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# Assessment of Competitive Bidding Strategy Scenarios in the Construction Industry of India

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**Abstract:** Construction companies must have the ability to deal with various bidding situations successfully in today's highly competitive construction market. The contractors' strategy is affected by various factors and influences. The low-cost mentality dominates in the competitive business of the construction industry. Previous various study have been devoted to finding solutions for helping contractor's bidding strategy. This paper presents the analysis of factors affecting contractor's bid or not to bid decision, mark-up percentage of 17 respondents from top five contractors in highway sector across India, relationship between successful bid ratio with firm's net profit margin (NPM) & total revenue, relationship between mark-up size with successful bid ratio in different construction business sector & mark-up size variations in different construction sector by applying various research methods like RII method, descriptive statistics, Chi-square test of independence, Spearman's rank order correlation coefficient method. This paper also suggests some recommendations as lots of scope of future research is present in this field.

**Keywords:** Bidding strategy, Bid or not to bid, Mark-up, Net Profit Margin, Total Revenue, Successful bid ratio

## I. INTRODUCTION

In spite of huge opportunities for the construction organizations of the country, only a small number of organizations will succeed and establish its existence. The basic reason for the failure of many numbers of construction organizations is selection of inappropriate projects for execution which leads to inefficient contract management and disputes thereafter. So, the bid selection phase plays a vital role in the success of a contractor. In Indian construction industry, some of the large construction organizations practice a specific and standardized strategy in the selection of best project proposal. The development of the construction industry has led to an increase in the number of criteria which is affected contractor bidding strategy. The contractors' strategy is affected by various factors and influences. Generally, construction projects are awarded on the basis of the lowest bid price in the tender that meets the specifications mentioned. The percentage of markup in the construction industry is a crucial decision that could affect the contractor's ability to win or lose construction offers and future projects. The losing bid affects the contractor's cost of doing business and places a heavy burden on all project stakeholders to win another project in the future. Further, the probability for a contractor to win a bid depends not only on his mark-up, etc but also on the approach adopted by the competitors. Therefore, contractors need to make strategic decisions in respect of:

- 1) project selection whether or not to bid;
- 2) determination of mark-up range if contractors choose to bid; and
- 3) different bidding strategy models.

The study will investigate the mentioned three areas. In this research, the study will focus on the bidders' competitiveness strategies during the pre-construction stage in the project life cycle.

## II. OBJECTIVE OF THE STUDY

The main objectives of this study were as follows,

- A. examine the factors related to the contractor that affects his/her decision to bid or not
- B. factors related to the client that affects the contractor's decision to bid or not
- C. factors related to the contractor that affects the mark-up size
- D. correlation between annual average successful bid ratio with firm's net profit margin & total revenue
- E. assess the mark-up size differences observed among different business sectors
- F. Whether any association between 'mark-up size' & 'successful bid ratio in different project size'.

This paper has an objective to act as a foundation for future studies and its results will become worthwhile information in efforts to improve the contractor's bidding strategy in the construction industry.

### III. LITERATURE REVIEW

The relevant literature on factors affects bid or not to bid decision, factors affecting mark-up size, mark-up size differences in different civil business sectors was reviewed and presented here. During study it was found that there are lots of scopes to analyze the correlation between mark-up size with different bidding models & successful bid ratio in different project size as this part of bid is not much studied earlier.

#### A. Bid or Not to Bid Decision

Jayeshkumar Pitroda et.al (2015) identified the most important factors affecting contractor's bidding strategy are: Terms of payment, Current financial situation of the company, Possessing enough qualified technical staff to do the job, Possessing enough qualified technical staff to do the job etc. A regression model was developed by Drew, D. et al. (2001) to find the effect of client, type and size of construction work on a contractor's bidding strategy which revealed that, the bidding behavior of the reputed construction contractor was largely unaffected by the type of construction work, but significantly affected by the client type and size of the construction work. Over the period of five years, the research carried out by Deng, F. et al (2012) on Chinese Construction Industry gave similar results with additional key factors influencing bid decision like qualified professionals, skilled workers, management and work ethic and steady growth of the home market. In another research, Jarkas, A. M. et al. (2014) found that, previous work experience, project type, project size, current workload, financial conditions of company and clients are the most important factors which are to be considered before taking the bid or no bid decisions.

