

Exploring the Challenges to Usage of Building and Construction Cost Indices in Ghana

J. J. Gyimah, E. Kissi, S. Osei-Tutu, C. D. Adobor, T. Adjei-Kumi, E. Osei-Tutu

Abstract—Price fluctuation contract is imperative and of paramount essence in the construction industry as it provides adequate relief and cushioning for changes in the prices of input resources during construction. As a result, several methods have been devised to better help in arriving at fair recompense in the event of price changes. However, stakeholders often appear not to be satisfied with the existing methods of fluctuation evaluation, ostensibly because of the challenges associated with them. The aim of this study was to identify the challenges to usage of building construction cost indices in Ghana. Data were gathered from contractors and quantity surveying firms. The study utilized survey questionnaire approach to elicit responses from the contractors and the consultants. Data gathered were analyzed scientifically, using the Relative Importance Index (RII) to rank the problems associated with the existing methods. The findings revealed the following among others: late release of data; inadequate recovery of costs; and work items of interest not included in the published indices as the main challenges of the existing methods. Findings provided useful lessons for policy makers and practitioners in decision making towards the usage and improvement of available indices.

Keywords—Building construction cost indices, challenges, usage, Ghana.

I. INTRODUCTION

THERE is a link between the construction sector and global economic growth. This link plays an important role in the attendant wealth and standard-of-living comparisons, hence, improving construction efficiency would certainly contribute to cost savings for the country [6], [28]. According to [4], cost estimating is overly critical to every facet of a construction contract from pricing, through award of contract to final account. Unfortunately, empirical studies have opined that the Ghanaian Construction Industry is one that is saddled with inefficiency. Reference [7] identified delayed payment as a paramount cause of this problem. Delayed payment is inextricably linked to inefficiency. Other studies [15], [9] described the cost of a building as cost of materials, construction plant and equipment, labor, overheads, and profits involved in its erection. The prices of these factors may vary in terms of time dimension [9]. As a result, uncertainties in supplies and prices of resources, particularly with materials constraint to indigenous contractors in Ghana and Nigeria contribute to the need of construction and building cost indices [25], [14]. Surprisingly, this trend of materials and construction input resources prices are uncertainties and seems to be increasing over the years, and studies over the past two decades revealed a consistent trend of rising cost of construction input

resources [21]. For instance, between 1997 and 2010, the combined prices of labor and materials increased by 1,229% [8]. The factors responsible for this increment remain the same and are thus expected to experience this trend for the next decade. As a result, price fluctuation contracts have been designed to provide adequate reliefs for changes in input prices during the construction. This form of contract has generally been accepted in construction contracting [1], [12], [3] and accordingly, reasonable provisions to realize this prime aim of fluctuation contracts have been made in many standard forms of contracts. Consequently, the need to develop cost indices to reflect such price movements [11] is indispensable in fluctuation contracts as this represents the thrust of the contract. Such indices must incorporate basic construction material component and labor components [9], [11]. However, [11] argued that a building price database is indispensable in the development of construction cost indices. Unfortunately, [22] as cited from [11] observed that such database is lacking in most organizations in developing countries thereby hindering pricing and planning of projects. To this end, compiling a price database for various construction factors such as materials components, labor components and plant which takes recognition of various geographical location is therefore imperative. Accordingly, certain notable institutions in Ghana publish cost indices using different approaches. Therefore, the aim of this study was to identify the challenges to usage of building construction cost indices in Ghana.

II. LITERATURE REVIEW

The focus of research in the discipline of construction cost indices have been on the development of factor cost indices and tender price index. Reference [9] explored the application of factor cost indices in Kenya while [11] developed a factor cost index for Egyptian construction industry by modifying the Engineering News Records (ENR) indices model. The ENR indices model was designed to indicate basic underlying trends of construction costs and not result in substantial cost recovery when utilized [16] also developed a project-specific formula method by breaking down main components of the contract sum. This formula was developed to recover profits in a hyper-inflation economy. Thus, each study follows these three main formulae adopted in the index's calculations:

A. Price Indices Formulae

There are several different formulae propounded in the

calculation of indices. Reference [29] identified three formulae of constructing price indices, which are the Laspeyres, Paasche and Fisher indices. The difference lies in the approach of deriving their respective weightings. The three indices are the ratios of the weighted average of the prices in the reference period to the weighted average of the prices in the base period.

