Average***
1	Frequent changes in design	100	202	2.02
2	State of market	100	202	2.02
3	Fluctuation in the currency exchange rate	100	204	2.04
4	Inflation factor	100	204	2.04
5	Fluctuation of prices of materials	100	215	2.15
6	Lack of coordination between designers and contractors	100	225	2.25
7	Experience of estimating team	100	230	2.3
8	Specification	100	240	2.4
9	Experience of field staff	100	249	2.49
10	Poor planning	100	256	2.56

according to averages:

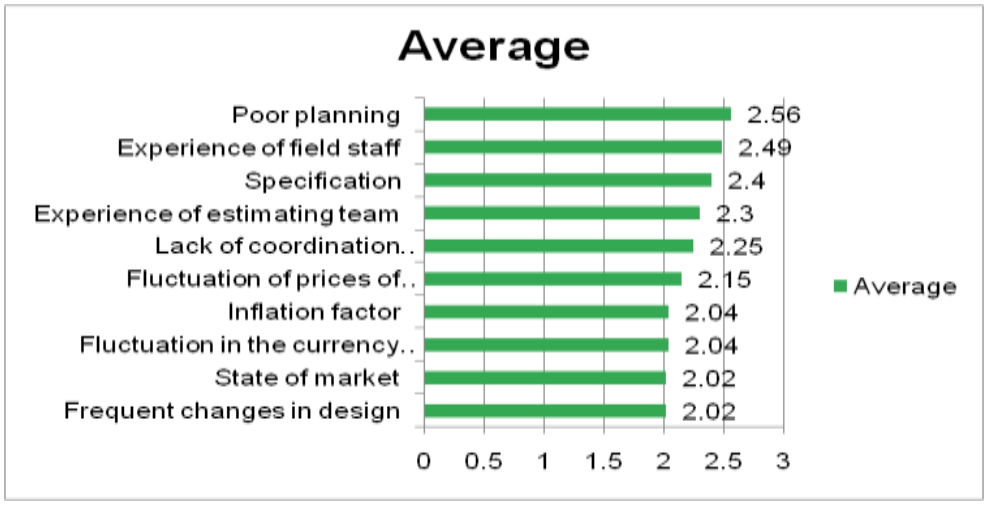


Fig 4 Averages of entire stake holders

6.2.2 Top five factors according to variance:

Table 5 Top five low variance factors:

SUMMARY					
No	***Groups***	***Count***	***Sum***	***Average***	***Variance***
1	Availability of productivity standards	100	313	3.13	0.6799
2	Currency exchange	100	304	3.04	0.7055
3	Fluctuation in the currency exchange rate	100	204	2.04	0.7863
4	Cost of insurance	100	281	2.81	0.8221
5	Lack of coordination between designers and contractors	100	225	2.25	0.8359

Here above factors have low variance so that factors are critical factor for the cost estimation.