#### B. Mark-up Size

Park (1964), Miller & Starr (1969), Ahmad et al (1988), Jha (2004) suggested that numbers of competitors & intensity of competition, size, cost of project, type of project, duration & location of projects plays most important factors in making mark-up decision. According to a survey conducted among top 400 contractors identified by *Engineering News Record*, degree of hazard, degree of difficulty, Type of job, Uncertainty in estimate are the most influencing factors in mark-up decision. Park (1977) identified several factors influencing the profit consideration in a bid markup decision. These factors are related to the issues of perceived risks, construction efficiency, survival and expansion of the contractors. Lai (1982) suggested that the determination of the markup during tender adjudication is dependent on factors such as overheads, capital availability, staff quality, machinery, political trends, market potential, and technological changes.

K.N.Jha (2004) defined to determine the Bid price, by considering the mark-up as given below,

Bid price = Total cost + Mark-up amount

Bid price = Direct cost+ Indirect cost+ Mark-up amount

Mark-up amount = profit + contingency+ allowances for risks+ general overheads

Mark up in terms of percent of total cost TC

$$\text{mark up (\%)} = \left( \frac{B}{TC} - 1 \right) \times 100\%$$

Mark up in terms of percent of bid price B,

$$\text{off top (\%)} = \left( 1 - \frac{TC}{B} \right) \times 100\%$$

Mark up obtained in 2<sup>nd</sup> case referred to as 'off-top percent' in some construction companies.

#### C. Bidding Models

K.N.Jha (2012), "Construction Project Management", 2<sup>nd</sup> edition, defined two type bidding models i.e. statistical model & cash flow-based model.

- 1) *Statistical Model*: Jha (2004) suggested two models. In 'Friedman model' in 1956 he attempted to develop an expected value model describing the bidding situations with probabilistic formulations. According to 'Gate's model' (1967) defined that a contractor who is competitive should be able to obtain 'his share' of the work. K.N.Jha (2004) defined that based on the two models in order to find the probability of winning associated with any mark-up percentage, firms need to either (1) calculate probability of beating individual contractors such as A,B, or C, or (2) calculate probability of beating a typical contractor. Rickwood (1972) stated that Friedman's model is found to be more correct when the cost estimates of different competitors are nearly the same & difference in bid price is mainly due to difference in mark-up. Gate's model gives more accurate result when mark-up used by competitors are nearly same & difference in bid price mainly due to cost estimate.

- 2) *Cash flow-based Model*: Fondahl & Bacarreza (1972) developed model for the calculation of mark-up assuming a fixed minimum rate of return. Farid (1981) also developed the Fair and Reasonable Mark-up (FaRM) pricing model based on cash flow approach.

#### IV. PRE-QUALIFICATION BIDDING PROCESS

In India for the contractor, the tendering process starts with the receipt of request for pre-qualification in case of limited bidding, while it may start at the onset of notice inviting tender (NIT) in case of open bidding. Follows the below mentioned steps,

- Get involved in pre-qualification process
- Study the tender document, drawings and prepare tender summary
- Decisions to take
- Arrange for site visit and investigation
- Consultation, queries, meetings and other associated works
- Prepare construction schedule and other related schedules
- Collect information
- Determining bid price

