ISSN(Online): 2319-8753
ISSN (Print): 2347-6710

International Journal of Innovative Research in Science, Engineering and Technology

(A High Impact Factor, Monthly, Peer Reviewed Journal)

Visit: www.ijirset.com

Vol. 6, Issue 12, December 2017

Factors Influencing the Markup Ratio in the Construction Industry

Shady Montasser Mohamed[1], Ayman Hussein Khalil[2],Mohamed Badawy[3]

Department of Structural Engineering, Faculty of Engineering, Ain-Shams University, Egypt[1,2,3]

ABSTRACT*:* The low-cost mentality dominates in the competitive business of the construction industry. The pressure on contractors' profit margins has further increased after a prolonged recession in this sector, which has seen construction demand and output shrinking significantly. This paper examines the factors that contractors perceive to be important when they are considering the ratio of their bid markup. A structured questionnaire was established to meet these objectives. The questionnaire consisted of thirty-two factors depending on previous research and expert opinion. The survey was done for one hundred engineers from different companies. This study identifies the key determining factors in calculating the markup ratio and their importance weights. The analysis of data was done using SPSS software. The most important two factors are cash flow and inflation in material prices. A model to determine the markup ratio for different project cases was established. This model will help the construction companies in determining the markup ratio in a scientific way. The model was validated on four different projects.

KEYWORDS*:* Markup; Cash flow; Construction; Tendering

I. INTRODUCTION

Government agencies and private sector clients usually rely on competitive bidding to select the main contractor. The process of building tenders is a very complex and dynamic process involving difficult decisions and a multidimensional analysis of interrelated and complementary factors that are constantly changing. The company's decision-makers face a major challenge to look at all factors related to their environment to enhance the likelihood of successful implementation of a profitable project. 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. Therefore, the assessment process needed to make a coding decision involves a complex analysis of interrelated factors involving more than just project characteristics. These decisions depend on a range of internal and external factors based on the company's previous experience. Accordingly, the decision to bid is dynamic and highly disorganized and has a higher degree of uncertainty. For these reasons, knowledge of these factors is necessary to determine the percentage of homogeneous profit. Previous project experiences contribute to the success of future projects so that more informed coding decisions can be made to reduce and / or eliminate unexpected errors. There is a great need to develop a model to calculate the best markup ratio in different cases in the construction projects.

II. LITERATURE REVIEW

FACTORS AFFECTING MARKUP RATIO

Mak (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. Lifson and Shaifer (1982) argued that knowing the importance of the factors influencing the decision-making process

ISSN(Online): 2319-8753
ISSN (Print): 2347-6710

International Journal of Innovative Research in Science, Engineering and Technology

(A High Impact Factor, Monthly, Peer Reviewed Journal)

Visit: www.ijirset.com

Vol. 6, Issue 12, December 2017

would allow key and major decisions to be reviewed and discussed regularly. Odusote and Fellow (1992) highlighted ten factors that affect the bid/no bid decision. The top factors were the identity and reputation of the client, physical resources necessary to carry out the project, the present state of the company's workload, and the ability of the client to pay. Others include the margin of profit involved, the availability of work, the financial resources necessary to carry out the project, the identity of the consultants, the time available in which to tender and the type of work.

Park and Chapin (1992) stated that the successful competitive bidding strategy is one in which a contractor bids high enough to make a profit and low enough to win the contract. Many organizations used bidding in their procurement systems, therefore, many managers and researchers were interested in understanding the bidding strategy and what was involved in winning a contract. Shash and Abdul-Hadi (1992) determined, thirty-seven factors underlying the markup size decision, with their relative importance to contractors operating in Saudi Arabia. Shash (1993) suggested fifty five factors that they argued to be appropriate and applicable to the tendering decisions considered by top UK contractors and noted that project size, owner promoter, contract conditions, type of contract, project cash flow, current workload, past profit in similar projects, need for work, tendering method, number of competitors tendering, and experience in projects are some of the factors that affect their project selection decision; the need to the work, number of competitors and experience were the three major factors that affect a contractor's decision to bid.

Drew and Skitmore (1997) identified several factors affecting competitiveness in bidding. However, their research was focused only on contract type and size.

Harris and McCaffer (2000) highlighted that the competitive bidding is the route for obtaining a sizeable proportion of construction business by contractors globally. Bidding is said to be achieved in a fair way, set out to produce the lowest commercially viable tender price in the current market condition. Some contractors conduct construction activities without actually winning a tender but most contractors will only survive and make profit in the industry by winning tenders. Akintoye (2000) identified the main factors directly affecting the budget estimating in the construction projects. The study was done on eighty-four UK contractors. These companies were grouped into four main categories according to their size. These categories were very small, small, medium and large companies. In that study 24 factors were considered and the data collected were analyzed. It was found that the main factors affecting the cost estimating were the complexity of the project, scale and scope of construction, market conditions, method of construction, site constraints, client' s financial position, build ability and location of the project. Dulaimi and Shan (2002) explored that a lower cost mentality had a significant impact on the decision to bid in the construction industry. Consequently, most construction projects are awarded on a lower-bid basis, although a number of other factors are considered in addition to cost. Most construction projects are awarded through competitive bidding, which requires the determination of the roles of the client and the contractor in accordance with the rules in black and white.

