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Evaluation Model for Unbalanced Bidding in Construction Industry

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Abstract:
The procurement of best contractor by differentiating the various tendering processes is one of the major challenges that owners and clients face in the public and private sectors. In this regard, the past studiesfinds Unbalanced Bidding is one of the major factor that makes difficult in finding out the potential bidder. In order to challenge Unbalanced bidding this study presents the approach for evaluation of bidding to help owners in selecting optimum bidder by neutralizing the impact of largely variated bid prices. This evaluation process finds the impact of profit contribution that made in advance due to multiple uncertainties in line item quantities on the total project cost at each payment period with respect to Engineers estimate. Incorporation of this process in evaluation stage will assess each bidder's likelihood of being the truly lowest bidder and protects the owners in avoiding unbalanced bidding. This process nullifies the large variations in item price that affect in the procurement of a contractor and promote competitive bidding by awarding a project to the optimum bidder in a fair competitive process. Also, the procedure followed for evaluating contractor's unbalanced bids is discussed using a model.

Keywords: Engineers Estimate, Evaluation process, Unit Price Bidding, Unbalanced Bid, Profit Contribution

I. INTRODUCTION

Development of unfair bids or inappropriate bids to the requisite original or Engineers estimate that maximize the top line items cost rather than later item cost without altering the total cost to win the tender are called unbalanced bids. Numerous research papers proposed different mathematical models and techniques that assists in maximizing the profit contribution of contractors. This study presents the model for evaluation of biddings that helps in selection of optimal bidder by neutralizing various factors that affects in procurement of contractors. Most often the lowest bidder may not always be the promising bidder to award a tender on the total price. The Bidder true value cannot be determined until scheduled end of the construction project. Different construction durations of biddings cannot be compared directly but there is no chance for the contractor to carry the work or activities of project by differing non-critical activities where by taking this as advantage the following model is framed to evaluate the biddings. This method can be adopted in detecting the uncertainties in the front-line items. It considers expected payment time and calculate interests earned in differences made with Engineers Estimate for the following quoted biddings at each payment period. It requires a tentative schedule based on sequence of works, proper discount rates and expected payment periods. This method uses improvised simple mathematical equations in the model and provides a uniform profit margin on all line items ensures that the included mark-up percentage in the construction stage will be in harmony with the actual profit margin obtained untill very end of the project, provided that the contractor's cost estimate proves to be accurate during construction.

II. LITERATURE REVIEW

As per procurement laws and regulations many researchers have listed the rejection the lowest bid if it does not remain the lowest after calculating the present value of the expected payments to each of the competing bidders and then either award the contract to the second lowest bidder or reject all the bids and let the contract out for bid again. (Arditi and Chotibhongs(2009)). As per Khaled heshamhyari(2015) rejection in this case is based on contractor's non responsiveness to the bidding requirements. The contract should be awarded to the responsive bidder to protect the owner's interest and ensure fairness to other bidders that complied with all the bidding requirements. David W. Cattell, Paul A. Bowen and Ammar P. Kaka (2007) listed out various proposed methods and models like Marvin Gates (1959,1967), Starks (1968,1972,1974), Ashley and Teicholz's (1977) Diekmann (1982), Cattell's (1984), Tong and Lu's (1992). Critical assessment is made with the proposed scientific contributions, in particular faults with the techniques that are carried out in this field. The analysis of item price loading and similar practices that neutralises front-end loading are significant benefited. David W. Cattell, Paul A. Bowen and Ammar P. Kaka (2011) proposed CPT (Cumulative Prospect Theory) that serves to equate different return-risk alternatives to find set of item prices that process the optimal outcome. Dwarika Puri and S.Tiwari(2014) review and Identified various criteria used for Bid Evaluation and also introduced some recommendations for enhancing the contractors selection process Khaled Hesham hyari (2015) also proposed Rebalancing model for Biddings in the construction industry which helps in neutralising the impact of manipulated biddings with the statement of 'Prevention rather than Detection, an approach to handle unbalanced bidding. He also mentioned Arditi and Chotibhongs (2009) proposed using the Present worth method recommended rejecting the lowest bid if it does not remain the lowest when calculating the present value of the expected payments to each of the competing bidders.