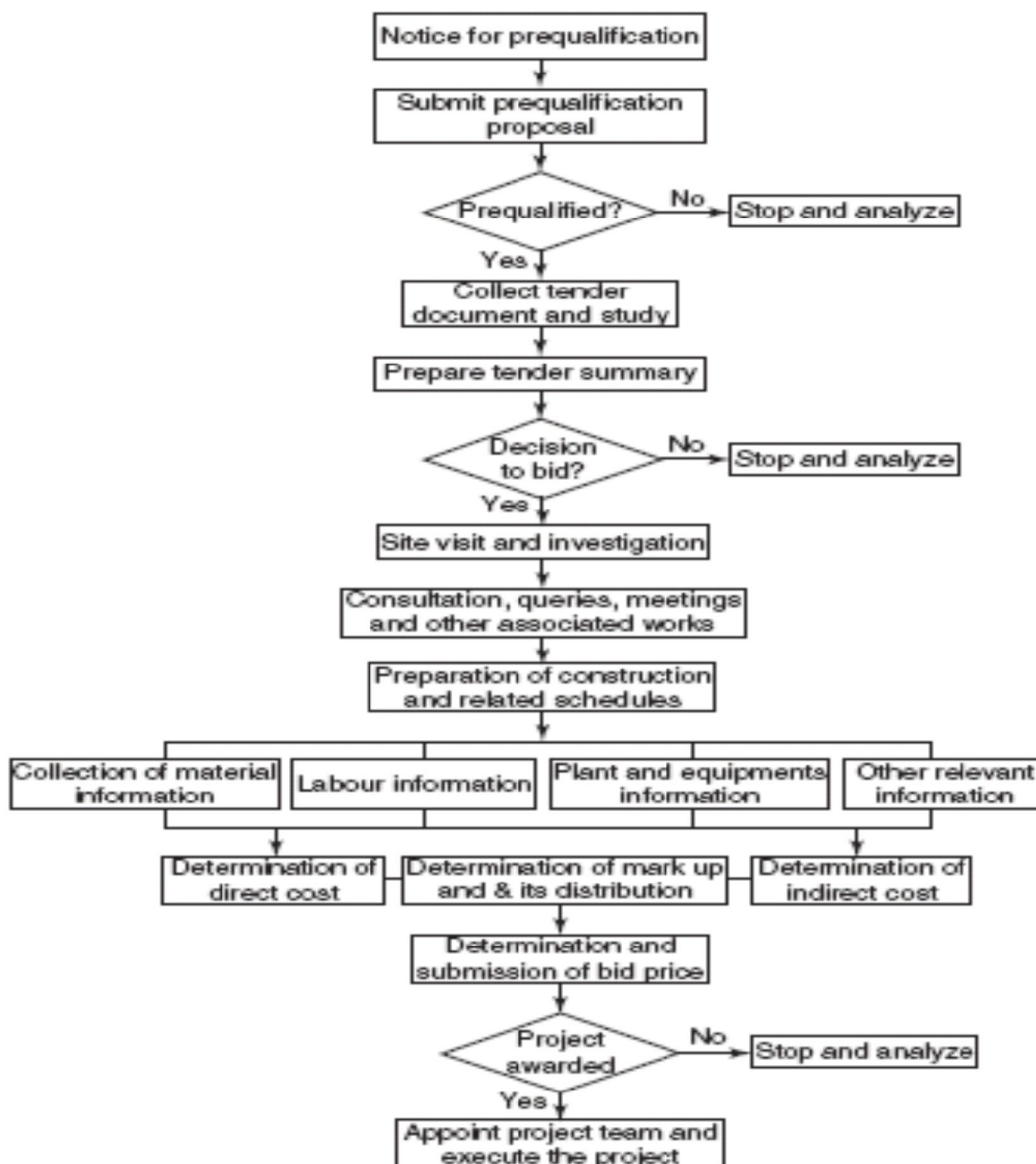


Fig. 1 Bidding process from contractor's perspective



## V. RESEARCH METHODOLOGY

### A. Sample Size & Data Collection

Several surveys were conducted to reach the solution of the study objective. 17 respondents pertaining experience from five to fifteen years, from 5 construction firms of highway sector, head office based at Mumbai, Delhi, Ahmadabad and Bhopal were randomly selected for the study. Survey was also conducted in H.O of Reliance Infrastructure Limited & company 'A' at Mumbai. Data was collected for the study in two ways; primary data collected through the distribution of questionnaires via electronic mails, telephonic discussions, personnel meetings. Primary data included: annual average successful bid ratio (%), mark-up size observed in different business sectors, number of successful bid in different project size at given mark-up range, number of successful bid in different construction sector in given bidding models.

