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Multiple Objective Decision Making Tool for Contractor Screening

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Abstract - *Construction project accomplishment depends critically upon selecting experienced and potential construction contractor, which is a prime and critical decision taken by project clients. The present report assesses the qualifications of contractors by scrutinizing the criterion utilized. Centrally placed criteria for assessing the construction contractors is nothing but quoted tender amount. Lowest quoted price generally cannot assure attentiveness on quality and overall time span of a construction project. Consequently, when choosing a contractor, a client should not solely collate tender amount however in addition other criterions for assessment of qualification must be set and their weightage should be worked out. A contractor should be chosen in accordance to both quantitative and qualitative criterion, and tenders should be collated. Solely depending on quantitative and qualitative assessment criterion and by collating tenders of contractors it is feasible to choose potential, experienced and trustworthy contractor, to assess its qualification, budgetary and monetary condition, technical potential and abilities and to bring out successful execution of construction project. The present paper provides an investigation of Indian companies, which scrutinizes issues pertaining to evaluation of construction contractors' qualification.*

Keywords - ***Criterion, Tender price, Adjudication, Relative Rank Index, Attributes, Development scheme***

1. INTRODUCTION

The construction sector plays a crucial role in the overall evolution of any continent in terms of life expectancy, literacy and levels of employment. It is frequently viewed as the 'engine' that powers the gait of nations overall evolution which comes into picture as a result of constructions divisions noteworthy offering to Gross Domestic Product (GDP).

Construction division in India encompasses 300 organization's in corporate province and furthermore to these there are about 0.14 million class-A contractors registered with different governmental construction bodies. In addition, thousands of small contractors exist, who contend to get minor works, at the same time serves under principal organization whom the contract is allotted. An intricate, tangled also distinctive nature of construction calls for the inclusion of multiple contractors in the execution of a project.

There have been immense delays in the framed schedule, cost shoot up, serious troubles related to quality and a rising number in claims and litigation. Construction industry has noticed the un-success of many contractors due to varying causes such as budgetary problems, meagre performance, or catastrophe arising from the negligence in in safe work environment at the project. One of the outcomes of inspection says, approximately 66.67% of development schemes going through operation stage perceived to face huge losses in terms of delay in duration and cost overrun. [1]

A construction project is generally undertaken in the form of treaty where exists project owner and the contractor. Depending on the particular requisites of the project and the objectives of his organization, the client decides a relevant bidding process and contractual arrangement to confirm that acceptable economy to the client, and contentment to the end-users have been equally achieved without any claims and cross action. Since crucial job is performed by selected vendor during execution of construction project, the critical task for the client is to choose competent contractor for the project, therefore, comprise the critical pivot upon which the overall project success is unreliably balanced. [2]

The salient feature of the construction industry is like most service providers working in project seem to be sole traders. Within lot of nations, exists huge number of entities, these have experience of working on single day project up to long duration projects. These entities include workforce of several thousands. If there are huge quantity of contractors exists within restricted development schemes and unsure construction industry environment concludes in fierce competition among these entities. [3]

2. LITERATURE REVIEW

Grouping of criterions is done for establishing utility functions, which is the procedure of multi objective decision-making phenomena that enumerates on a developed means of measurement and also a statistical configuration of rating of criteria. Term for measuring eligibility or contentment and serves a unvarying calibration tool for collating real & unreal criterion is known to be Utility. [4].

Opting a service provider for construction project is a procedure that includes concluding on one vendor among several others available and which involve the consideration of multiple selection criterion. These

criterions are on the whole subjective in nature and not easy to gauge. In public sector construction assignments, contractors deliver dominant role in the current emerging and all-round development of real estate sector. Contractor is most responsible for any under performance in a construction project. [5]

Continuous improvement is observed during past twenty years among various decision making tools utilized in procurement of construction work. In defiance of this, however, there has been no proportional improvement in the speed of 'success' of construction projects.

Straight forward classification of several attributes is being performed as Early-Assessment and Scheme Bound and have been utilized in selection of optimal contractor. [6]

From the point of view of executing the construction development scheme successfully along with expected results, number of meaningful attributes and benchmarks have been framed for different entities involved in the development scheme.[7]

This tool critically takes into consideration the adjudication teams desires as the utility functions those elucidated upon group of attributes. Below illustrated is stagewise process for ranking attributes in Multi Objective Decision Making tool:

1] Scrutiny of favoured and feasibility governed criterion.

2] Ordering scaling constants related to attributes.

3] Working out of indifference points.

4] Expression regarding sole and several attribute utility functions.

5] Working out of data of scaling constants.

6] Determining a view point of the adjudicator based on the overall data of scaling constant.

