

Methods of Valuing Construction Variation in Lump Sum Contract from the Public Client's Perspective

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Abstract. A valuation of variation orders has become a daily task on large construction contracts. It is a norm where one of the contracting parties disagrees about the valuation of work done. Therefore, the valuation of variation orders has become one of the main causes of conflicts and disputes in construction management. The aims of study to determine the best practicing method in valuing a variation order for lump sum contract and identify the main related causes of variation project. The mixed method (interview and case study) of research was adopted in the collection of necessary data. Interview was conducted from 6 construction expert (clients) were analyzed. 6 case study building projects were selected by targeting sampling technique and used as the source of data for this study. The data were analysed with frequencies, sums and percentages. The study found that the client needs, lack of coordination during design and omission in design are the main causes of variation. An analysis of data indicated that used schedule of rate, fair market rate, daywork rate and negotiation are the four most famous method practicing in valuing a variation order in lump sum contract but its rely on the circumstances and the character of works.

1 Introduction

Variation orders involve additions, omissions, alterations and substitutions in terms of quality, quantity and schedule of works. In general, the term 'Variation' usually means a change, modification, alteration, revision or amendment to the original intent of the contract and/or its works [1, 2]. The nature of a variation order can be determined by referring to both the reasons for their occurrence and subsequent effects.

In almost all construction projects, changes or variations are common occurrences during the design and construction phases. Major problems facing by construction project are issue of variation orders during the construction phase. It is therefore not surprising that in most construction contracts, standard forms or bespoke, the provision for a variation clause in the contract has become a standard, if not compulsory feature [1, 3].

A fair valuation or fair allowance/ adjustment on contract rate/price, usually encompasses consideration based on cost plus or market rate basis together with the circumstances the variation work was subjected to. In recent case law on variations, *Weldon v The Commission for New Towns [2000] BLR 496 Technology & Construction Court*, Judge Humprey Lloyd QC, upheld the Contractor's appeal on an Arbitrator's Award which excluded overheads and profit on costs of a variation

order by deciding that a fair valuation has to include each elements usually found in contract rates or prices: costs of labour, plant, material, overheads and profit in the variation rate or price. He also said that it would not be a fair valuation if it did not include something on account for each of these items. The contract was under ICE Form [1].

Hence, the research focuses on the valuing a variation orders practice by client construction projects which would be helpful for building professionals in assessing and taking proactive measures for reducing the adverse of variations.

2 Literature Review

2.1 Lump sum contract

Lump sum contract is a traditional contract. It is called a lump-sum because contractor is required to submit in bills of quantities a total and lump price instead of bidding on individual items. In a lump sum contract, the contractor is responsible for carrying out all the works shown in the bills of quantities or drawings and specification, for a fixed price. The price will include all costs, overheads, risk contingencies and profit. Although the contract price is fixed in advance, the contract conditions may allow the lump sum be adjusted for variations to the work and any other matters.

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Normally, the contractor must calculate his tender sum based upon the contract drawings and specification. Contractor may be required to submit a schedule of rates used to arrive at the tender figure in order to value variations.

According to The Constructor [4], a lump-sum contract is a great contract agreement to be used if the requested work is well-defined and construction drawings are completed. The lump-sum agreement will reduce owner risk, and the contractor has greater control over profit expectations. However, the most disputable issues are: a) unbalanced bids: certain projects need submission of payment applications using unit quantities and unit prices, b) change orders: in case of change order proposals suggested or received by the owner that may demand increased expenses, the rate quotation could lead to disagreements, c) changes related to scope and design: contract provisions should be able to explain how those alterations in plan will be addressed and who will bear the add-on expenses, d) compensation for early completion.

2.2 Nature of variation order

The nature of a variation order can be determined by referring to both the reasons for their occurrence and subsequent effects. Arain and Pheng [5] classified variation into two main types: beneficial and detrimental variation orders.

2.2.1 Beneficial variation orders

A variation order is beneficial when it is issued to improve the quality, standard of workmanship, reduce cost, schedule or degree of difficulty in a project [5, 2]. A beneficial variation order removes unnecessary construction costs from a project, and as a result, it optimizes the client's value for money. For example, a variation order to solve the discrepancies between contract documents involves the abortion of works that have already been executed. Cost for aborted works should not have been incurred if discrepancies were not found between contract documents [6].