Yoong et al (2009) stated that the contractor's business strategy is directly impacted by a bidding decision and a markup decision. This relationship influences contractors' bidding strategy models which are used in competitive bidding situations. Toh et al. (2012) determined the main factors that affect the cost of the construction projects in Malaysia. It was found in old researches that there are seventy-nine factors that may affect the cost of construction projects. Consequently, a questionnaire was developed and distributed to construction contractors in Malaysia. The respondents were asked to rank the factors in the questionnaire on a scale from one to five. A result obtained from the questionnaire that only thirty-five factors have a significant effect on the cost of the construction projects. The most critical factor was the 'Client requirements on quality'.

Nourah (2013) identified and ranked the factors that affect the markup ratio in the construction industry. The factors were identified through conducting interviews with experts. On the other hand, a questionnaire was developed and distributed in order to rank the factors according to their importance. Finally, a bidding model has been developed in order to assist in determining the markup ratio in the construction project. Tonnessen (2014) analyzed the factors that affect the markup ratio in the construction industry for both public and private construction firms. Nineteen factors were ranked in that research. The top five factors affecting the markup on the public companies were the profit, risk, subcontractor market conditions, market conditions, and need to work. On the other hand, the top five factors affecting markup on the private firms were profitable, market conditions, need to work, contractor markup, and complexity of the project. Asal (2014) stated that there are many factors that effect on the accuracy of the cost estimating of the construction industry, moreover, these factors should be identified and analyzed in an early stage of the cost estimating process. That research identified the factors and ranking them according to their importance. The most important

ISSN(Online): 2319-8753
ISSN (Print): 2347-6710

International Journal of Innovative Research in Science, Engineering and Technology

(A High Impact Factor, Monthly, Peer Reviewed Journal)

Visit: www.ijirset.com

Vol. 6, Issue 12, December 2017

factors affecting the cost estimating process concluded were the economic instability, quality of firm's project planning and management, relevant experience of estimating team, availability of management and finance plans, ability of estimating team, labor and equipment required, estimating method, project location, periodical payments, accuracy of bidding documents provided by client, competent and leadership of project manager and impact of project schedule.

Ji et al. (2014) defined thirty-seven factors which could influence the final contract price. Many factors were identified relating to project, client and contractor characteristics, design consultants and tendering conditions, estimating practices and external factors. The most important three factors identified in that research were poor tender documentation, complexity of design & construction, and completeness of project information. Oyeyipo, et al. (2016) identified and analyzed the factors that affect the bid / no bid decision making in the construction industry. A questionnaire was conducted and one hundred copies of the questionnaire were distributed. Then the collected data from the questionnaire were analyzed and the results showed that, the most important three factors were financial capability of clients, availability of capital and availability of material. In the other hand, it was stated that the number of the competitors has the least effect on the bid / no bid decision. Zhao et al. (2017) determined forty-five factors affecting the cost of constructing buildings in New Zealand. These factors were classified into seven main categories. The identified factors are ranked according to their importance through a questionnaire that was distributed to specialist persons in the construction industry in New Zealand. The analysis of the collected data was held using structure modeling equation software. The structural modeling equation is a multivariate method, which examines the relationship among exogenous latent variables and endogenous latent variables. Structural equation modeling (SEM) uses various types of theoretical models to describe the relationship between observed and latent variables, which provides the quantitative test for a researcher's hypothesis. After analyzing the data, it was found that the main factors affecting the cost of constructing buildings in New Zealand are the property market and construction industry factor, statutory and regulatory factor, and socioeconomic.

MODELS FOR ESTIMATING THE MARKUP RATIO

Tamer et al. (2012) developed a protocol to analyze profitability to understand the differences between the actual and estimated profit resulting from construction projects. The protocol identified relationships among cost and profit, so the construction company decision makers would be able to recognize the changes in profit margins of projects; improve their overall profitability by eliminating problems from the relationships that affect prospective projects; and be selective of more profitable projects in the bidding phase. Lee et al. (2012) created an automated tool using matrix laboratory (MATLAB) to improve the uncertainty of activities' costs in order to estimate the best fit probability distribution of cash flows, overdrafts and profit. Mahfouz (2013) proposed an automated Latent Semantic Analysis model with support Vector Machines to assess cost estimates based on error ranges in order to improve construction cost decision making.

Researchers have adopted a wide variety of techniques to model mark-up value decision making process; however, little has been accomplished in the way of statistical modelling using ordered probability to predict construction mark-up values.

III. RESEARCH OBJECTIVE

The objective of this research is to identify the factors affecting the mark-up ratio in the construction industry in Egypt, rank these factors according to their importance to identify the most important factors and develop a model to determine the percentage of mark-up in various construction projects.

IV. RESEARCH METHODOLOGY

The research included a postal survey to collect the data from construction companies in Egypt. A questionnaire was conducted to determine the factors affecting the mark-up ratio in construction project in Egypt. The final questionnaire was extracted with the help of experts using Delphi technology.