III. STATEMENT OF PROBLEM

The bidder unbalances its unit prices or quantities in order to conceal its pricing strategy from competitors with the hope of

receiving large sums at the beginning of a project to generate greater present value of the total contract revenue for the contractor which is unfavorable for the owner.

IV. OBJECTIVE

The intend of recommendation in this research is to mitigate the early payments or uncertainties with the award of unbalanced bid and minimize the possibilities of additional costs to the project as a result of the award of contracts which are clearly unbalanced in terms of pricing. Identify and propose a model which attempts to resolve uncertainty of item price biddings by quantity and price variations, and provide wellconsidered recommendations for future practical application by present value cost.

V. METHODOLOGY

The effectiveness of a bidding optimization method can be measured by comparing its profitability to that resulting from other methods. To overcome these deficiencies of the uncertainties in the quoted biddings, it is proposed that biddings can be evaluated based on profitability obtained by the bidders based on the present value of money by comparing the results of the approaches among themselves. The methodology for this study was analysed through multi step series as shown below

Model Development: The proposed model is designed to consider uncertainty in the estimated quantities of work at the bidding stage in order to detect objectionable unbalanced bidding (i.e., material bid or cost unbalancing) in unit price contracts. The model mainly focus on the early payments.It utilizes payment timings to quantify profit contribution fromthe cost deviations in the actual quantities of work quoted in the biddings from the estimated quantities used in the bidding stage to evaluate submitted bids

