[1.]Abdelnaser OMRAN, [2.]Lai BOON HOOI

DETERMINING THE CRITICAL FACTORS IN ENSURING THE ACCURACY OF COST ESTIMATE IN OBTAINING A TENDER

[1.] Department of Risk Management, School of Economics, Finance and Banking, College of Banking, Universiti Utara Malaysia, Sintok, 06010, Kedah State, MALAYSIA
[2.] Department of Engineering and Built Environment, Penang Branch Campus, Tunku Abdul Rahman University College, 11200 Tanjung Bungah, Pulau Pinang, MALAYSIA

Abstract: In construction industry, cost plays an important role in determining the feasibility of a project and ensuring its continuity from conceptual to reality. Different types of cost estimates are used in different stages of construction, from design stage to tender stage and throughout the whole construction stage at the site. Thus, this study was conducted with the intention to identify the critical factors that are significant in ensuring the accuracy of estimation for the purpose of obtaining a tender and delivering it at the completion date. A quantitative approach was used to collect the data. The results indicated that "understanding the scope of works" shall be treated as the most important factor, followed by "correct material price and forecasting fluctuation", "read and check all tender drawings, compare the drawings with specification, check for discrepancy", "site visit to be acquainted with the accessibility, topography, constraints, etc.", "reviewing quotations from subcontractors and suppliers" and "experience and competency of estimator". Apparently, these six critical factors identified, have much higher relative importance index and it implies that these six factors have been given appropriate consideration accuracy cost estimating in successfully obtaining a tender and ensuring the work tasks can be delivered after being awarded with the tender.
Keywords: construction industry, cost estimation, critical factors, accuracy, tenders, Malaysia

INTRODUCTION

In construction industry, cost plays an important role in determining the feasibility of a project and ensuring its continuity from conceptual to reality. Gilson and Vanreyk (2014) stated in their study that cost estimation is a key factor in the construction industry and the success and quality of a project depend on the accurate estimation. Akintoye (2000) described estimating as a process of predicting costs that are required for the completion of the work. These 2 positive descriptions are supported by Enshassi et al. (2007) who explain that estimating is an important step in the construction process as the reliability of its estimate accuracy from conceptual to detailed stages determines the success or failure of a project. In other words, estimating is one of the most important functions of a successful project (Barzandeh, 2011). He further stated that accurate estimates optimise good contracting as well as the process of calculating and analysing all the costs that will enter into a particular job to arrive at a set total. The purpose of estimating is to determine the forecast costs required to complete a project in accordance with the contract plans and specifications (Peurifoy and Oberlender, 2002). They stated that for every given project, the estimator can determine with reasonable accuracy the direct costs for materials, labour and equipment. The tender/bid price can then be determined by adding to the direct cost the costs of overhead and profit. According to Ashworth (2004), the purpose of estimating is to indicate probable construction costs. This is an important factor that clients consider when deciding to build; it determines the feasibility of a project or even provides the basis for budget control during tendering and construction. Hendrickson (2000) stated that a detailed estimate is created when the scope of work is clearly stated and a more detailed design are in progress so that the essential features of the building are visible. Ashworth (2004), cost planning process consists of 3 (three) phases include phase one, involving the determination of realistic. The second phase, how to plan estimates on the various parts of the work of a project. The third phase, a checking process to ensure that the actual design detail to the parts of this work can be carried out within the limits of the cost plan. There are in fact several types of cost estimates which used in different stages of construction, from the design stage to tender stage and throughout the whole construction stage at the site. In during different stages of work in the construction process, the client would require different types of costing information. Due to the varying requirements, a different type of cost estimates has evolved to enable the estimator or quantity surveyor to produce a cost advice that best fits the needs of the client. Peurifoy and Oberlender (2002) mentioned that there are different types of cost estimates used at different stages of a project. These estimates are performed throughout the life of a project, beginning with the first estimate and extending through the various phases of design and into construction is shown in Figure (1). Although each project is unique, generally three parties are involved: the owner, the designer and the contractor. Each has responsibility for estimating costs during various phases of the project. In a simple manner, cost estimates can be classified into three major categories according to their functions. A construction cost

estimate serves one of the three basic functions (design, tender and control (Peurifoy and Oberlender, 2002). In Malaysia, there are various project procurement methods used for building works, such as traditional, design and build, management contracting, public and private partnerships. Amongst these, the traditional method is the most popular.