ISSN(Online): 2319-8753
ISSN (Print): 2347-6710

International Journal of Innovative Research in Science, Engineering and Technology

(A High Impact Factor, Monthly, Peer Reviewed Journal)

Visit: www.ijirset.com

Vol. 6, Issue 12, December 2017

In the second part, another output was required from the respondents regarding identifying the mark-up percentage for different cases of each factor in order to be used in obtaining a model to identify the mark-up percentage for different projects.

Questionnaires were mailed to respondents and completed forms were requested to be mailed back to the researcher, the response to this request was poor. Another approach of collecting data was used; involved follow up telephone calls and subsequent visit to firms and work sites, most of data were collected by this method. Questionnaires were given to respondents to complete, then the completed questionnaires were collected later. In many instances, forms were completed at the meeting; this method has the added benefit of making clarifications to respondents about questions in formal. Over a period of 7 months, the researcher collected 100 responses from a total of 130 questionnaires. This means the rate of response was about 78%. The sample was selected randomly from a combination of contractors under all contractors' grades. The population is the whole engineers who are working in the construction companies and there is no data for this number so the population was unknown. The margin error is calculated using equation (1).

$$e^2 = [Z^2 * p * (1 - p)] /n \qquad \text{eqn. (1)}$$

Where e is the margin error. Z is the standard normal deviation set at 95% confidence level (1.96). p is the percentage picking a choice or response (0.2). The margin error in this research is 7.84%.

V. QUESTIONNAIRE SURVEY

QUESTIONNAIRE DESIGN

The design of the questionnaire took into consideration the objectives of the study in order to answer the research questions. A preliminary questionnaire from the literature review was proposed and considerable efforts were made to prepare the questionnaire. The final questionnaire was provided with the help of experts to identify the correct questions that are required, and to present them correctly and clearly. Special attention was given to the formulation of questions in a language easily understood by respondents and with the expectation that all respondents were not fluent in English readers or speakers. An Arabic version of the questionnaire was prepared.

CONTENTS OF THE QUESTIONNAIRE

The questionnaire includes factors affecting decision-making in determining the markup ratio. The questionnaire consists of two parts. The first part includes a list of the main factors affecting the percentage of markup as read from literature based on previous research along with input, revisions and adjustments by local experts. The first part was divided into five main categories that identified the key factors of 32 specific factors. Respondents were asked to determine the importance of these factors in estimating the markup ratio. The questionnaire has the specific advantage of requiring less time to respond and more accurately in the end result. Respondents were asked to nominate a degree for each specific factor depending on the importance of this factor for their companies. The answer was required on a scale of 1 to 5 according to the importance of each factor as shown in Table 1. In the second part, respondents were asked to determine the percentage of markup for the different cases of each factor to be taken into account when concluding an equation to determine the percentage of the markup of the project.

Table 1. Important scale

Description	Scale
Very low important	1
Low important	2
Medium important	3
High important	4
Very high important	5

ISSN(Online): 2319-8753
ISSN (Print): 2347-6710

International Journal of Innovative Research in Science, Engineering and Technology

(A High Impact Factor, Monthly, Peer Reviewed Journal)

Visit: www.ijirset.com

Vol. 6, Issue 12, December 2017

VI. SAMPLE SIZE AND SELECTION

The respondents target includes contractors only. A systematic random sample was selected to ensure a representative sample of all targeted respondents. Accordingly, the total number ''N'' of considered classified contractors of construction companies in Egypt (current members of the Egyptian Federation for Construction and Building Contractors (EFCBC's)) who have valid memberships under the available seven grades in the category of integrated building works is 19,789 as on 1st of March, 2014. The overall number of the completed questionnaires included in this study is 100 which comprise the statistical data sample size that represents all contractors. According to the study by Shash (1993), there are three factors that should be considered in determining the sample size: Standard error of sampling distributions, population size, and variation in the answers. The sample size can be determined using the following formula: n = n' / (1 + n' / N) where; n = Sample size for desired level of precision. N = Size of the population limited to infinity, $n' = S^2 / \sigma^2$ Where; σ = the standard error of sampling distribution = 0.05, S = the standard deviation in the population elements, $S^2 = p (1 - p)$, where; p is the proportion of the population expected to choose one of the response categories. As we assume that the answer will be homogeneous and the confidence level is 95 %., then p value will be 0.1667. As N = ∞, then n' / N = 0, so n = n'. As example n = 100 and $n' = n = S^2 / \sigma^2$, and $S^2 = p (1 – p)$, then $100 = 0.1667 * (1 – 0.1667) / \sigma^2$ then σ^2= 0.00138, then σ = 3.72 %.

VII. ANALYSIS AND RESULTS

For analysing data, (Rlli) Relative importance index technique was used per factor for each group of respondents. This index was computed by using Tawil et al 2008.

Rlli %= $[(5n_5) + (4n5_4) + (3n_3) + (2n_2) + (1n_1)] / [5(n_5 + n_4 + n_3 + n_2 + n_1)]$

Where "Rlli" is the relative importance index of each factor for each group of respondents, and n_5, n_4, n_3 , n_2,and n_1 are the numbers of the respondents in each group. For example, the RII of the factor "project cash flow" estimated as shown in equ. (2). Table [2] shows the relative importance index and ranking form each factor.