B. Laspeyres Formulae

This one was suggested by German economist Étienne Laspeyres (1834–1913) for the moderation of current prices or quantities compared with those of a chosen base period. It comprises consistent (base period) weights, that are quantities to be multiplied by prices, or expenditure shares to be multiplied by price comparatives. Laspeyres index is an unchanging formula because it uses a stable proportion of goods and services, it does not allow for replacement of distinct products [26]. A Laspeyres price index is calculated by taking the ratio of the total cost of acquiring a specific group of commodities (basket of goods) at current prices to the cost of that same group at base-period prices and multiplying them by 100. The base period index number is 100 and periods with higher price levels have index numbers greater than 100. It is also known as a base weighted or fixed-weighted index because the rises in prices are weighted by the quantities in the base period [29].

C. Paasche Price Index

The “Paasche principle” comprises using a variable’s current period quantities or current period expenditure shares respectively [27]. The Paasche index is mostly the current weight index [29]. It is assessed for appreciating inflation as it does not reflect the choice of commodities under the base period prices [29].

D. Fisher Ideal Index

As already noted, the Paasche Price Index has deficiency in the determination of inflation which is of paramount essence in terms of pricing. Whilst the Laspeyres formula overstates inflation, the Paasche Price Index tends to understate inflation. Therefore, there was the need for a new formula that estimates correctly and accurately inflation, hence, the development of Fisher Ideal Index. This formula overcomes the principal weakness of the indices methods as it attempts to arrive at the true measure of inflation. Thus, the formula is an average of the Laspeyres and Paasche indices. The formula was proposed by Irving Fisher (1867-1947). The problem with this formula is its lack of use in practice as it requires adequate information of quantities at both base and reference periods [24].

E. Construction Cost Fluctuations

Construction cost fluctuation has been defined as changes in price levels of construction input resources driven by underlying economic conditions [1]. Fluctuation reflects changes in price-drivers such as productivity and technology, as well as changes in market conditions such as high demand, labor shortages, and profit margins among other things [1]. Fluctuation in construction input resource price is a construction risk which must be adequately assessed to ensure

smooth implementation of construction projects. Standard forms of construction contracts incorporate fluctuation clauses as a mechanism to evaluate changes in prices of construction resources and thus to mitigate this form of risk. Though the incorporation of these clauses is not a strict requirement and mandatory, its inclusion as a reasonable compensation against variation in prices of inputs aids in the smooth administration of the contract.

In Ghana, more than 90% of construction contracts are procured using the traditional design-bid-build method [19], where construction projects are performed according to a pre-confirmed contract amount and contract agreement under a lump-sum contract. Therefore, there is a strong probability that the cost of construction inputs will increase during the life of projects. More so, passing the risk of price increments to the contractor represents gross unfairness on the part of the client and consequently, fluctuation clauses are incorporated in construction contracts. This is imperative as [2] and [18] observed that construction projects, on average, experience time overruns of more than 48 months in Ghana.

F. Methods of Computing Fluctuations

As already noted, the various forms of construction contracts make provisions for evaluating fluctuations. For instance, the Joint Contracts Tribunal (JCT 98) used in the United Kingdom, The Federation Internationale des Ingenieurs Conseils (FIDIC) and, the Public Procurement Authority (PPA) in Ghana make provision in their standard forms for evaluating fluctuations.

G. The Traditional Method

The traditional or factual method is to determine actual price increase of materials and labor. In this method the contractor attaches a list of input materials and labor with their corresponding prices known as basic price list prevailing 28 days to opening of the tender as part of the tender [1]. A base date is thus pre-determined at tender stage. The contractor is reimbursed for increases in the prices of the materials and the labor during construction on the basic price list. Cost increases are evaluated on items provided in the basic list only. Items not provided for in the list do not attract fluctuations, even if those prices change.

Reference [17] stated that the traditional method is a partial fluctuation repayment on the grounds that the amount of increase recuperated is less than the total amount by which costs have really increased. This method of price fluctuation is greatly disadvantaged in the computation of the prime resources of construction. For instance, there is great difficulty in defining what constitutes labor costs, whether to include the several ancillary costs of labor. Statutory and other labor cost increases are generally known throughout the industry, hence there is no confusion about that. However, where a contractor is observed to have paid higher than the nationally negotiated rates of wages there is no attempt whatsoever to be reimbursed the increase, not even on a pro-rata basis. In summary, under the traditional method the contractor is inadequately reimbursed the cost because of price fluctuations.