Secondary data collected in the form of five years audited financial statements from the given six firms, financial websites etc.

Secondary data included: average of net profit margin (%) & average total revenue (Cr) of last five years.

### B. Data Analysis

Several methods were applied to conclude the objectives. Relative Importance Index (RII) method for ranking of factors. Spearman's rank order correlation coefficient for measure of association between two variables. Chi-square test of independence to test the independence of two variables, descriptive statistics to show statistical significance.

### C. Hypothesis

In the words of Leedy and Ormrod (2005), a hypothesis is a logical supposition, a reasonable guess or an educated conjecture. It is a speculation on how the study will turn out. The following are the four hypotheses tested in this study;

Hypothesis 1 (H1): There is a positive relationship between 'annual average successful bid ratio' with firms' growth (net profit margin) & firms' size (total revenue)

Hypothesis 2 (H2): Although there seems to be an increasing trend of mark-up level as the work becomes more specialized or complicated, the mark-up size differences observed between two business sectors are not statistically significant

Hypothesis 3 (H3): There is no association between 'mark-up size' & 'Number of successful bid in different project size'

## VI. DATA ANALYSIS

### A. Relative Importance Index (RII) Method for ranking the factors:

- 1) *Bid or not to bid Decision:* As previously mentioned objectives were to examine the factors related to the contractor that affects his/her decision to bid or not & factors related to the client that affects the contractor's decision to bid or not. 17 respondents randomly selected from 5 construction firms of highway sector, employed in the department like contract, business development & pertained experience from 5 to 15 years. Total 17 & 24 factors were chosen for the first & second case consecutively. The respondents were asked to give their perceptions using a five-point likert scale (from 1 for 'very less important', 2 for less important, 3 for moderate important, 4 for high important and 5 for very high important). The Relative Importance Index (RII) was calculated in Microsoft Excel using the following equation (Naoum, 1998; Assaf et al., 1999, 2001; Abdul-Hadi, 1999; Wanous et al., 2003):

$$\text{Relative Importance Index} = \frac{\sum w}{AN} = \frac{5n_5 + 4n_4 + 3n_3 + 2n_2 + 1n_1}{5N}$$

W = is the weight given to each factor by the respondents and ranges from 1 to 5.

$n_1$  = number of respondents for 'very less important',  $n_5$  = number of respondents for 'very high important'

A = is the highest weight (i.e. 5 in this case) and;

N = is the total number of respondents. (Here total number of respondents 17 Numbers)]

Total 41 factors were analysed using RII Method and ranked as shown in Table 1 & Table 2.

Table 1: Factors related to the contractor that affects his/her decision to bid or not

Sl. No.	Factors	RII	Rank
1	Financial capabilities of the contractor	0.929	1
2	Experience in similar projects	0.905	2
3	Experiences and competencies of the contractor's staff	0.870	3
4	Relationship between the contractor and the banks (expected bank facilities)	0.858	4
5	Availability of equipment owned by contractor	0.858	4
6	Specific features that provide competitive advantages to the contractor, like ability to make vertical integration	0.835	5
7	Previous relationship and communication level with the clients	0.800	6
8	Expected and planned profits for the project	0.776	7
9	Administrative skills, technical skills and experience of the contractor's project manager	0.765	8
10	Contractor's culture – how, when and why to deal with the clients	0.753	9
11	Number of previously executed projects by the contractor	0.741	10
12	Bids in hand	0.729	11
13	Contractor's competitive strategy	0.706	12
14	Importance of the project to the contractor	0.694	13
15	Contractor's ability to make sustainable or temporary joint venture	0.671	14
16	Risk taken and expected	0.635	15
17	Relationship between the contractor and the subcontractors	0.624	16

Table 2: Factors related to the client that affects the contractor's decision to bid or not