Rlli % = [(5*20) + (4*45) + (3*30) + (2*4) + (1*1)] / (5*100) = 75.8% eqn. (2).

Table [2]: The relative importance index and ranking of factors

Factor	Relative importance index	Rank
Project cash flow	75.8	1
Inflation in material prices	75.2	2
Experience in similar old projects	74.6	3
Availability of required cash	74.6	4
Availability of qualified staff	73.6	5
Degree of safety	73.2	6
Procurement method	72.4	7
Size of contract	71.4	8
Duration of project	70.6	9
Specifications	70.4	10
Need of work	69.8	11

ISSN(Online): 2319-8753
ISSN (Print): 2347-6710

International Journal of Innovative Research in Science, Engineering and Technology

(A High Impact Factor, Monthly, Peer Reviewed Journal)

Visit: www.ijirset.com

Vol. 6, Issue 12, December 2017

Location of the project	68	12
Cost contract	67.8	13
Past profit in similar projects	67.6	14
Uncertainty in cost estimate	66.6	15
Number of competitors tendering	66	16
Productivity measurement	64.6	17
Owner (Private/Public)	64.4	18
Degree of difficulty	64	19
Current work load	63.8	20
Establishing long relationships with the client	63.4	21
Price contract	62.8	22
Availability of other projects	61.8	23
Risk involved in investment	61.8	24
Management contract	60.2	25
Use of nominated subcontractors	59.4	26
Consultant	57	27
Percentage of insurance premium	55	28
Documents required	53.6	29
Tendering duration	52	30
Bidding document price	49	31
Tendering method	48.4	32

VIII. DISCUSSION

The perceived effect of each of the 32 factors explored on the determination of the margin of markup in the construction projects in Egypt was determined using the SPSS statistical program. These factors had been categorized and ranked based on their relative importance index. It was noted that the first factor is the project's cash flow, noting that it had the highest impact on determining the value added to the project with the index of relative importance equal to 75.8%. The second factor of importance was the "material price inflation" (the increase in the prices of materials during the duration of the project) which had an index of relative importance is 75.2% near the first factor of importance. The least important factorwas the "bidding method" (since the bidding method is not an important factor to consider when considering the return rate for a particular project). Therefore, it had the least impact and the relative importance index is 48.4% of 32 workers.

Dulaimi and Shan (2002) stated in their research that the "degree of difficulty" is the most important factor in determining the ratio of markup, but in this study, it became the factor in the 19th ranking in terms of importance. The "risk involved in investment" factor was the second important factor in previous studies but in our country, it became in

ISSN(Online): 2319-8753
ISSN (Print): 2347-6710

International Journal of Innovative Research in Science, Engineering and Technology

(A High Impact Factor, Monthly, Peer Reviewed Journal)

Visit: www.ijirset.com

Vol. 6, Issue 12, December 2017

twenty-four places. The final factor was the "project location" in previous studies with regard to the twelfth in this study.

IX. RESEARCH MODEL

Moreover, a model was developed to assist decision makers in construction companies to determine the optimum markup percentage for different construction projects. The model calculations are based on the summation of the markup percentage of all factors influencing the markup percentage. In the other hand, the markup percentage for each factor is multiplied by a constant. This constant is conducted from the relative importance index of each factor. The summation of the constants of all factors is one. The markup percentage for each factor was identified and determined through analysing the data collected from the questionnaires. Table [3] shows the markup percentage for different project cases of each factor influencing mark-up percentage.

Table 3. Markup Percentage of the different project cases

Variable	Factor	Project Case	Markup Percentage (%)
X1	Project cash flow	Front Loaded	21.50%
		Normally distributed	34.59%
		Back Loaded	47.72%
X2	Experience in similar old projects	Very Good	41.64%
		Intermediate	30.24%
		No Experience	29.73%
X3	Availability of required cash	Easy to manage	22.73%
		Intermediate	35.55%
		Hard to manage	48.47%
X4	Availability of qualified staff	Available	36.13%
		Easy to manage	34.74%
		Not Available	35.41%
X5	Degree of safety	Low Specs	20.22%
		Intermediate	33.72%
		High Specs	48.51%
X6	Procurement method	Local	22.63%
		Local/Imported	34.92%
		Imported	49.41%
X7	Size of contract	>500 M	21.30%
		100 M – 500 M	30.96%
		25 M – 100 M	39.19%
		<25 M	50.42%
X8	Duration of project	<6 months	31.80%
		6-18 months	35.71%
		>18 months	39.11%
X9	Specifications	Low Specs	22.85%
		Intermediate	33.04%
		High Specs	47.35%
X10	Need of work	Highly needed	26.09%
		Intermediate	32.20%
		Low needed	38.18%
X11	Location of the project	Inside the city	22.39%
		Near the City	32.01%
		Far from the city	44.92%
X12	Type of contract	Cost plus	30.73%
		Fixed Price Contract	31.76%
		Management Contract	29.49%
	Past profit in similar projects	High %	33.52%