2.2.2 Detrimental variation orders

Variation order is detrimental when it negatively affects the client's value or project performance [5, 2]. Hence, a client who is experiencing financial difficulties may require the replacement of quality, standard and expensive materials to sub-standard and cheap materials [6].

2.3 Causes of variation order

There is many research has been undertaken properly to identify the causes of variation orders. Patrick , Begum and Andrew [7] believed that the causes have been grouped into three categories for the contracting parties: owner related variations, consultant-related variations,

and contractor related variations. All these factors and many others necessitate changes that are costly and generally unwelcomed by all parties. Supported by Jamal, Tareq, and Kollarayam [8] as a result conducted, these variations increase the capital cost and time of the projects and result in a heavy administration load. Similarly, the most important cause of variation orders given by consultants according to Oluwaseun et. al. [9] and Alnuaimi et. al. [10] is the changes in the specifications and scope, initiated mostly by project owners.

While many of the identified causes may be generic, [5], [11] and [12] reported that the errors and omissions in design, change in the specifications by owner, design discrepancies, additional quantities of works or materials, reduction of work, change in specifications by the consultant and lack of coordination, communication between the parties, lack of understanding and correct interpretation of customers' requirement are the main factors causing variations in building projects.

2.4 Valuation of variation

The valuation of variation may not just only include to the instructed work order but it also comprises to other expenses that may result from the variation which could give to the addition or deduction in the contract value [13].

Based on Public Work Department Form of Contract, PWD203 (Rev 1.2010) all variations instructed in writing by the S.O. in accordance with clause 24 hereof shall be measured and valued by the S.O. The valuation of Variations, unless previously or otherwise agreed, shall be made in accordance with the following rules:

Clause 25.1(a) The rates in the Schedule of Rates, after adjustment if necessary as provided in Clause 26.2 hereof, shall determine the valuation of work (other than work involving whole addition of any item of work priced in the Summary of Tender, which shall be valued in accordance with rule (b) hereof) of similar character and executed under similar conditions as work priced therein;

Clause 25.1(b) The said rates, where work is not of similar character or executed under similar conditions as aforesaid, shall be the basis of rates for the same, so far as may be reasonable, failing which a fair valuation thereof shall be made by the S.O.;

Clause 25.1 (c) Where works involves the additional of the whole of any similar item of work and executed under similar conditions as work priced in the Summary of Tender, the price of such item of work in the Summary of Tender shall be the basis of the valuation of the said item of work.

Clause 25.1 (d) The rates in the Schedule of Rates shall determine the valuation of work omitted; provided that if the omission involves the omission of the whole of any item of work in the Summary of Tender, the price of such item of work in the Summary of Tender shall be the basis of valuation of the item omitted. Omission of the whole of

an item of work in the Summary of Tender shall mean omission of the whole of the work where it is not required and shall not apply to the substitution of any work in the Summary of Tender.

Clause 25.2 where work cannot properly be measured or value, the S.O. may allow daywork price as specific in Appendix. Unless otherwise provided in the Bills of Quantities, the daywork prices for the purpose of this Contract shall be taken to mean the actual net cost to the Contractor of his materials, plant and labour for the work concerned. The Contractor shall be paid daywork prices, plus fifteen percent (15%), which shall include for the cost of all ordinary plant, tools, scaffolding, supervision and profit.

Clause 25.3 The amount of variations shall be certified by the S.O. and added to or deducted from the Contract Sum as the case may be and the amount shall be adjusted accordingly.

3 Research Methodology

The research method used for this research is the case study and interview of clients. Six (6) case study building projects were selected by targeting sampling technique and used as the source of data for this study. The building projects were selected in Selangor area and the target projects used for the study are recent project (completed between 2014 and 2017) and used lump sum contract. The valuation order documents were obtained from the Quantity Surveyor contracting firms that executed the selected projects and the information extracted from them include lump sum building projects, instruction of variation and total variation cost.

In addition, 6 clients (architects, engineering and project managers) represent from each case study were interviewed on the method of valuing a variation order for lump sum contract. This study also observed on the causes of variations view of the client's perspective. The data collected from method of valuing a variation were basically analysed with sums, frequencies and percentages. The data collected from interview were also explained with table and discussions.

4 Data analysis

Table 1 shows the general information of the projects used for this study. All the projects are government construction project used PWD Form 203 (Rev.1/2010) where drawings and specifications form part of the contract. The general information of projects that are considered include: procurement method, type of project, overall contract sum and number of floors of projects.

