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Bidding Strategy and Cash Flow Forecasting in Private Construction Companies in Iraq

Abstract- *The sector of Private Construction Companies is one of the most important sectors in construction market in IRAQ. This sector played an important role in the last ten years in the Iraqi construction field. The idea of this research came from the hardly competitive bidding among these many private companies, and because of the lack of knowledge by many of these companies about the bidding strategy theories. This research is a trial to create a balanced condition of the bidding price for the contractor. The average bidding strategy method depends on historical data for the bidders and it is a relationship between the added percentage of profit and the winning probability. An important factor is inserted in this research, which is the maximum fiscal deficit that is facing the contractor during construction period of any project; this deficit is the difference between the received discounted payments and the cost of finished works for any period during construction. The contractor apply the bidding strategy method to lower his profit margin to the lowest certain extent to rise the opportunity to win the contract. Nevertheless, he forget that the lowest profit margin leads to highest cash deficit during construction. A survey was done for a contract construction company in the private sector in Iraq, where the competition is more clearly than the governmental sector, by collecting data for (5) competitive companies in (16) projects. By using the average bid method, to determine the added (12%) of profit the winning probability was (9%), and from the analysis of the cash flow forecasting curve the maximum fiscal deficit will be IQD (8,972,000) at the second month of the project execution duration. By applying the resultant equation and to lower the deficit through rising profit by (0.1%) the winning opportunity will be decrease by (0.6%). In this research, a relationship is drawn between the profit margin and the maximum deficit for project, and finally a relationship is drawn between the deficit and the winning opportunity of the contract. Both of these two relationships are linear, and the important results are that any contract should apply both average bid method and cash deficit method at the same time, according to the economic condition to its firm.*

Keywords- *bidding strategy, cash-flow, construction projects*

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1. Introduction

Competitive bidding system plays a central role in both public and private agencies in many countries. Leaving a bid for a profitable project by the contractor or any investment opportunity may leads to lose a profitable project by the contractor and also may leads to lose a good opportunity to get a better reputation in the industry of construction filed and wins a better clients respect.

When the contractor invest his money in a non-profitable project, because a wrong decision was made by his consultant to compete for this project, he may lose his money and resources and also lose his time, while he can invest his money in another alternative and get the profit from this project when a right decision made by his adviser based on scientific methods [1].

Unlike package deals, concession, and negotiated contracts, which creates 10% of construction contracts [2], the rest of contacts awarded to the contractors through priced or unpriced tenders prepared by the owner's consultant.

The random nature of the bidding process also ensures that contracting companies will be able to plan their company's activities with much certainty that many contracts will be for with unrealistically low prices and that the pre-occupancy of most contractors with claims also continue.

If the contactor wants to get a contract, he must either submit or negotiate the price for the work, which he will get. This procedure is usually called "bidding process".

Each contractor must have a knowledgebase about any other contractors whom he will beat to be sure that he will get the job. In some countries contractors had a database for their competitors, the availability of such data are issued some times by the government of this county or any other organizations [3]. This information creates a favorable environment for the work of contractors and make it easier for them in the competition process to apply for tenders [4]. In addition, the

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availability of these data creates a clear vision by each contractor. It is worth mentioning that, in Iraq, there is a totally absence of this type of information on both privet and governmental levels.

I. Research objective

The main objective of this research is to put a systematic manner, to help the contractors, finding the optimum profit percentage derived from the probability of winning (POW) the contract and the maximum deficit, which will be, endures by the contractor, determined from the cash flow forecasting curve of the project.

II. Research hypothesis

Two hypotheses are suggested in the research, the null hypothesis stipulates that there is a relationship between (POW) and maximum deficit, which will be, occur during construction, while the alternative hypothesis stipulates that there is no relationship between them.

III. Background

In the middle of the nineteenth century, especially in Europe and the United States, many researchers was interested in the field of bidding strategy. The endeavors of these researchers' leads to statistical models for estimating the probability of winning the project or procurement contract for competition for projects in construction sector.

These models try to give an advice to the competitors in the construction sector of the probability of winning the contract with a certain profit percentage.