Sl.No.	Factors	RII	Rank
1	Financial capabilities of the client	0.941	1
2	Payment policy	0.918	2
3	Reputation of the client	0.906	3
4	Client's policy to adopt the advanced payment for contractors	0.894	4
5	Client's policy for compensation	0.882	5
6	Experiences and competencies of the client's staff	0.871	6
7	The client's requirement from the contractors (financial, technical and administrative)	0.847	7
8	Project source of funding	0.836	8
9	Previous relationship and communication level with the contractor	0.836	8
10	Client's policy in resolving disputes and litigations	0.800	9
11	Criteria of contractor's selection	0.776	10
12	The client's level of supervision, restriction, monitoring and control over the contractors	0.765	11
13	Number of previous advertised projects by the client	0.765	11
14	Client's evaluation and awarding policy	0.765	11
15	Adopting contractual agreement system	0.753	12
16	Quality level that the client asks for	0.741	13
17	Targeted categories by the client	0.729	14
18	Type of tendering system (open, restricted, pre-qualification or other systems)	0.718	15
19	Currency paid by client (dollars, Rupee, Euro)	0.706	16
20	Client's safety requirements	0.706	16
21	Adopting the e-tendering policy by the client	0.694	17
22	Advertisement duration for the tender	0.694	17
23	Way of advertisement (newspaper, web site, portals or other)	0.647	18
24	Address of the client offices (where tenderers submit bids if it is not electronically tendered)	0.624	19

- 2) *Mark-up size*: The objective of this study were to examine the factors that affects mark-up size in construction projects of India before calculating bid price. Total twenty one factors were chosen & 17 respondents randomly selected from 5 construction firms of highway sector, employed in the department like contract, business development & pertained experience from 5 to 15 years, same as previously mentioned.

Table 3: Factors related to the contractor that affects their mark-up size

Sl.No.	Factors	RII	Rank
1	Number of competitors & intensity of competition	0.941	1
2	Project cash flow	0.929	2
3	Size, cost & intensity of the project	0.905	3
4	Inflation in material prices	0.882	4
5	Experience in similar old projects	0.870	5
6	Type of project-buildings, infrastructure projects etc.	0.870	5
7	Duration of the project	0.858	6
8	Procurement method	0.800	7
9	Location of project	0.765	8
10	Season in which the work is done	0.753	9
11	Degree of hazard & difficulty associated with the project	0.729	10
12	Name of owner, consultant & designers	0.718	11
13	Time available for bid preparation	0.718	11
14	Labour availability & productivity	0.694	12
15	Material availability & cost	0.671	13
16	Percent of the work which is to be subcontracted	0.635	14
17	Uncertainty in estimate & historic profit	0.635	14
18	Availability of supervisory talent	0.624	15
19	The current & forecasted economic conditions	0.613	16
20	Method of performing the work	0.607	17
21	The contractor's risk attitude	0.589	18

### B. Hypothesis Testing

- 1) *Null Hypothesis ( $H_0$ )*: There is a positive relationship between 'annual average successful bid ratio' with firms' growth (net profit margin) & firms' size (total revenue) of construction firms in highway sector.

$$\text{Here, Annual average successful bid ratio (\%)} = \frac{\text{Average numbers of successful bid}}{\text{Average total no. of attempt to bid}} \times 100$$

To test the hypothesis arithmetic mean of successful bid ratio of five top contractors in highway sectors of India were collected from financial year of 2013 to 2017. After that arithmetic mean of their Net Profit Margin (NPM) & Total Revenue were collected from company's annual report. The hypothesis was tested by Spearman's rank order correlation coefficient method. All collected data are represented in the following table:

Table 4: Spearman's rank order correlation coefficient table

Company	Annual average successful bid ratio (%)	Mean of Net Profit Margin (%)	Mean of Total Revenue (Cr)	Ranking according to 'successful bid ratio' (R <sub>1</sub> )	Ranking according to 'NPM' (R <sub>2</sub> )	Ranking according to 'total revenue' (R <sub>3</sub> )	Difference (R <sub>1</sub> -R <sub>2</sub> )=d <sub>1</sub>	Difference (R <sub>1</sub> -R <sub>3</sub> )=d <sub>2</sub>	d <sub>1</sub> <sup>2</sup>	d <sub>2</sub> <sup>2</sup>
Ashoka Buildcon	55	7.47	1893	1	4	4	-3	-3	9	9
PNC Infratech	25	8.57	1563	5	2	5	3	0	9	0
IRB infrastructure	48	9.40	2750	2	1	3	1	-1	1	1
Dilip Buildcon	35	7.91	3215	3	3	1	0	2	0	4
Sadbhav Engineering	27	4.46	2802	4	5	2	-1	2	1	4

Now,  $\sum d_1^2 = 20$  &  $\sum d_2^2 = 18$

Now, spearman's rank correlation formula:

$$r = 1 - \frac{6\sum d^2}{n(n^2-1)}$$

$r_1 = 0$  &  $r_2 = 0.1$

That means, there is no relationship between 'Annual average successful bid ratio' with firms' growth i.e. net profit margin (%) & very low positive relationship between 'Annual average successful bid ratio' with firms' size i.e. total revenue (cr)

So, reject the null hypothesis ( $H_0$ ) for the first case & accept the null hypothesis ( $H_0$ ) for the second case.

2) *Null Hypothesis ( $H_0$ ):* Although there seems to be an increasing trend of mark-up level as the work becomes more specialized or complicated, the mark-up size differences observed between two business sectors are not statistically significant

To test the hypothesis a survey was conducted in company 'A' head office at Mumbai. Since the mark-up is a confidential point for any contracting organization, direct response to this point is extremely difficult. Therefore, a five-point ordinal scale for the response was designed. Each point represents a range of mark-ups, such as 1 for 0%-5%, 2 for 6%-10%, 3 for 11%-15%, 4 for 16% to 20%, 5 for more than 20%. Below mentioned table shows in detail:

Table 5: Statistical representation of mark-up percentage in different business sectors

Business sector	Mean value of mark-up derived from the range of response points (%)	Sample size	Standard deviation (%)	Variance (%)
Buildings	10.00	16	4.80	23.30
Factories	11.56	16	3.75	14.10
Roads	10.84	12	5.36	28.80
Bridges	13.67	10	4.29	18.40
Large industrial projects	10.44	17	4.69	13.20
Piling job	12.86	11	4.15	17.30
Tunneling job	14.07	11	5.13	26.40
jetties	13.51	11	1.89	3.60

3) *Null Hypothesis ( $H_0$ ):* There is no association between 'mark-up size' & 'Number of successful bid in different project size'

To test the hypothesis the survey was conducted by questionnaires at Reliance Infrastructure Limited (RIL), Mumbai. Mark-up range & project cost (considering all business sectors of RIL) was categorized as per follows:



Table 6: Categorization of mark-up range &amp; project cost

Mark-up range (%)	Low (0-9)%	Medium (10-19)%	High (20-30)%
Project Cost (crore)	Small - less than 200 cr	Medium –(201-1000) cr	Large- more than 1000 cr

The hypothesis was tested by Chi-square test of independence method. All collected data are represented in the following table:

Table 7: Chi-square test of independence table

Mark-up range	Number of successful bid in different project size			Total
	Large	Medium	Small	
Low (0-9)%	0	4	2	6
Medium (10-19)%	3	7	1	11
High (20-30)%	5	2	0	7
Total	8	13	3	24

This Chi-square test statistic is calculated as follows:

$$\chi^2 = \sum_{i=1}^r \sum_{j=1}^c \frac{(O_{ij} - E_{ij})^2}{E_{ij}}$$

The expected frequency in the cell corresponding to the  $i^{\text{th}}$  row &  $j^{\text{th}}$  column is given by:

$$E_{ij} = \frac{R_i \times C_j}{n}$$

$R_i$  = total for the  $i^{\text{th}}$  row

$C_j$  = total for the  $j^{\text{th}}$  column

$n$  = total sample size

Here, degree of freedom =  $(r-1)(c-1)$  [ $r$  = number of row,  $c$  = number of column], here,  $r=3$ ,  $c=3$