The projects that are procured traditionally are 66.7% and owned by Government are 100%. Office/laboratory and commercial are 33.3%, residential and social project are 16.7%. The numbers of projects with contract sums below 5 million are 66.6%, within 5 million and 10 million are 16.7% same with contract sums above 10 million. Lastly, 50% the projects were more than one

storey building and rest the project were one single storey. Total percentages of variation cost are 66.6% below than 10% of total contract sum and 33.4% are between 10% until 20% of total contract sum.

Table 1. General information of lump Sum building projects used for study.

	Frequency	Percentage (%)
Procurement method		
Traditional	4	66.7%
Design and build	2	33.3%
Total	6	100%
Type of Project (in terms of use)		
Residential	1	16.7%
Office / Laboratory	2	33.3%
Commercial	2	33.3%
Social	1	16.7%
Total	6	100%
Type of Project Client		
Government	6	100%
Contract Sum		
Below 5 million	4	66.6%
5 – 10 million	1	16.7%
Above 10 million	1	16.7%
Total		100%
Number of Floors		
1 Single storey	3	50%
1 Storey and Above	3	50%
% of Variation Cost		
Below 10% of contract sum	4	66.6%
10% - 20% of contract sum	2	33.4%
Above 20% of contract sum	0	-

Table 2 shows the result of interview conducted on causes of variation in construction projects. After analysis, 16 causes of variation were identified and tabulated. The table shows the main causes of variation as rated by interviewee are client needs, lack of coordination during design and omission in design (10.2%), while the second main causes are design error, discrepancies between design and specification, change in scope and specification by client and complexity in design and technology (8.5%), change in scope and specification – fulfil the government/any requirements (6.8%).An examination of causes of variation mentioned in table 2 shows that the client has a power to order variations as a right. That such power is essential in the Contract.

Table 2. Causes of variation in construction projects.

Causes of Variation	Frequency	Percentage (%)	Rank
Client needs	6	10.2	1
Design error	5	8.5	2
Discrepancies between design and specification	5	8.5	2
Change in scope and specification by client	5	8.5	2

Change in scope and specification – fulfil the government/any requirements	4	6.8	3
Change in work schedule	3	5.1	4
Lack of coordination during design	6	10.2	1
Difficulty in financing by client (have limitation)	3	5.1	4
Omission in design	6	10.2	1
Unfamiliarly with the site condition	2	3.4	5
Complexity in design and technology	5	8.5	2
Lack of specialized /inexperience project manager	1	1.7	6
Lack of specialized/ inexperience of designer	1	1.7	6
Lack of specialized /inexperience contractor	1	1.7	6
Lack of strategic planning	3	5.1	4
Unavailability of material	3	5.1	4
TOTAL	59	100.0	

Table 3 shows the method of valuing a variation order that practise in construction projects according to interviews session. The methods of valuing found in each of the documents investigated were also shown in the table. Furthermore, the table also depicts the percentage of each type of practicing method according to the works character and the total percentage method of valuing a variation in the construction project.

A total number of 48 practicing method of valuing a variation order discovered in the selected construction project. Out of the 48 practicing method for work is similar character and under similar conditions (10), work is not similar character under similar conditions or similar character not under similar conditions (12), work is not similar character and not under similar conditions (14) and work cannot properly be measured and valued (12) respectively. These figures translate to 20.8%, 25.0%, 29.2% and 25.0% respectively.

From table 3, it can be observed that the most practicing method according to work is similar character and executed under similar condition are referring the same rate in PWD Schedule of Rate (10.4%), followed by referring the same rate in PWD Schedule of Rate plus fair adjustment so far as reasonable (6.3%), practise by prorate from Summary of Tender price (2.1%) and negotiation rate, after price compared (2.1%).