7] Ordering of options relying on feasibility values.

Higher utility option will be regarded as most suitable.

2.1 Existing Contractor Selection Exercises

Undoubtedly, procedure that is more often utilized for choosing construction service providers is by combative tendering. This procedure follows rule of granting contract to tenderer who quotes least price. Database of acquirement alternative exists for the project owners. The elements grouped as development scheme tasks, call for tenders, pre-screening, short-listing and tender evaluation. [8]

Menace will be faced when the tendering procedure follows the same old traditional criterion of focusing on least quote submitted by contractor solely. This could lead to opting the less proficient contractor. Here is the need of versatile criterion assessment tool which considers this menace seriously and guides the overall vendor evaluation and assessment mechanism without considering only least quote criterion. [9]

2.2 Contractor Selection Practices for Clients in Various Areas

Project owners in government areas are often restricted through mandatory policies across different nations, for adopting unfastened contending viewpoint to exclude intuition about nepotism at the same time express accomplishment of ideal status for public money has been ensured. Successful project accomplishment in terms of quality, finance & tenure have been achieved in many projects which are performed via joint venture in which more than one entity operates.

Scenario is really different on the other side in private sector. There such policies & ordinance are neither imposed on private sector organizations nor these entities are bind to such directives. This is the reason that private entities can utilize most sophisticated procedure in selecting contractors for their projects. However, ultimate desirable service provider can be opted through different available tools depending on goals of the project owner's company. Whatsoever tools are chosen in finalizing the contractor for project. Whichever route is opted for the final selection, the prime target would always be getting fair and reasonable value for financial investment made by project owner. [12]

2.3 Bid Evaluation Techniques

The critical task that is faced by project owner during bid assessment process will be laying down the weightages or seriousness of the attributes, designing an appropriate measure of rating framework that will be utilized by adjudication team in ascertaining the proficiency of construction service providers, choosing an acceptable tool for cumulating the orders provided by team of adjudicators on subdivision of attributes within an comprehensive presentation value, vendors sequencing on the occasion wherein one vendor marks high score than alternative depending upon attributes.

Project owner's need to give high priority for tender assessment when framing bidding plan of action for contractors. Tender evaluation procedure also needs to take into consideration the vast experience of the engineer which is also essential element. [13]

2.4 Review of Current Contractor Selection

North central part of the country still follows the same old traditional surveillance related to development schemes under governmental bodies, government subdivision bodies, etc. This surveillance illustrates the process finalizing the contractor for the development scheme only depending upon lowest quote made by bidder. Pre-screening of contractor and tender scrutinization essentially need the improvement in desirous & meaningful contractor finalization attributes. [14]

Extensive advancements in overall project specific prerequisites which have been noticed in the past twenty years gives rise to exertion of several development schemes execution delivery structure. [16]

3. BUILDING A FRAMEWORK FOR FINALIZING CONTRACTOR

Finalizing contractor has always been a critical operation for making a fair and productive determination that demands concurrent contemplation about several judgmental criterion, generally contrasting. These judgments come from group of several adjudicators. Selecting a service provider, consequently about making a critical judgment among several criterion inculcating unreliability, involvement of peoples, adopting rhetorical evaluation of very relevant conditions.

Within such segment, a comprehensive evaluation tool is taken to converse about. As an outcome of which the tool is collated in order to serve a desirable framework for finalizing service providers. [13]

3.1 Multi Attribute Utility Theory

A comprehensive assessment tool known as Multiple Attribute Utility is recognized and favoured universally by numerous organizations in regard to evaluation of their products. An objective of utilizing such a comprehensive tool in adjudication procedure will be to advance a statistical scheme for assisting the operation. This tool enables adjudicator to potentially work out the profitability of several options available to assess.

This tool adopted as standard adjudication mechanism in different continents around the world. The tool is utilized in making determination among multiple attributes along with directness, clarity involved in it for making framework. These thinks made it more favoured and that's why adopted for choosing most efficient service provider within the set of available options.

The MAUT an efficient Multi-Criterion Decision Making approach in handling with such type of decision making troubles. This is a standardized way of dealing (i.e.) based on how to value the company, which companies are good or bad.

The final outcome of utilizing such tool depicts the analyzers favoured options among available options set. [5]

3.2 Choosing the Attributes

Attributes are chosen in the way according to which the adjudicators favoured options should have to be exhibited in criterion aspects. The designer's preference will be reflected in the attribute characteristics. Criterion scope need to be picked up in the sense that, should be productive, practicable & need to stipulate an envisaged. The scope of the criterion must be chosen so that it is productive, practicable, and should stipulate the envisaged execution of framework within the tool.