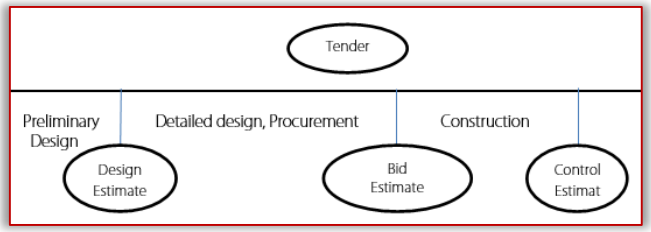

Figure 1. Estimates and Re-estimates through phases of project development
Source: Peurifoy and Oberlender (2002)

Cost estimations for accuracy estimating for a tender are influenced by many factors and there are many empirical studies had looked at these factors. For instance, Dysert (2006) mentioned that there are many factors which influence the estimate accuracy; i.e. the level of project scope, quality of the data, quality of the assumptions, the experience and expertise of the estimator, techniques used, effort put into the preparation of the estimate, and the market conditions. Akintoye (2000) in his research indicated that the biggest factor that influences project cost estimating practice is complexity of design followed closely by the scale and scope of construction. Liu and Zhu (2007) categorised the factors that influence the cost of a project as control factors and idiosyncratic. Control factors are those that can be determined by the estimators to increase the performance of the estimation. Idiosyncratic factors are factors that affect estimation but are outside the control of the estimator; this includes (market conditions, project complexity, weather, size of contract, type of client, site constraints, resource availability, etc). Odusami and Onukwube (2008) identified and studied the influences that affect the accuracy of pre-tender cost estimation. These included (expertise of the estimator, quality of information, project teams experience, tender period, market conditions, design detail, complexity of design, and availability of labour and materials). Oberlender (2000) stated in his published book that a range of accuracy, usually a plus or minus percentage, should be assigned to any estimating by the estimator based on his or her best assessment of the project's true cost. He further mentioned that there is no industry standard that has been agreed on regarding the amount of plus or minus percentage that should be applied to an estimate. In estimating the cost, there are common errors that could affect the accuracy of estimation for a tender where it is impossible for construction cost estimates to be perfect and with no error. Getting too many errors on the plus side or over estimating will make the tender not being competitive. While getting too many errors on the minus side or under estimating can cause the tenderer or eventually the successful contractor to lose money if the contract is being awarded to him. A study by Lim (2011) mentioned that there are some factors which may affect the accuracy of cost estimate during tender stage. These include (political climate, facilities and machineries available in the firm, location of the project, type of project or developer, size of project and site conditions, quality accredited, green building certification, payment terms and financial conditions, differences in standard, types of contract, financing). In this study, the researchers looked at the main problem by establishing a general hypothesis that when there is a tender, definitely there will be only a winner and many losers.

Tenderers spent much money in participating in a tender exercise. They have to pay for tender documentation charges, tender deposit, earnest money (tender bond) and also to hire taker off to carry out measurement if the tender documents are only based on schedule of rates, specifications and drawings without bills of quantities. If they lose the tender, the documentation charges will not be refundable and also the wages paid for the taker off and estimator will be void. Hence, for a contractor to obtain a tender during tendering stage, he or she has to be extra careful in pricing the tender. In another word, a contractor's cost estimate is crucial in determining the success of the tender. When a contractor obtains a tender, there is a possibility that this is the lowest tender among other tenderers and underlying with the issues of under-estimating in his tender without his knowing. Problems exist when construction works carry out at site. Thus, the main purpose of this paper is to study the importance of the cost estimates and determine the critical factors in ensuring the accuracy of the estimation by finding answers to these 2 on why is it important to study the cost estimate? and what are the critical factors in ensuring the accuracy of the estimation?

RESEARCH METHOD

The study was carried out in Penang Island. Essential steps and measures were taken during data collection and process to analysis the findings in which to ensure those findings are sufficient to complete the outlined research questions. A set of questionnaire was used to identify the crucial of accuracy in cost estimation and identifying critical factors in ensuring the accuracy of cost estimations. The respondents were included project managers, contractor estimators, consultant quantity surveyors and others like architects, engineers, site supervisors, and postgraduates. The survey was designed and structured in two main groups as (a) factors related to cost estimates, and (b)factors related to the knowledge and experience of quantity surveyor who does the cost estimate. The respondents were asked to rank some variables in respect of the research questions using a five-point Likert scale (1= strongly disagree to 5= strongly agree). The Statistical Package for the Social Science (SPSS), Version (21.0), was used to calculate the valid percentage ratings of research variables. Finally, Relative Importance Index (RII) was used to determine the underlying relationships among the critical factors into a

fewer number of variables or grouping the factors into lesser dimensions.