Table 3. Method of valuing a variation order

	Fr.	Total practicing method per works' character (%)	Total practicing method (%)	Rank
Work is similar character and executed under similar conditions				
PWD Schedule of Rate (same rate)	5	50.0	10.4	1
PWD Schedule of Rate (plus fair adjustment)	3	30.0	6.3	2
Prorate from Summary of Tender price	1	10.0	2.1	3
Negotiation rate (after price compared)	1	10.0	2.1	3
Total	10	100	20.8	
Work is not similar character under similar conditions OR similar character not under similar conditions				
PWD schedule of Rate (plus fair adjustment)	6	50.0	12.5	1
Quotation – fair market rate	4	33.3	8.3	2
Negotiation rate (after price compared)	1	8.3	2.1	3
Agreed rate (refer from previous rate)	1	8.3	2.1	3
Total	12	100.0	25.0	
Work is not similar character and not under similar conditions				
PWD schedule of Rate (plus fair adjustment)	2	14.3	4.2	3
Quotation – fair market rate	6	42.9	12.5	1
Daywork price plus 15% profit and overhead.	1	7.1	2.1	4
Negotiation rate (after price compared)	4	28.6	8.3	2
Agreed rate (refer previous rate)	1	7.1	2.1	4
Total	14	100.0	29.2	
Work cannot properly be measured and valued				
Quotation – fair market rate	3	25.0	6.3	2
Daywork price plus 15% profit and overhead.	6	50.0	12.5	1
Negotiation rate (after price compared)	1	8.3	2.1	4
Agreed rate (refer previous rate)	2	16.7	4.2	3
Total	12	100.0	25.0	
OVERALL	48		100.0	
Fr. = frequency				

Refer to table 3, according to the work is not similar character under similar conditions or similar character not under similar conditions, table 3 indicates that the most practicing method are referring the same rate in PWD Schedule of Rate plus fair adjustment so far as reasonable (12.5%), refer to the quotation fair market rate (8.3%), negotiation rate (2.1%) and agreed rate by refer from previous rate (2.1%).

Aside consideration according to work is not similar character and not under similar conditions, the highest practicing method are refer to the quotation fair market rate (12.5%), negotiation rate, after price compared (8.3%), followed by referring the same rate in PWD Schedule of Rate plus fair (4.2%), daywork price plus 15% profit and overhead (2.1%) and agreed rate by refer from previous rate (2.1%).

And last works character, where the work cannot properly be measured and valued, table 3 indicates that the most practicing method are daywork price plus 15% profit and overhead (12.5%), refer to the quotation fair market rate (6.3%), agreed rate by refer from previous rate (4.2%) and negotiation rate (2.1%).

5 Conclusions

Based on the findings of this study, it can be observed that the frequency of method of practicing valuing a variation order according for each works character are different. Several conclusions can be drawn as follows; one, the method for valuing a variation order for work is similar character and under similar conditions are referring the same rate in PWD Schedule of Rate have the highest frequency (most popular method) followed by referring the same rate in PWD Schedule of Rate plus fair adjustment so far as reasonable. Two, the most practicing method for work is not similar character under similar conditions or similar character not under similar conditions are referring the same rate in PWD Schedule of Rate plus fair adjustment so far as reasonable and followed by refer to the quotation fair market rate. Three, work is not similar character and not under similar conditions the highest practicing method are refer to the quotation fair market rate followed by negotiation rate, after price compared. Four, work cannot properly be measured and valued the most practicing method are daywork price plus 15% profit and overhead followed refer to the quotation fair market rate.

Based on these conclusions, the study can conclude that the best method of valuing a variation order for additional works that similar character and similar condition where the word 'similar' interpreted to mean of a like nature or as an original contract should be refer to the same rate in PWD Schedule of Rate.

While, for valuing the additional work where the work is not similar character under similar conditions and conversely refer to the same rate in PWD Schedule of Rate but plus fair adjustment so far as reasonable.

That is may be the character of the varied work intents and purposes be similar to the works in the Contract Documents but the dissimilarity here shows on the sense of application, difficulties or significant change in the quantity of work to be carried out. It is only fair if the rates and price in the Contract Document (PWD Schedule of Rate) are to be used and there must be some fair adjustment to these [14].

Also, for valuing the variation for work is not similar character and not under similar conditions, its shows that the additional work is not similar character to work as set out in the Contract Document, then the valuation shall be at fair market rates and prices (quotation method). May be three number or several number of related quotations needs to submit and determined by the Quantity Surveyor. Lastly, for work cannot properly be measured and valued the daywork basis of valuing varied work. Stated in PWD 203 Form of Contract (Rev1.2010) daywork price plus fifteen percent (15%) include for the cost of all ordinary plant, tools, scaffolding, supervision and profit. The daywork price is a mechanism of cost reimbursement to the contractor to be compensate for the actual costs incurred inclusive of his profit. However, for valuing a variation for omission work is quick direct where omitted work is valued from the Lump Sum Contract.

This study recommends the best method for valuing a variation order practice for lump sum contract and its clearly shown that the valuation are rely on the circumstance and as long as both contracting parties agreed with.

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