When choosing the attributes, they must be:

1. Intact, in the sense, significant features should throw back in framework development.

2. Functional, in the sense, adjudicator inspection needs to be logically implemented

3. Very essential, such that no duplication happens.

4. User-friendly and accessible. [16]

3.3 Relative Rank Index Analysis [RRI]

Data collected shall be analyzed using the RRI technique. RRI technique will be utilized for analyzing the data. The RRI technique has been favoured across the globe as best analytical tool in the research and analysis of the detailed project data.

Significant stages of the variables can be collated through this RRI tool and this tool is utilized for collating the importance level of variables and illustrated from the Likert scales that portrays the stages of significance of variables nominated via respondents and these should be transformed into a RRI tool. Finally, it resulted numerically as value of one or less. Equation of RRI tools has been illustrated below:

$$RRI = \frac{1}{gT}\sum_{q=1}^{p} w_i \; v_i$$

Where RRI denotes to Relative Rank Index

g - Maximum Likert scale value (In this case 5)

T - Overall numbers of responses

q- 1, 2, 3.....n

w_i =Likert scale (w_1 is the least important and l_n is the most important)

v_i = the frequency of the i^{th} response. [10]

3.4 Development of Model

On the frequent occasion, depending on Multiple objective decision making phenomena, the weightages analogous with the criterion should correctly give back the correlative significance about the criterion only when scores p_{ij} are pertaining to same dimensionless measure. Dominant role done by utility functions such that: they transfigure the rough presentation data in order to get desirous presentation gains top utility number.

Attaining maximum profit has been contemplated as the key goal of project tendering action plan and has been most favored only criterion utilized. However, as per recent investigation data, it has come to know about an increasing awareness, such that adjudicators are concerned about corporate compassion, growth, market share. [5]

4. ADDITIVE MODEL

A utility function is a very decisive tool that works out the priority of decision maker by assigning a numerical value to varying levels of gratification of a criterion.

4.1 Multi-Criteria Additive Utility function

All adjudications mainly involve selecting one, from multiple alternatives. Typically, each alternative is evaluated for suitability on a number of scored criterions. What couples the criterion scores with desirability is the nothing but the utility function. The most familiar production of a multi-criteria utility function is nothing but the additive model.

$N_i > M_j.N_{ij}$ for all i,

Where

N_i is the inclusive utility value of alternative i,

Nij is the utility value of the j^{th} criterion for the ith alternative

N_{ij} equals $u(X_i)$, for $1 \geq i \geq a$ and $1 > j \geq b$

Xi equals $(x_{ij},)$ for $1 > i > a$ and $1 > j > b$.

X_i denotes a particular value of x_{ij}

a is the total number of criteria

b is the total number of alternatives

M_j is the relative weight of the j^{th} criterion

4.2 Selection of Superior Alternative

Every alternative is evaluated by the sum & multiplication of utility value allocated to criterion scores (served by decision makers) to the individual indices priorities.

$N_i = \Sigma(PI)_j . N_{ij}$

N_i = overall utility value of alternative I

N_{ij} = utility value of j^{th} criterion for the i^{th} alternative

$(PI)_j$= indices priority of the j^{th} criterion.

Optimal Contractor (Leading alternative) = highest overall utility value. [17]

4.3 Additive Model Conspectus

The benefit of the additive tool is its directness & accessibility. In the context to work out the overall utility function for any alternative, a decision-maker supposed to only ascertain 'n' uni-facial utility functions for that alternative.

Multi-criteria utility theory generally couples the main benefit of straight forward scoring techniques and models of improving efficiencies. Moreover, in scenarios in which gratification is unsure utility functions have the feature that expected utility can be utilized as a guide to rational decision-making. [10]

5. CONCLUSIONS

At present, tender quoted amount has been more significant attribute in regard to finalization of a contractor in industries. Whilst, tender provisions lay down variety of different assessment criterions, project owner need to choose a contractor with the lowest tender price. Contractors selection should never be done concentrating only on the minimal tender price, but it should be attributed to the highest weightage.

Demand for a contractor finalization tool is there which can consider multiple criterions. Multiple attributes utility theory serves one such walkway and is extensively efficient as the tool permits the treatment of criterions including both quantitative and qualitative. Additive model of MAUT is opted due to its uniqueness, viability and directness in critical choice scenarios. Significance of each contractor criterion is individually illustrated through a weightage which also encompasses the jeopardy of the decision-maker.

Above discussed multiple objective decision-making method is an efficient tool for utilization in determinations where criterions are of divergent features and it seems to be extremely meeting the requirements of construction contractor selection.

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