The workers in construction field industry try through there researches and papers to find the optimum profit which would be applied to the contract price to achieve the maximum probability of winning the competed contract.

The derived relationships between the maximum profit margin and the optimum probability of winning did not take into account the financial position (the firm's budget) of the competed firms [1].

Therefore, the proposal of recent researches is to use the estimated probability as a dependent variable and the maximum profit as an independent variable, as the following equation [5].

$$overall\ success = \frac{number\ of\ jobs\ won}{number\ of\ bids\ submitted} \quad (1)$$

In December 2001, Drew et al. studied the effect of client and type and size of construction work on a contractors bidding strategy using Regression analysis in measuring a contractor's competitiveness between bids (by using the lowest bid / own bid ratio) and within bids (by using the lowest bid / cost estimate ratio) they concluded that there is a successfully developed for projects from the private sector, the Hong Kong Government and the Hong Kong Housing Authority respectively [6].

Mochtar and Arditi studied the alternative pricing strategies in construction. From reviewing and exploring the historical data in the field of bidding strategies alternatives, they highly recommended using Friedman-Gates models, which was the best from their point of view [7].

Shrair, determine 125 factors which effect on the bidding strategy method among companies, and take five contractors as a sample for his study. He filtered these factors to 88 factors depend on their importance, he find that the competitive contractors must have a continuous development for their laborer and must follow a constant policy in their bidding strategy [8].

Bagies and Fortune, prepared a research is mainly based on the review of the literatures for bidding strategy fields and they try to derive a theoretical method to build a decision whether to bid for a project or not, this method cares about making decisions in the presages of the project life cycle. In addition, these researchers try to build a database for the future projects in their country to help construction firms for right competition in construction filed [1].

In 2008, Banki et al. prepared a research for Iranian construction companies to determine their bidding strategies. In this research a bidding cost was estimated based on the prices of past tender which was awarded, they took into account many variables such as the strategies of competitors, project criterion, owner tendencies, etc. this research found the reverse relationship between bid prices and number of bidders [8].

An, et al. [9], in this research the firms were classified as groups. In addition, a simple simulation model is used to generate several iterations to estimate the behavior of the number of the competitors when the created groups are changed.

A positive relationship was found, in this research, between number of the competitors and the created groups [6].

Photios and Leu, address the Average Bid Method problem in a research, the companies in construction industry are interested with the average bid method. Owner and contractor can improve their bidding policies through this

method. This result was obtained through comparing this method with others [10].
All researchers above discuss the problem of biding for contracts from the profit margin point of view, but they neglect the cash, which is available by the bidder.

2. Nature of Bidding in Construction

Bidding strategy theories is used by many areas in the live in addition to the construction sector. There are three types of tender submitting, the first type is the open tender, the second type is the closed or sealed tender, and the third is a combination of them.
A solo negotiation takes place between contractor and owner about the price of announced contract, also the negotiations among the competing contractors are allowed, in the open tender form of contract, as long as the owner dose not award the contact till now. This type is used in commercial contracts [1].
In the second type a sealed or closed tender, which is widely used in construction of the project fields, on the contrary of the first type, the negotiation between the owner and the contractors or the contractors themselves are prohibited. It is worth mentioning that there are two types of the second type above, the unpriced tender may be submitted with prices in a single envelope or prices and tender are submitted in separate sealed envelopes [1]. In civil engineering, construction bidding is distanced by two main criterions: [3]
1. There is a huge amount of data inserted with detailed requirement prepared and inserted by the client and the contract, which are submitted to the engineer as a drawings and specification to estimate their prices.
2. All contractors bid for the same project at which it has the same properties.

The above two points reflects a type of sealed bids that is generally described as a one-step / solitary Envelope (SSSE) bidding method [10].
After receiving the tenders for a certain project, all the competitor contractors put their priced tender and technical proposals in single stamped folder.
At the next stage the awarding committee, after analyzing the time and price for each tender, award the contract to the contractor whom submit the lowest price relative to best specification.
In construction, projects there are two types of proposed projects, which the owner to the competitive contractors will submit their tenders. The first type the owner does not have a design for the project, the second type he has full designs for his proposed project.
There are two ways available by the contractor to submit for the first type above, he may submit his prices and technical properties (designs) to the owner in separate envelopes.
In the first way the two envelopes are opened by the committee at the same time and the contract award to the lowest price, or the priced tender envelop will be opened first and a negotiation takes place and then the technical envelop is opened, after that the awarding is done.
In the cases where the owner submitted tenders with full details for designs and technical properties, the submission for this tenders by the contractors are in single envelop and the committee opened these price tenders in one stage, after this step the owner award the contract to the firm with lowest price.
Skitmore said that the determinants, which was affected by the step selective method and consists of two-step bidding, depends mostly on the bidding theory which was used [2].