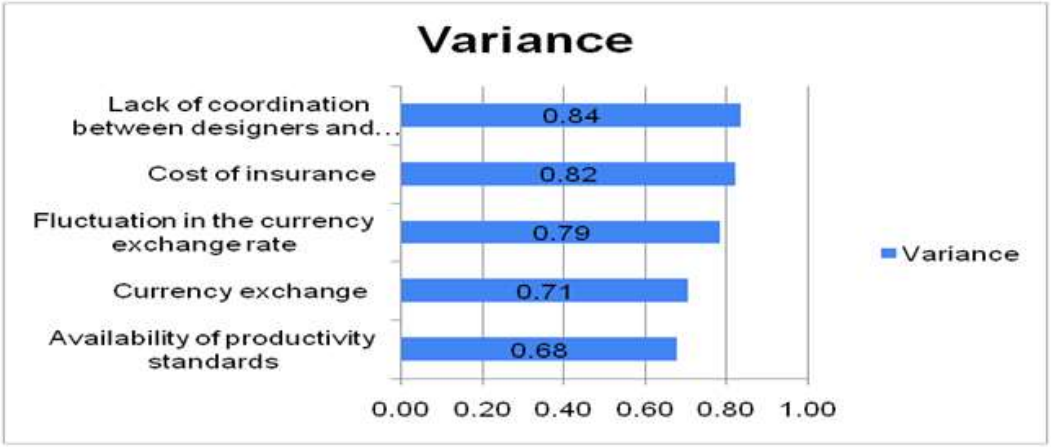


Fig 5 Variance of entire stakeholders

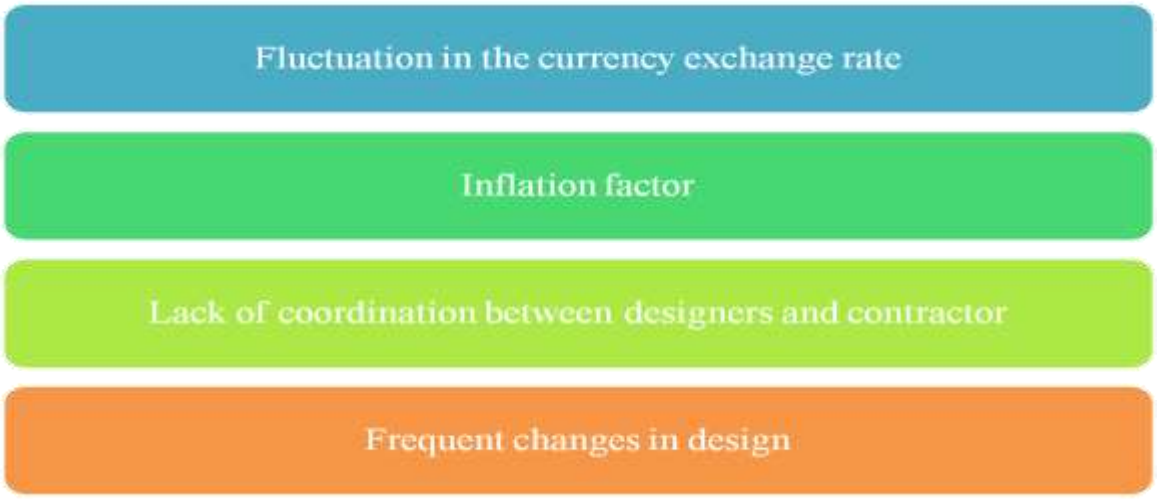
6.3 Critical factors affecting to the cost estimation according to the different stakeholders:

Table 6 Top ten critical factors affecting cost estimation according to different stakeholders

Site engineer		
No	***Groups***	***Average***
1	Fluctuation of prices of materials	1.8
2	Fluctuation in the currency exchange rate	1.88
3	Inflation factor	1.88
4	State of market	1.92
5	Frequent changes in design	2.08
6	Lack of coordination between designers and contractors	2.12
7	Specification	2.12
8	Experience of estimating team	2.2
9	Experience of field staff	2.24
10	Poor planning	2.28
Contractor		
No	***Groups***	***Average***
1	Fluctuation of prices of materials	2.08
2	State of market	2.08
3	Experience of estimating team	2.08
4	Inflation factor	2.12
5	Frequent changes in design	2.2
6	Fluctuation in the currency exchange rate	2.32
7	Poor planning	2.4
8	Lack of coordination between designers and contractors	2.44
9	Cost of labour	2.52
10	Specification	2.72
Owner		
No	***Groups***	***Average***
1	Frequent changes in design	1.64
2	Fluctuation in the currency exchange rate	2.16
3	Inflation factor	2.16
4	State of market	2.24
5	Fluctuation of prices of materials	2.28
6	Cost of machinery	2.36
7	Experience of estimating team	2.36
8	Lack of coordination between designers and contractors	2.4
9	Financial status of the owner	2.48
10	Transportation cost	2.6
Architecture		
No	***Groups***	***Average***
1	Fluctuation in the currency exchange rate	1.8
2	State of market	1.84
3	Specification	1.92
4	Inflation factor	2
5	Lack of coordination between designers and contractors	2.04
6	Frequent changes in design	2.16
7	Numbers of competitors	2.28
8	Awarding the contract to the lowest bidder	2.36
9	Experience of field staff	2.36
10	Poor planning	2.4

7. Recommendation and mitigation:

Most common critical factors between the stakeholders:



Fluctuation in the currency exchange rate:

Currency fluctuation rate are directly or indirectly impact to the construction material which is affected to the cost estimation. Economic growth, capital flows, inflation, and interest rates can all be impacted by currency exchange rates. The price of raw materials rises as a result of currency exchange rates or foreign exchange rates, which results in cost overruns. To managing or control the currency exchange rate we focus on careful planning and management, analysis of foreign exchange future rate during the cost estimation in construction project.

Inflation factor:

The construction business faces significant challenges from inflation, which drives up the cost of building supplies, machinery rental fees, consulting costs, and other project inputs. As a result, it can cause the project to take longer to complete, cost more to build, and have worse profit margins. From 35% to 60% of the total cost of construction goes towards the cost of the building materials. So, it is crucial to understand the variables that affect the materials. While it is impossible to completely manage inflation, there are steps that may be taken to decrease its impact. Consider moving up the deadline, modifying the budget, using different building materials, implementing lean construction techniques, etc.

Lack of coordination between designers and contractors:

Lack of coordination between designers and contractors indirectly affected to the cost estimation in construction project. In construction project most events leading to design

changes can be eliminated by improving on communication and coordination between stakeholders. Lack of coordination between the stakeholders are create causes, Delay in obtaining information, Misunderstandings arise from the information flow from the designer/contractor to the design team through several individuals Conflict.
Designer is delaying the draftsmen

These problems can avoid by,

- Recurrent conferences, calls, and deadlines
- Get familiar with the goals and processes of other teams.
- Double-check that everyone has access to the changes' details.

Frequent changes in design:

It is a major problem in cost estimation when designs of structure are frequently change or revised document or revised specifications are provide during the execution. It will change the cost of whole project and create difficulties and errors in cost estimation. That can be avoid and mitigate by the taking proper skilled and experienced team of designers and quality planning in design the structure.

7. Conclusion:

This research work examined the effects of erroneous cost estimates and the results that follow. The results showed that project stakeholders are negatively impacted by erroneous cost estimation. Total 47 variables collected by the previous research studies, which are analyze by ANOVA method. All four stakeholders have different perspective for factor affecting cost estimation. Results shows the top ten impactful factors affecting cost estimation by weight and results also shows that the top five lowest variance of factors of entire stakeholders. There are four most common variables of factor perspective of the different stakeholder which are fluctuation in currency exchange rate, Inflation factor, Lack of coordination between designers and contractors, frequent changes in design.

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