ISSN(Online): 2319-8753
ISSN (Print): 2347-6710

International Journal of Innovative Research in Science, Engineering and Technology

(A High Impact Factor, Monthly, Peer Reviewed Journal)

Visit: www.ijirset.com

Vol. 6, Issue 12, December 2017

X13		Intermediate %	33.18%
		Low %	33.62%
		Low uncertainty	22.97%
X14	Uncertainty in cost estimate	Intermediate	31.25%
		High uncertainty	40.02%
		>9	20.94%
X15	Number of competitors tendering	4-9 companies	31.46%
		<4	41.61%
		High productivity	25.69%
X16	Productivity measurement	Intermediate	33.02%
		Low productivity	41.51%
		Public with long work relationship	29.07%
		Public with no work relationship	27.29%
X17	Owner (Private/Public)	Private with long work relationship	37.76%
		Private with no work relationship	36.24%
		Easy	23.86%
X18	Degree of difficulty	Intermediate	34.63%
		Difficult	49.73%
		No work load	29.53%
X19	Current work load	Intermediate	34.42%
		Big work load	38.05%
		Client with long work related	30.40%
X20	Establishing long relationships with the client	Client with intermediate work related	33.36%
		New Client	37.42%
		No Projects	26.24%
		No. of projects is less than the company size	30.88%
X21	Availability of other projects	No. of projects is good comparing with the company size	41.25%
		No. of projects is more than the company size	41.20%
		Low	23.54%
X22	The risk involved in the investment	Intermediate	34.10%
		High	50.71%
		No nominated	27.27%
X23	Use of nominated subcontractors	Some nominated	36.24%
		All are nominated	44.21%
		With many requirements	45.22%
X24	Consultant	Intermediate requirements	35.01%
		With low requirements	27.44%
		<5%	24.83%
X25	Percentage of insurance premium	5-10%	31.74%
		>10%	39.50%
		Low	25.12%
X26	Documents required	Intermediate	31.52%
		High	38.47%
		< 1 month	34.12%
X27	Tendering duration	1-3 month	32.51%
		> 3 months	37.07%
	Bidding document price	< 10,000	23.64%

ISSN(Online): 2319-8753
ISSN (Print): 2347-6710

International Journal of Innovative Research in Science, Engineering and Technology

(A High Impact Factor, Monthly, Peer Reviewed Journal)

Visit: www.ijirset.com

Vol. 6, Issue 12, December 2017

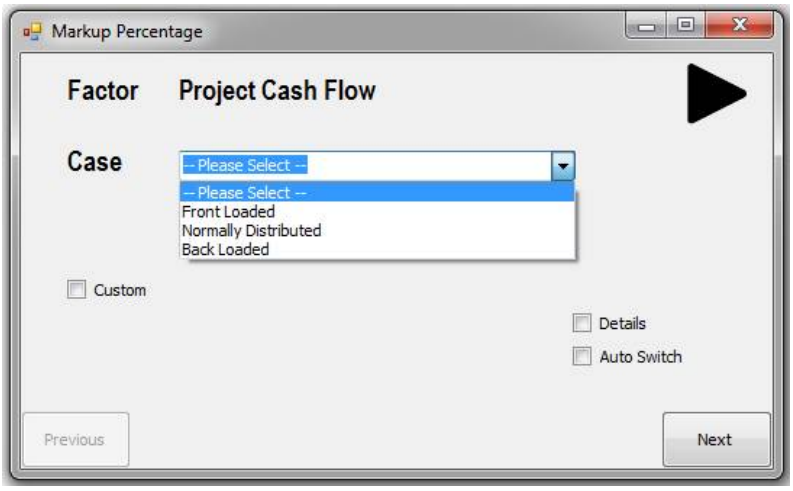
		10,000-50,000	29.73%
X28		50,000-100,000	37.44%
		> 100,000	41.19%
		Public tender	22.97%
X29	Tendering method	Limited tender	32.78%
		Direct attribution	43.74%

The model concept is to assign the case of each factor in the project to the model in order to obtain the optimum markup percentage for the project. The equation conducted and used in developing the model is as following

Markup percentage = (0.039751 * X1) + (0.039174 * X2) + (0.039174 * X3) + (0.038693 * X4) + (0.0385 * X5) + (0.038115 * X6) + (0.037634444 * X7) + (0.03725 * X8) + (0.037153 * X9) + (0.036865 * X10) + (0.035999 * X11) + (0.03590268 * X12) + (0.035806 * X13) + (0.035325 * X14) + (0.035037 * X15) + (0.034363 * X16) + (0.034267117 * X17) + (0.034075 * X18) + (0.033978 * X19) + (0.03378607 * X20) + (0.033016395 * X21) + (0.033016 * X22) + (0.031862 * X23) + (0.030707371 * X24) + (0.029745 * X25) + (0.029072 * X26) + (0.028302 * X27) + (0.026859 * X28) + (0.02657 * X29). Equ. (2)

The required input of the bidder is to determine the status of the project in relation to each factor through the combo box as shown in Figure [1] and then click Next to move to the second factor until the last factor. The check box was added to the Detail form to show the coefficient and percentage used for each of the different factors as shown in Figure [2]. Another check box was added to allow the bidder to add a custom ratio to each factor instead of the percentage of the model by checking the "custom" as shown in Figure [3]. An option has been added to the model to facilitate the process of entering the data into the form which is "automatic switch" as is the case when the worker status is chosen, the form goes to the next factor automatically and so on. After finishing entering all the factors, click Run to show the result of the model as shown in Figure [4].