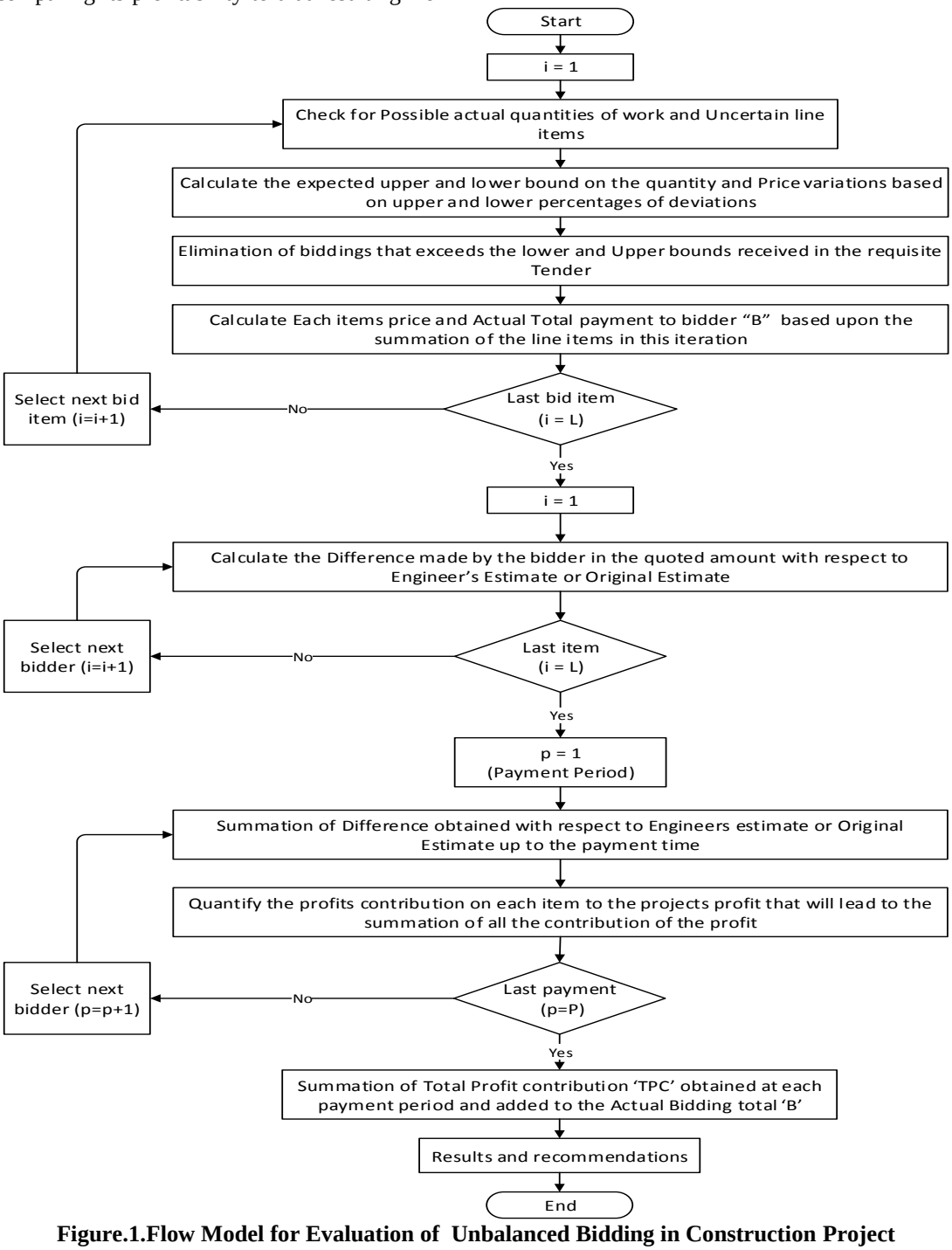

Figure.1.Flow Model for Evaluation of Unbalanced Bidding in Construction Project

VI. EVALUATION PROCEDURE

Step 1: It has been commented on by Stark (1968, 1972, 1974), Diekmann et al. (1982), Teicholz and Ashley (1978), and Tong and Lu (1992) that individual item prices should be bound by constraints, this can be done by calculating the expected upper and lower bound on the quantity and Unit price variations based on upper and lower percentages of deviations or with some fixed boundaries.

$$UP_i \geq L\% \quad \&UP_i \leq U\%$$
$$Q_i \geq L\% \quad \&Q_i \leq U\%$$

Where U, L = Upper and Lower Percentage Limit

UP_i = Unit Price of i^{th} item, Q_i = Quantity of i^{th} item

Step 2: Run simulation of actual quantities and price variations in the biddings with item price

$$P_i = Q_i UP_i$$

WhereP_i= Price of i^{th} item

Step 3: Calculate the actual payments where bidder quotes for the requisite tender or project

$$A_i = \sum_{i=1}^{n} Q_i UP_i$$

WhereA_i= Total Cost Value

Step 4: Calculate the differences of cumulative item price(P) and cumulative Enginineers Estimate(EE) in the biddings with respect to the Engineers Estimate or Original estimate

$$D_i = Cumulative\ (P_i) - Cumulative\ (EE_i)$$

WhereD_i =Differnce of i^{th} item, EE_i= Engineers Estimate of i^{th} item

Step 5: Calculate the payments made dates with respect to the estimated work of completion of the project and then calculate the profit or loss contribution (PC) from the requisite payments made.

$$PC_n = D_{i-1} * (1 + \frac{R}{N})^{NT} - D_{i-1}$$

Where PC_n = Profit Contribution up to n^{th} item,

R = Rate of Interest, N = Number of times the interest rate to be compounded annually, T =Time period

Where at last payment the summation of differences is not considered because last payment incurs no interest whereas the profit contribution from last item incurs

Step 6: Calculate the total value of the projects based upon the present value of money and final award of the project who becomes the lowest bidder.

$$TPC = \sum_{i=1}^{n} PC_i$$

Where TPC = Total Profit Contribution

$$B = A_i + TPC$$

Where B = Total Bidding Amount

VII. DISCOUNT RATE

From the perspective of economic theory, if the interest is R% per year and time fraction during which money were used before repayment is T. As every area will have different commercial behavior's in the discount rates and it is not commonly seen at constant interest rate. So, Discount rate can be adopted depending upon the local legal acts.

VIII. COMPARITIVE STATEMENT AND RESULT ANALYSIS

Preparation of evaluation process with the defined formula in an step by step order. However, it can be made through software based approach to evaluate the biddings, Where Excel is being used instead for the ease of evaluator. By this approach the comparative statement even helps you in knowing the price variations at each items process that has been quoted for required Tenders. Finally, the results came through this process that inclusion of all profit and loss contributions based on the present value are compared, analysed and concluded by final award of project to the reasonable bidder. In The Present Scenerio, The two bidders is taken to represent the evaluation process by using comparative statement where at constant Discount rate of 5 percent and duration of project as 30 months. The following evaluation process is represented in thebelowtables