3. Conceptual Bidding Model

The basic assumption of all the bidding calculations is that a relationship exists between the tender sum and the 'probability', or 'chance', of winning the contract. The aim of probabilistic models is to express this numerically.
Although, many trails, literatures, and documents concerned with bidding strategy made by scientists and researchers. Many of these models are relatively little use and most of them stayed on academic shelves, except Friedman bidding model which was applied to many contracts because its quantitative property feature [1].
The contractor must estimate his profit by adding a percentage of the cost of the contract to the original contract's cost. The added percentage must be within certain rang to contribute in the overhead company expenses, i.e. (indirect company cost, taxes, insurances, salaries of employees, etc.) furthermore some profit.
Each contractor can derive a formula at which the winning probability is a function of bidding price, with historical data in the following steps: [3]
1. Historical price data collection about his competitors in the past.
2. Dividing the data collected in (1) by his estimated cost in each case.
3. Plot a curve at which the x-axis represents the percentage of profit and the y-axis represents the probability of winning.

So that the contractor can use this curve as a guide for the future works, and the same competitors assuming that the policy of competition of these companies will not change in the near future.

Table 1: Prices for competitive bidders

	Symbol of the project	cost of contract estimated by (Ardh Al-Karam) company X 10^6 IQD	Prices of competitive bidders x10^6 IQD				
			Contractor 1	Contractor 2	Contractor 3	Contractor 4	Contractor 5
1	A	97	107	104	-	-	-
2	B	555	594	572	565	-	-
3	C	244	264	257	-	-	-
4	D	988	1043	1100	1098	1150	1170
5	E	718	760	740	754	-	-
6	F	308	358	326	-	-	-
7	G	201	216	212	210	-	-
8	H	481	478	504	498	-	-
9	I	614	660	632	-	-	-
10	J	800	810	880	840	860	-
11	K	150	200	210	165	-	-
12	L	350	370	390	375	380	391
13	M	416	456	470	461	-	-
14	N	522	600	590	588	594	-
15	O	707	774	770	782	779	810
16	P	633	690	700	706	-	-

Table 2: Percentage of price of winner tender to cost of contract

	Cost of contract (x10^6 IQD)	Price of winner (x10^6 IQD)	% of price of winner tender to cost of contract (x10^6 IQD)	Percentage of profit for the first winner 1 2 3 4 5 6 7 8 9 10 11 12
1	97	104	1.07	
2	555	565	1.02	
3	244	257	1.05	
4	988	1043	1.05	
5	718	740	1.03	
6	308	326	1.06	
7	201	210	1.04	
8	481	478	0.99	
9	614	632	1.03	
10	800	810	1.01	
11	150	165	1.10	
12	350	370	1.05	
13	416	456	1.09	
14	522	588	1.12	
15	707	770	1.09	
16	633	690	1.09	
			Σ	15 14 13 11 10 7 6 5 5 2 1 1

A direct relationship between our intended mark-up and the chances of beating that particular competitor.

4. Case Study

Because of the frequent losses of some contracting company, in the privet sector in Iraq, a bidding strategy model is proposed to enable these companies to estimate the optimum marginal profit which must be added, and the probability of awarding (winning) the contract at this estimated marginal profit, although an important factor is added in this research which is the maximum fiscal deficit that may occurs at any time during the construction phase in the project's life. A historical data of awarding of (16) contracts for the five competitive privet companies in Iraq was collected. This historical data is listed in Table 1. Analysis was made to the collected data in table 1 to determine the percentage of marginal profit, which was added by the first winner bidder, using equation (2) [1].

$$x = \frac{pow}{coc} \quad (2)$$

Where:

X : percentage of the price of contract to cost of contract.