Figure 1. The case of the factor



ISSN(Online): 2319-8753
ISSN (Print): 2347-6710

International Journal of Innovative Research in Science, Engineering and Technology

(A High Impact Factor, Monthly, Peer Reviewed Journal)

Visit: www.ijirset.com

Vol. 6, Issue 12, December 2017

Figure 2. The details of the factor

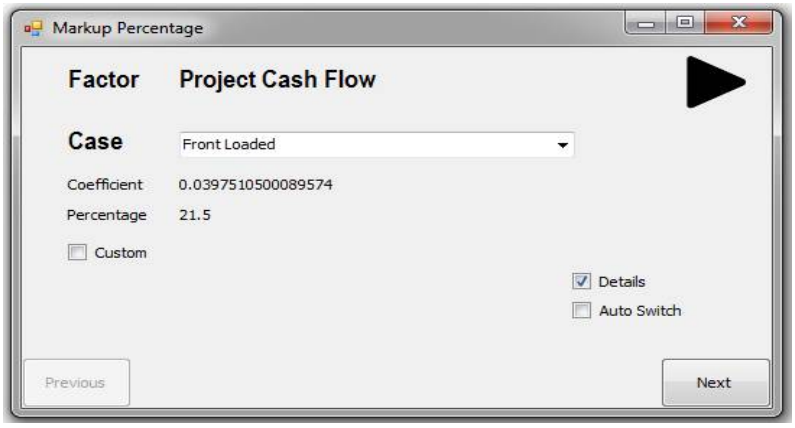


Figure 3. The Custom of the factor

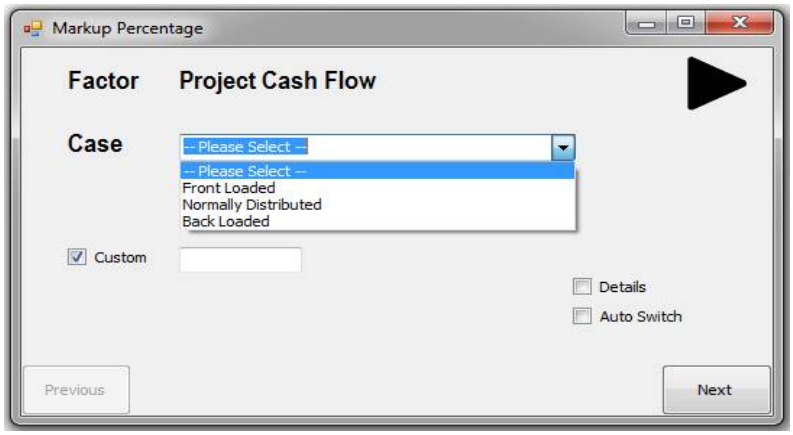
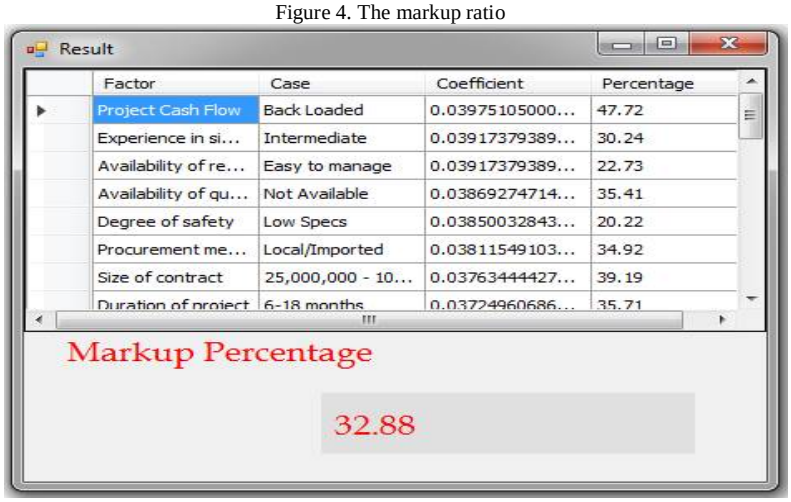


Figure 4. The markup ratio



ISSN(Online): 2319-8753
ISSN (Print): 2347-6710

International Journal of Innovative Research in Science, Engineering and Technology

(A High Impact Factor, Monthly, Peer Reviewed Journal)

Visit: www.ijirset.com

Vol. 6, Issue 12, December 2017

A Survey was done to determine the percentage of markup for different cases of each factor affecting markup percentage. In the questionnaire, the respondents were asked to nominate a percentage for each case of the different identified factors. The respondents were asked to indicate the extent to which their company would consider the markup percentage in each case for a scale from 0% to 100%. The model was applied to different projects and the results were compared with the actual percentages of mark up.