So, degree of freedom = 4, used level of significance 5% i.e.  $\alpha = 0.05$

Computation was given in the following table:

Table 8: layout of contingency table

Combination (row, column)	$O_{ij}$ (Observed frequency)	$E_{ij}$ (expected frequency)	$(O_{ij} - E_{ij})^2$	$\frac{(O_{ij} - E_{ij})^2}{E_{ij}}$
1,1	0	2.00	4.00	2.00
1,2	4	3.25	0.56	0.17
1,3	2	0.75	1.56	2.08
2,1	3	3.67	0.45	0.12
2,2	7	5.96	1.08	0.18
2,3	1	1.38	0.14	0.10
3,1	5	2.33	7.13	3.06
3,2	2	3.79	3.20	0.84
3,3	0	0.88	0.77	0.88
Total				9.43

So, From  $\chi^2$  table, at  $\alpha=0.05$  & degree of freedom = 4

$\chi^2_{\text{critical (table)}}$  value = 9.49

$\chi^2_{\text{calculated}}$  value = 9.43

So,  $\chi^2_{\text{critical}} > \chi^2_{\text{calculated}}$

So, null hypothesis  $H_0$ , is accepted, that means both variables i.e. 'mark-up size' & 'Number of successful bid in different project size' are independent to each other.

## VII. CONCLUSIONS & RECOMMENDATIONS

The findings of the present study reported different competitive bidding strategy scenarios of Indian construction industry. The study has following major findings:

- 1) Financial capabilities of the contractor, experience in similar projects, experiences and competencies of the contractor's staff, Relationship between the contractor and the banks, Availability of equipment owned by contractor, Specific features that provide competitive advantages to the contractor are the prime driving factors that related to contractor, affect bid or not to bid decision.
- 2) Financial capabilities of the client, Payment policy, Reputation of the client, Client's policy to adopt the advanced payment for contractors, Client's policy for compensation are some of the top main driving factors related to the client, that affect bid or not to bid decision of contractors in India.
- 3) Number of competitors & intensity of competition, Project cash flow, Size, cost & intensity of the project, Inflation in material prices, Inflation in material prices, Type of project-buildings, infrastructure projects etc., Duration of the project are the prime driving factors that affect mark-up size of contractors in India.
- 4) From hypothesis test it was found that there is no relationship between 'Annual average successful bid ratio' with firms' growth i.e. net profit margin (%). That means, if 'successful bid ratio' increase there might be a chance of increase of 'NPM' or decrease as well. So, both variables are independent to each other. In second case very low positive relationship between 'Annual average successful bid ratio' with firms' size i.e. total revenue (cr) was found. That means, if 'successful bid ratio' increase there will be a very low increase of firm's size i.e. 'total revenue', which may not be satisfactory for the respective contractors.
- 5) On the close observation of table 5, it can be concluded that as the complexity & specialization of job increase, the mark-up range also tends to increase. But mark-up percentage between two business sectors are not statistically significant. It is also can be concluded that increased competition in traditional areas like buildings, roads, factories tends to pull the mark-up level down.
- 6) From the study it can be concluded that both variables i.e. 'mark-up size' & 'Number of successful bid in different project size' are independent to each other.

### A. Recommendations

From above study it is helpful in future to assess the important factors with high concentration to take decision of bid or not & determination of mark-up size. The hypothesis testing of relationship between mention variables will help to take decisions in bidding. Some recommendations for future research scope are mentioned below:

- 1) Determination whether any differences of the factors for bid or not to bid decision from client & contractors perspective.
- 2) Factors affect bid or not to bid decision of domestic & international construction firms in India.
- 3) Whether any differences in mark-up size between statistical & cash flow-based bidding models.
- 4) In this study two different approaches presented about association between mark-up size & project cost. So there is lots of scope to study in future.

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