Pow: price of first winner, Coc: cost of contract

The results of analysis using equation (2) are represented in Table 2 below at which the numbers from 1 to 12 represents the decimals of the price of winner tender.

Table 3: Percentage of probable profit

% of profit	Number of winner contract	Probability of winning	Percentage of probable profit
1	15	93%	0.15
2	14	87%	0.28
3	13	81%	0.39
4	11	68%	0.44
5	10	62%	0.50
6	7	44%	0.42
7	6	37%	0.42
8	5	31%	0.40
9	5	31%	0.45
10	2	12%	0.20
11	1	6%	0.11
12	1	6%	0.12

Table 4: Flow forecasting

	Activity duration (months)	1	2	3	4	5	6	7	8	9
A	2	392	392							
B	2		336	336						
C	4		280	280	280	280				
D	4				336	336	336	336		
E	2							168	168	
SUM=		392	1008	616	616	616	336	504	168	
Discount 10%			39.2	100.8	61.6	11.2				
received payment			352.8	907.2	554.4	604.8	616	336	504	168
cumulative r. payments			352.8	1260	1814.4	2419.2	3035.2	3371.2	3875.2	4043.2
cost		350	900	550	550	550	300	450	150	
cumulative cost		350	1250	1800	2350	2900	3200	3650	3800	
deficit		-350	-897.2	-540	-535.6	-480.8	-164.8	-278.8	75.2	
		350	897.2	540	535.6	480.8	164.8	278.8	75.2	

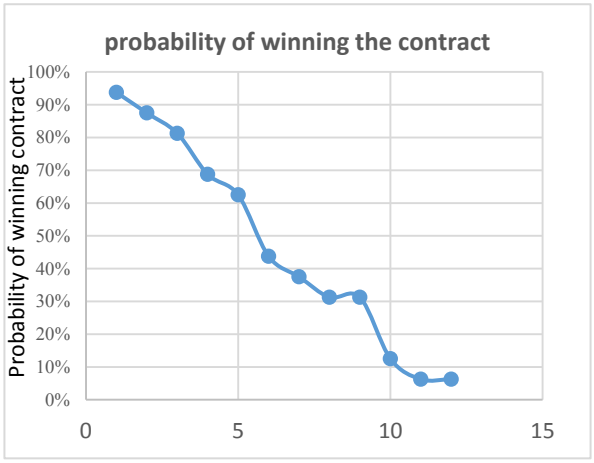

Figure 1: The probability of the winning contract

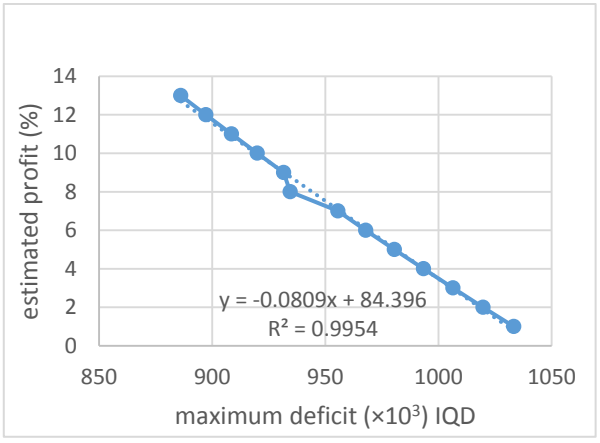

Figure 2: Relationship between the profit and max deficit

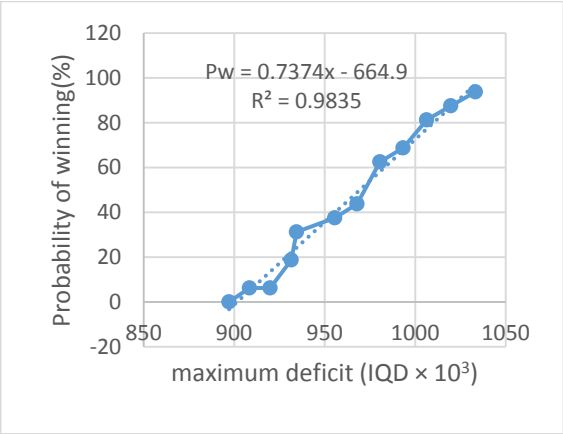

Figure 3: Relationship between the max deficit and the percentage of added profit

By re-arranging the Percentage of profit for the first winner in table 3, a simple division of the summation of winner contract calculated in table 2 by the total number of contracts (16), the percentage of winning possibility and percentage of expected profit can be determined, as shown in table 3.