X. CASE STUDY

Project 1

The scope of the work is the implementation of architectural works, mechanical and electrical works of the administrative building located in a compound near the city with a total area of 1100 square meters. The total cost of the project is EGP 13,000,000, which is normally distributed and it is easy to manage the required cash by the company. It is a re-measured contract. The company has good experience in such projects, the consultant has low requirements and there is no need for subcontractors. The safety specification of the project is very high because of the project location. The duration of the project is 5 months, however, most of the materials used are imported. The owner of the project is a private company and has no old relationship with the contractor. The current work volume in the company is average and there is no urgent need to grant the project as the number of projects in the company is good compared to the size of the company. The tender was limited and the number of competitors was less than 4. The duration of the tender is less than one month with low document requirements and no fees for the required tender.

After considering the aforementioned data and substituting in the model concluded from the research, the markup percentage was found 34.2%. On the other hand, the actual markup percentage of the project was 36.66%. Accordingly, the difference between the calculated markup percentage and actual percentage is 2.46%.

Project 2.

The scope of work is the implementation of architecture and MEP works for airport lounge located at the airport with a total area of 1400 square meters. The total project cost is EGP 25,000,000, and it was easy to manage the cash flow by the company. It is a lump sum contract. The company has intermediate experience in such projects, the consultant has low requirements and no subcontractors are required. The project's safety specification is very high because of the project location. The duration of the project is 8 months, however, most of the materials used are imported. The owner of the project is a private company with no old relationship with the contractor. The current workload of the company is an intermediary but there was an urgent need to grant the project as it was a good project in the company profile. The number of projects in the company was less than the size of the company. The tender was limited and the number of competitors was less than 9 years. The tender period is greater than three months with low document requirements and there is no fee for the required tender.

After considering the aforementioned data and substituting into the model concluded from the research, the markup percentage was found 34.49%. On the other hand, the actual markup percentage of the project was 32.69%. Accordingly, the difference between the calculated markup percentage and actual percentage is 1.79%.

Project 3.

The scope of work is the execution of the architecture and MEP works for an administrative building of 12 floors and 3 basements with total area of 50,000m2. The project total cost is 160,000,000 EGP which is back loaded and it was hard to manage the required cash by the company. It is a lump sum contract. The company has a very good experience in such projects and the consultant has very high specifications and requirements, and some nominated sub-contractors are required. The project has very high safety specifications due to the location of the project. The project duration is 13 months and most of the materials used are imported. The owner of the project is a private company with no old relationship with the contractor. The current workload in the company is intermediate. The number of projects in the company was less than the company size. The tender was limited tender and the number of competitors is less than 4. The tendering duration is greater than three months with many document requirements and the/re are no fees for bidding required.

ISSN(Online): 2319-8753
ISSN (Print): 2347-6710

International Journal of Innovative Research in Science, Engineering and Technology

(A High Impact Factor, Monthly, Peer Reviewed Journal)

Visit: www.ijirset.com

Vol. 6, Issue 12, December 2017

After considering the aforementioned data and substituting in the equation concluded from the research, the mark-up percentage was found 37.02%. On the other hand, the actual markup percentage of the project was 36.5%. Accordingly, the difference between the calculated markup percentage and actual percentage is 0.52%

Project 4.

The scope of work is the renovation, executing the architecture and MEP works for a mall of 3 floors and 2 basements with total area of 35,000m2. The project total cost is 220,000,000 EGP which is normally distributed and it was easy to manage the required cash by the company. It is a lump sum contract. The company has no experience in such projects and the consultant has intermediate requirements and some nominated sub-contractors are required. The project has low safety specifications. The project duration is 14 months and most of the materials used are local. The owner of the project is a private company with no old relationship with the contractor. There is no work load in the company. The number of projects in the company was less than the company size. The tender was limited tender and the number of competitors is less than 9. The tendering duration is less than three months with intermediate document requirements and there are no fees for bidding required.

After considering the aforementioned data and substituting in the equation concluded from the research, the markup percentage was found 30.24%. On the other hand, the actual markup percentage of the project was 28.5%. Accordingly, the difference between the calculated mark-up percentage and actual percentage is 1.74%.

XI. CONCLUSION

The aim of this study is to identify and recognizes the influence of the main factors affecting the markup percentage in the construction industry in Egypt. The markup is defined as the factor that applied to the total cost of a bid to cover overhead, profit, and other indirect costs. This research has identified 32 factors causing variation in determining the markup percentage of constructing projects in Egypt. Identifying the qualified relative importance indices of these factors is the first step toward achieving the optimum markup. In order to factually determine the markup percentage for different construction projects, the influencing factors are analyzed and specified from the perspectives of the construction companies. It must have a clear understanding of the scope of the contract and ask the clients for necessary clarifications regarding the drawings and specifications prior taking any decision in order to avoid the wrong study of the factors affecting markup which leads to the wrong estimation of the markup percentage. This study reveals the important causes of accurate computation of markup percent for constructing projects overall. All factors must be taken into consideration when calculating the markup percentage in the construction projects in Egypt. The top five factors influencing the markup percentage resulted from this research are “Project cash flow” (75.8%), “Inflection in material prices” (75.2%), “Experience in similar old projects” (74.6%), “Availability of required cash” (74.6%), and “Availability of qualified staff” (73.6%). The lowest five factors are “Tendering method” (48.4%), “Bidding document price” (49%), “Tendering duration” (52%), “Documents required” (53.6%), and “Percentage of insurance premium” (55%).