$$\text{Relative Importance Index (RII)} = \frac{4n1 + 3n2 + 2n3 + 1n4 + 0n5}{4N}$$

$$(0 \leq \text{RII} \leq 1)$$

where: N = Total number of respondent, 4, 3, 2, 1, 0 = weighted score on a scale of agreement, n1 = number of respondents who strongly agree, n2= respondents who agree, n3=respondents who are neither agree or disagree, n4=respondents who disagree, n5 = respondents who strongly disagree

The RII value was a ranged from 0 to 1, and the 0 is not inclusive. The higher the RII value the more significant was the critical factors in accuracy estimating in obtaining a tender and ensuring the work task can be delivered.

RESULTS AND ANALYSIS

Respondents' background

The respondents were classified into four groups, namely project manager, contractor estimator, consultant quantity surveyor and other professions not directly involved in cost estimating in the industry. Detailed information on the socio-demographic variables included in the survey regressions in Table (1).

Table 1. Overall Descriptive Statistics of Respondent's Demographic Data

Variable		Number of Respondents	Percentage (%)
Gender	Male	20	62.5%
	Female	12	37.5%
	Total	32	100%
Age	21 – 30 years old	10	31.3%
	31 - 40	8	25%
	41 - 50	13	40.6%
	51 - 60	1	3.1%
	Total	32	100%
Profession	Project manager	6	18.8%
	Contractor estimator	8	25%
	Consultant QS	11	34.4%
	Others	7	21.9%
	Total	32	100%
Working experience	1 - 5 years	7	21.9%
	6 - 10 years	6	18.8%
	11 - 20 years	16	50.0%
	> 20 years	3	9.4%
	Total	32	100.0%
Education background	Diploma	9	28.1%
	Degree	16	50 %
	Master & above	2	6.3%
	Professional	5	15.6%
	Total	32	100.0%

The table shows that the most of the respondents were males (62.5%) and the age of those surveyed was ranged between 41-40 years old (41.6%) and between 21-30 years old (31.3%). It can be seen from Table (1) that 34.4% of the respondents were consultant quantity surveyors and 25% of them were contractor estimators. Regarding the working experiences of the participants, it was found that 50% of them had working experiences from 11-20 years followed by nearly 22% of them with working experiences between 1-5 years. Concerning the educational background, it can be seen from the analysis that 50% of the participants were holding a degree (BSc degrees) and only 3.6% of them were of those holding postgraduate qualifications like (MSc and PhD degrees).

Factors in ensuring the accuracy of cost estimate in obtaining a tender

With reference to the questionnaire survey with 18 applicable critical factors, Table (2) illustrates the breakdown of relative importance index, thus the significance by percentage and degree of importance for the said factors from the tabulation of combined scores of every respondent's way of perceiving. In line with the study's objective, this was used to determine the 5 most important critical factors perceived by the estimators in the construction industry in Malaysia. The result shows that the most important factor that governs the accuracy in cost estimating "understanding the scope of works of the project" was ranked the first significant factors (RII=0.929) in ensuring the accuracy of estimation for the purpose of obtaining a tender and delivering it at the completion date. The obtained results in this study were also revealed that "correct material price and forecasting fluctuation" as the second highest (RII=0.921) as it is the major percentage in the pricing of the cost estimate. It is generally known that in today's market, the material prices are unstable and they are fluctuating up and down. Therefore, there is a need for the estimator to be clearly understood the frequency and extent of the price variations as well as the timing of the buying cycle with precise anticipating.

The critical factor of "Read and check all tender drawings, compare the drawings with specification, check for discrepancy" was viewed by the respondents as the third highest critical factors (RII=0.9141) and it reveals that the complete set of drawings given by other consultants are relatively important in built-up rates by cost estimators. The fourth factor which is crucial in ensuring the accuracy and ranked by the respondents was "site visit to be acquainted with the accessibility, topography, constraints, etc." with relative important index (RII=0.867).