The percentage of probable profit is also simply calculated by multiplying the number of winning contract by percentage of profit in column 1 of table 3. Finally a curve is drawn using data in table 3 to show the relationship between the percentages of added profit versus the probability of getting the contract by this company.

The company now can use this curve for competing against other competitive contractors to calculate the winning chance of the contract and to determine the expected profit at the same time i.e. if the company will add a marginal profit of 6%, the probability of winning is easily determined from the curve in figure 1 by about 43 %.

To make an accurate estimating of the profit, which will be added by the contractor another factor, is taken into account, which is the maximum deficit, which can be calculated by using the cash-flow forecasting curve method. Where the deficit can be simply defined as the difference between the cost of the summation of activities cost, for a certain time in the project life, and the received payments from the owner for the same activities table 4.

Therefore, the percentage of profit that must be added by the contractor to compete others must be a function of winning the contract (*w*), and the amount of the maximum deficit (*d*), and in mathematical words:

$$y = f(w, d) \quad (3)$$

Where: *y:* is the profit percentage;

And *w, and d,* is the winning chance and the maximum deficit respectively. For the same company and for a project the following data was collected and analyzed in Table 4.

For many trails to find the best curve for the maximum deficit verses percentage of profit, which was estimated by the contractor, the curve in Figure 2 is shown.

It clear from Figure 2 that there is a linear relationship between the added profit percent and max deficit according to the following trend.

$$y = -0.0809x + 84.396 \quad (4)$$

Where: x is the maximum deficit and y is the percentage of added profit. Now from above a relationship between the probabilities of winning the contract and the maximum deficit which may occurs during construction could be drawn.

Form Figure 3 the following linear relationship is obtained:

$$Pw = 0.7374\,x - 664.9 \quad (5)$$

Where (Pw) expresses the percentage of winning the contract and (x) is the maximum fiscal deficit during the execution of the construction project.

5. Conclusion

The first finding of this research emphasizes on creation of a governmental or independent organization to issue a yearly publications or journals for the prices of awarding for the contracts in Iraq in construction industry, to help the competitor firm to build their own models of bidding strategy to decrease the gap between these models and the real life.

In general, by reviewing the contract pricing in Iraq the researcher found that there are unclear attractions for bidding in the construction market, and all the models are generally base on the relationship between the winning opportunity and the profit.

In this research, another important factor is entering which also helps the contractor to estimate his profit percentage for any contract this factor is the maximum deficit facing the contractor during the project life cycle.

The main objective for the contractor is to get a profit mostly at the middle life of the project life, therefore it is clearly from table 4 that loses continues until the seventh month of the project's life IQD (-2,780,800) at a profit margin of (12%).

Therefore, if the contractor cannot face this deficit (losses) he must apply another factor to avoid these losses by using the relationship of probability of winning and the maximum deficit of money that he can face by reducing the profit margin.

At (12%) profit margin the winning probability is about (9%), Figure 1, and the maximum deficit is about IQD (9,100,000), Figure 1. When he tries to raise the profit to avoid the maximum deficit he

may lose the contract, and when he ties to lower Profit he may face a deficit of money which he incapable of facing it.

By using the average bid method, to determine the added (12%) of profit the winning probability was (9%), and from the analysis of the cash flow forecasting curve the maximum fiscal deficit will be IQD (8,972,000) at the second month of the project execution duration. By applying the resultant equation and to lower the deficit through rising profit by (0.1%) the winning opportunity will be decrease by (0.6%).

The new suggested system is very powerful for the contractor to estimate the profit margin depending on the maximum deficit and the winning probability, to rise the profit margin and to estimate at the same time the maximum deficit, which he may face.

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