A model was proposed to assist decision makers in construction companies to determine the optimum percentage of markup for different construction projects. The model calculations are based on multiplying the percentage of markup for each factor in a constant. The constant for each factor was calculated from its relative importance index. The summation of the constants for all factors equals one. The percentage of each factor was determined by analyzing the data collected from the questionnaires. The model was tested and four case studies were conducted to demonstrate the accuracy of the model in determining the percentage of markup of the various construction projects.

REFERENCES

[1] Asal, E. (2014). Factors Affecting Building Construction Projects’ Cost Estimating (Doctoral dissertation, M. Sc. Thesis. College of Engineering and Technology, Arab Academy for Science, Technology and Maritime Transport, Cairo, Egypt.

[2] Akintoye, A. (2000). Analysis of factors influencing project cost estimating practice. Construction Management & Economics,18(1), 77-89.

[3] Drew, D., & Skitmore, M. (1997). The effect of contract type and size on competitiveness in bidding. Construction Management & Economics, 15(5), 469-489.

ISSN(Online): 2319-8753
ISSN (Print): 2347-6710

International Journal of Innovative Research in Science, Engineering and Technology

(A High Impact Factor, Monthly, Peer Reviewed Journal)

Visit: www.ijirset.com

Vol. 6, Issue 12, December 2017

[4] Dulaimi, M. F., & Shan, H. G. (2002). The factors influencing bid mark-up decisions of large-and medium-size contractors in Singapore. Construction Management & Economics, 20(7), 601-610.
[5] Harris, F. & McCaffer, R. (2000). Modern Construction Management. Fifth edition (Malden, MA: Blackwell science).
[6] Ji, C., Mbachu, J., & Domingo, N. (2014). Factors influencing the accuracy of pre-contract stage estimation of final contract price in New Zealand. Supply Chain Management, 4(2), 51-64.
[7] Lai, S. K. (1982) Tendering. Undergraduate dissertation, National University of Singapore.
[8] Lee, D. E., Lim, T. K., & Arditi, D. (2011). Stochastic project financing analysis system for construction. Journal of Construction Engineering and Management, 138(3), 376-389.
[9] Lifson, M. W., & Shaifer, E. F. (1982). Decision and Risk Analysis for Construction Management. JOHN WILEY & SONS, INC., 605 THIRD AVE., NEW YORK, NY 10158. 1982.
[10] Mahfouz, T., & Jones, J. (2013). Automation of markup decisions in construction projects. Canadian Society for Civil Engineering. 1. 887-896.
[11] Mak, Y. (1977). General study on contractors' profit and pricing. Undergraduate dissertation, National University of Singapore.
[12] Nourah, B. T. K. (2013). Development of Strategic Mark Up Decision by Contractors in Saudi Arabia. Doctoral dissertation, University of Manchester.
[13] Odusote, O. O., & Fellows, R. F. (1992). An examination of the importance of resource considerations when contractors make project selection decisions. Construction Management and Economics, 10(2), 137-151.
[14] Oyeyipo, O., Odusami, K. T., Ojelabi, R. A., & Afolabi, A. O. (2016). Factors Affecting Contractors' Bidding Decisions for Construction Projects in Nigeria. Journal of Construction in Developing Countries, 21(2), 21-35.
[15] Park, W. R., & Chapin, W. B. (1992). Construction bidding: Strategic pricing for profit (Vol. 74). Wiley-Interscience.
[16] Shash, A. A. (1993). Factors considered in tendering decisions by top UK contractors. Construction management and economics, 11(2), 111-118.
[17] Shash, A. A., & Abdul-Hadi, N. H. (1992). Factors affecting a contractor's mark-up size decision in Saudi Arabia. Construction Management and Economics, 10(5), 415-429.
[18] Tamer, Z., Yoon, Y., & Hastak, M. (2012). Protocol for profitability analysis using internal entities in organizational structure of construction companies. Journal of Construction Engineering and Management, 138(12), 1394-1402.
[19] Tawil, N. M. (2008). Management Cost of High Rise Residential Scheme in Malaysia: The Service Charge Aspect. The Malaysian Surveyor.
[20] Toh, T. C., Ting, C., Ali, K. N., Aliagha, G. U., & Munir, O. (2012). Critical cost factors of building construction projects in Malaysia. Procedia-Social and Behavioral Sciences, 57, 360-367.
[21] Tonnessen, J. (2014). Renovation markup factors for public and private campus construction (Doctoral dissertation, University of Colorado at Boulder).
[22] Zhao, L., Mbachu, J., & Domingo, N. (2017). Exploratory Factors Influencing Building Development Costs in New Zealand. Buildings, 7(3), 57.