"Reviewing quotations from sub-contractors and suppliers" and "Experience and competency of estimator" are equally important as both factors are getting the same value of relative importance index, which is (RII=0.875). All the factors that stated in Table (2) are proven to have significant effects in ensuring the accuracy of cost estimates. The RII values of these factors were so close to each other and the difference between the highest and the second lowest is only 0.226.

Table 2. Presents the ranking of Critical Factors in Ensuring the Accuracy of Cost Estimate in Obtaining a Tender

General	RII	Ranking
Understanding of the scope of works	0.929	1
Site visit to be acquainted with the accessibility, topography, constraints, etc.	0.867	4
Read and check the tender drawings, compare the drawings with specification, check for discrepancy	0.914	3
Review building codes/ by laws, permits and inspection procedures	0.609	18
Accuracy of measurement if BQ not provided	0.843	7
Adequacy of tender period	0.703	17
Experience and competency of estimator	0.875	5
Ability to collect, classify and evaluate data that would be useful in estimating.	0.812	10
Correct material price and forecasting for fluctuation	0.921	2
Sourcing of materials	0.812	10
Reviewing quotations from sub-contractors and suppliers	0.875	5
Correct wage rates for labour	0.843	7
Standard of workmanship required	0.757	15
Availability of labour (skill or unskilled)	0.742	16
Rates of rental of plant and machineries	0.812	10
Productivity and usage of plant and machineries	0.812	10
Allowance for Preliminaries costs	0.828	9
Allowance for Contingency or unforeseen works by the tenderers	0.812	10

CONCLUSION

This study is conducted with the intention to identify the critical factors that are significant in ensuring the accuracy of estimation for the purpose of obtaining a tender and delivering it at the completion date. This study has managed to come up with 18 critical factors and evaluated their degrees of importance based on the respondents' perceptions.

The results of this study showed that "understanding the scope of works" shall be treated as the most important factor, followed by "correct material price and forecasting fluctuation", "Read and check all tender drawings, compare the drawings with specification, check for discrepancy", "Site visit to be acquainted with the accessibility, topography, constraints, etc.", "Reviewing quotations from subcontractors and suppliers" and "Experience and competency of estimator".

Apparently, these six critical factors identified have much higher relative importance index, and it implies that these six factors have been given appropriate consideration in estimating cost accuracy for obtaining a tender successfully and ensuring the work tasks be delivered after being awarded with the tender.

References

[1] Akintoye, A. (2000). Analysis of factors influencing project cost estimating practice. Construction Management & Economics, 18(1), 77–89.
[2] Ashworth, A. (2004). Cost Studies of Buildings (4 ed.): Harlow, England; New York : Pearson/Prentice Hall.
[3] Barzandeh, M. (2011). Accuracy of estimating techniques for predicting residential construction costs – a case study of an Auckland residential construction company. A Bachelor degree Dissertation, Unitec Institute of Technology, Auckland, New Zealand, http://unitec.researchbank.ac.nz/handle/10652/1794.
[4] Dysert, L.R. (2006). Is "Estimate Accuracy" an Oxymoron? 2006 AACE International Transactions, 1–5.
[5] Enshassi, A., Mohamed, S., Madi, I. (2007). Cost Estimation Practice in the Gaza Strip: A Case Study. The Islamic University Journal (Series of Natural Studies and Engineering), 15(2), 153–176.
[6] Gilson, N.N., Vanreyk, A.J. (2016). Review of Cost Estimation Models International Journal of Scientific Engineering and Research, 4(3): 42-44.
[7] Hendrickson, C. (2000). Organizing for Project Management, Department of Civil and Environmental Engineering, Carnegie Mellon University, Pittsburgh, PA, 2000; sections 2.3 & 2.4.
[8] Lim, Y.M. (2011). *Cost Estimating*, A teaching module, Wawasan Open University (WOU), Penang, Malaysia.
[9] Liu, L., Zhu, K. (2007). Improving Cost Estimates of Construction Projects Using Phased Cost Factors. Journal of Construction Engineering & management, 133(1), 91–95.
[10] Oberlender, G.D. (2000). Project Management for Engineering and Construction. 2nd Edition, New York, McGraw –Hill.
[11] Odusami, K. T., Onukwube, H. N. (2008). Factors Affecting the Accuracy of a Pre-Tender Cost Estimate in Nigeria. Cost Engineering, 50(9), 32–35.
[12] Peurifoy, R.L., Oberlender, G.D. (2002). Estimating Construction Costs, 6th Edition, New York, McGraw Hill.

ISSN: 2067-3809