H. The Formula Method

To adequately reimburse contractors for losses incurred due to price fluctuation, an improvement on the traditional method was thus necessary. As a result, in the 1970's in the United Kingdom, the formula method was introduced. The method uses a set of formula rules which define a technical financial calculation, based on a wide variety of categories and published indices (monthly) by which each sum should be multiplied. The formula relieves the project team of the onerous task of evaluating fluctuation and to overcome some of the deficiencies with the traditional method. Presently, the Ghanaian Construction Industry adopts four formula methods for adjusting construction contract price:

- Local Price Adjustment Factor (LPAF) previously published by Construction Industry Efficiency Improvement Group of Ghana (CIECG-G);
- Construction Price Adjustment Formula published by the Ministry of Roads and Transportation for use in road contracts;
- Prime Building Cost Index (PBCI) published by the Ghana Statistical Service and used basically for building works; and,
- Construction Cost Indices (CCI) by Building and Road Research Institute.

I. Challenges with Usage of Existing Construction Cost Indices in Ghana

The usage of existing construction cost indices in Ghana has been met with unparalleled problems ranging from late release of data, inadequate recovery of cost among other things. The common dominant problem associated with all the four methods adopted in Ghana has to do with late release of published data. Time is of essence in fluctuation evaluation and index is representative and must be kept up to date. The problem lies with the monthly timely update of the indices. Hence, it is expected that the index and the basket of goods are reviewed monthly. The consistent finding is that, although it is updated, its late release sometimes renders the tool not useful.

There is inherent element of error in every human endeavor especially when dealing with huge volume of data. Around the middle of every month, price collectors are hired to record prices of items found in the 'basket of goods'. The price collectors thus go to the same shops from time to time noting the prices of these items to be able to compare 'like with like'. Hence, the reliability of the data collected and consequently the index generated depends on the goodwill of the retailer [20] and the recorder. Generally, more time is spent on some things than others, hence we would expect an increment in say price of cement to have a greater impact on the CCI than a similar rise in the price of nails. For this reason, the constituents of the index are 'weighted' to ensure that it reflects the significance of the various items in the average shopping basket, and the amounts we spend in different areas of the country and in diverse types of shops [20]. In the calculation of the weighting, certain items are excluded.

III. RESEARCH METHOD

The study adopted a mix research method, conducted in two stages. The first stage was exploratory including interviews (semi-structured interviews questionnaire among 20 quantity surveyors and contractors) and literature review. The reason for using the interviews and the literature review was to enhance results by elaborating and exploring the experience of the practitioners in relation to the phenomena under consideration. On this basis, various challenges with the existing methods were identified. The second stage of the study was conducted using quantitative method utilized close ended questionnaire which was found on the qualitative method. This was designed using the Likert scale, thus rating the level of severity of each identified shortcoming, according to the following scale: 1 = least, 2 = lower, 3 = high, 4 = higher and 5 = highest. The population of the study was Contractors (with their affiliation Association of Building and Civil Engineering Contractors of Ghana, ABCECG) and Quantity Surveyors (Registered Quantity Surveying Firms with the Ghana Institution of Surveyors). Based on purposive sampling technique, questionnaire was administered to 41, DIK1 contractors in Greater Accra and Ashanti Regions as these regions represent population where majority of construction works are concentrated. In addition, questionnaire was administered to 39 quantity surveyors of Registered Quantity Surveying Firms. Out of the 41 and 39 questionnaires administered to contractors and quantity surveyors, 27 and 26 questionnaires were retrieved, respectively. In addition, an overwhelming majority (80%) of the respondents had more than five years of experience in the construction industry. It was necessary to find out the working experience of the respondents to be able to obtain practical and convincing answers to the questions asked. All respondents have completed at least one project subject to price fluctuation within the last five years. In summary, the background variables of the respondents indicated that they were experienced in the construction industry and therefore are familiar with construction work and issues relating to use of construction cost indices.

IV. DATA ANALYSIS

Data generated were analyzed using RII to rank the factors identified. This helped in establishing the relative importance of the various factors identified as challenges of the existing methods of building cost fluctuation evaluation in Ghana. In the calculation of RII, the following formula was used [5], [13]:

$$RII = \frac{\sum W}{A * N} \quad (1)$$

where, W: weighting given to each statement by the respondents and ranges from 1 to 5; A: Higher response integer of 5, and N: total number of respondents.