TABLE. I. ENGINEERS ESTIMATE

Bid Item	Qty	Unit Price	Item Price	Cum. Item Price	Scheduled Time
1	500	1500	750000	750000	End of 6 Months
2	320	4000	1280000	2030000	End of 12 Months
3	440	2500	1100000	3130000	End of 18 Months
4	150	6000	900000	4030000	End of 24 Months
5	970	1000	970000	5000000	End of 30 Months
		Total	5000000		

TABLE .II. BIDDER 1

Bid Item	Qty	Unit Price	Item Price	Cum. Price	Item Diff	PC	Scheduled Time
1	500	1800	900000	900000	150000	0	End of 6 Months
2	320	4800	1536000	2436000	406000	3781.3	End of 12 Months
3	440	2400	1056000	3492000	362000	10234.8	End of 18 Months
4	150	4500	675000	4167000	137000	9125.6	End of 24 Months
5	970	755.67	783000	4900000	-100000	3453.6	End of 30 Months
			Bid Price = 4900000			TPC = 26595.3	Total = 4926595.3

TABLE. III. BIDDER 2

Bid Item	Qty	Unit Price	Item Price	Cum. Item Price	Diff	PC	Scheduled Time
1	500	1600	800000	800000	50000	0	End of 6 Months
2	320	4100	1312000	2112000	82000	1260.45	End of 12 Months
3	440	2400	1056000	3168000	38000	2067.13	End of 18 Months
4	150	6000	900000	4068000	38000	954.94	End of 24 Months
5	970	870.103	844000	4912000	-88 000	954.94	End of 30 Months
			Bid Price = 4910000			TPC = 5237.46	Total = 4917237.46

From the Following tables we can observe the Engineers Estimate is made for 5000k where initial bidder 1 quoted for lowest value of 4900k. In this scenario the bidder 1 opted slightly varied the item prices and tend to be the lowest bidder After evaluating with the following process of present worth analysis by taking profit contributions into account with the interest obtained from the earlier payments the bidder 2 tends to be lowest.So the Tender is awarded to the Bidder 2 for the quoted Price of 4910k.

IX. LIMITATIONS AND RECOMMENDATIONS

This model uses the scheduled time of completion of each activities and also uses the payment timing periods. So this project is limited only to the certain areas of construction projects where critical activities are obtained or sequence of works are carried out. It also will sustain for projects having payment period or with long run projects because the interest is generated only when the projects have certain time limits Despite of calculating the profit contributions from different line items in the sequence of works it still awards at the bidder quoted price where the bidder with optimum line item price who quotes uniform prices through out the project. In this evaluation process sometimes the lowest bidder may be rejected due to maximum price quantities at the beginning of the projects and awards to the second lowest bidder who seems to quoted uniform through out the projects. For this the rejection of lowest bidder can be opted in the real time tendering process by stating the evaluation process in the tender schedule and that fails to be rejected. The proposed model still can be improvised for further future works that saves the owners or clients investments. This model can also be adopted in finding the risks associated with the study of this model and making of risk free models.

X. CONCLUSION

Despite in the growing competitive world, still there is very limited empirical research considering overall impact of skewed or unbalanced biddings. Although several unbalanced pricing models have been developed to detect unbalanced line items still need to be improvised to the proposed models. This paper seeks to present new idea or model by considering "Cash in hand at present is more valuable than the cash in future" that quantifies the different bidding strategy played by the contractors in a perspective of optimizing unwanted benefits. The main advantage of this model is that it provides an opportunity to analyses the overallitem wise bid differences varying with the requisite Original or Engineers Estimate. The proposed model states that an unbalanced bid will be rejected if it generates the owners with initial variation in costs that yields to the other benefits by awarding the contract to a bidder, which ultimately might not be the lowest bidder at very end of the project Where in this model it also reduce the Bid riggings where in this process it is hard to find out the opponents strategy for each and every items. The proposed evaluation process also helps in reducing the delays due to early payments which incurs at maximum benefits or early rate of returns. So it helps in smooth conduction of work because of predefined schedule. It reduces cost overruns in the projects where it develops competitiveness among the bidders and helps in attaining early finishing of works. The work focusses on the long-term effects of costs that are typically facing more uncertainty in the biddings quoted by the contractors and carry out a complete cost-benefit study.Italso makes more complexity for the contractors where it wont allow in incurring of any extra benefits. This also provides guidance for the procurement process maker's that the terms to be considered in analysis of contractor procurement by weigh the costs which need to be examined for the optimization of biddings.

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