V. DISCUSSION

Table I shows the importance index and rank of each of the problems by the respondents. The respondents altogether agreed that the late release of published data is a major

constraint (Ranked number 1) to the adoption of fluctuation contracts in Ghana as it defeats the purpose for the implementation of these formula on construction contracts. The data are to help compensate for price variations because of differences in materials and other resources at a specific point in time, and if any data are unavailable for that time, the implication is that contractors are not reimbursed the losses suffered for that period. For instance, at the time of compilation of this report (i.e., October, 2012), the PBCI indices available were for March, 2012. Thus, practitioners preparing payments certificates for subsequent months after March are forced to rely on outdated March 2012 indices further resulting in low-cost recovery. This late release is usually ascribed to the long time required to collate prices of all materials across the country.

Not surprisingly, inadequate recovery of costs was subsequently ranked after late release of data. The problem is exacerbated by the late release of data on indices. Contractors surveyed were not satisfied with the level of cost recovery using the existing methods of construction cost indices. This is therefore not surprising that the problem was ranked second, as it is only a measure of average movement of construction prices irrespective of actual costs incurred. The magnitude of this problem can be lessened if published data are released as at the time of the valuation of works done.

Regarding the item of works in the 'basket of goods', the respondents agreed that most of the principal items were not found. Thus, fluctuation of prices of such items are not recovered using the existing methods of computation. Basket of goods and services is the term commonly used for the list of goods and services. Accordingly, [10], the Organization of Economic Cooperation and Development (OECD) reported that various countries use different methods in selecting items for inclusion in the basket. For example, Statistics South Africa, the body for compiling consumer price indices in South Africa, adopts two methods. The first involves the estimated total expenditure on an item. All those goods and services on which expenditure go above, a certain percentage of the total amount spent by the average family are candidates for adding in the basket, notwithstanding the number of families that bought the item [23]. The situation is the same in the construction arena.

Subscription fee usually is a translation of administrative costs of producing the indices. High administrative costs will inadvertently lead to a corresponding high subscription fee and the vice versa. Due to the large volume of data required and the level of accuracy that users of the index expect, there is a high cost incurred in the production as a result. The subscription fee is not high enough above the financial strength of the contractors. Consequently, the respondents indicated that *high subscription fee* not to be a problem with the usage of the existing methods of CCI. And even to some extent, beneficiaries of the indices do not bear any cost. For instance, the indices produced by the Ghana Statistical Service do not even require subscription. The problem was eventually ranked low by the respondents.

TABLE I
PROBLEMS ASSOCIATED WITH THE USAGE OF EXISTING METHODS OF CCI

Item	Problem	RII	Rank
1	Late release of data	0.838	1
2	Inadequate recovery of costs	0.708	2
3	Particular work item of interest not included in published indices	0.523	3
4	Components of a weighted sample	0.423	4
5	Non-familiarity with computation method	0.238	5
6	High subscription fees	0.223	6
7	Human error	0.223	6
8	Indices based on historical data	0.209	7
9	Obsolete methods and components	0.208	8

VI. CONCLUSIONS

Currently, the predominant method of evaluating fluctuations in Ghana is the PBCI method. The dominant problem established with this method is its late release of data. In addition, majority of the respondents (particularly contractors) reported not to be satisfied with cost recovery using this method. Given the importance and sensitive nature of CCI to the industry, there is the need for producers of these tools to devote enough resources in their compilation to produce the best results, even if to the 'detriment' (higher subscription fees) of the users. This will restore stakeholders' confidence in the existing methods of fluctuation evaluation. More so, new methods of evaluation that incorporates 'items of interest' in the basket of goods must be developed. Also, regular workshops and seminars must be organized to talk through stakeholders the processes and explain the development of the indices; and solicit input to enrich the developed indices. Policy makers should therefore ensure that government contract fluctuation evaluation adapt systems or method that will be litigation free, ensuring all project participants are satisfied.

Although, there are several problems with the usage of the construction cost data, which the Building and Road Research Institute (BRRI) of the Council of Scientific and Industrial Research cost indices is not an exception to such development. This index is based on construction works items and thereby giving a true reflection of what pertains in the bills of quantities reflecting conditions within the market. It is therefore important to note that, BRRI cost indices remained the preferred choice due to its ability to ensure value for money, adequate recovery to contractors and its computation of 40 work items.

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