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Assessing the Causes and Consequences of Costing Public Projects' Contracts in Cameroon: Case of Public Buildings' Projects in Buea & Limbe, South West Region

Francis A. Fumenya

Department of Economics and Management
University of Buea, Buea, Cameroon
Email: fuamenya@yahoo.co.uk

ABSTRACT
This study investigated several factors responsible for changes in the cost of construction that are associated with the direct cost elements under public projects' contract e.g. materials labour and plants. The study relied and used both primary and secondary data. The primary data was obtained from files of projects initiated and completed between 2011 and 2016 in Buea and Limbe, South West Region, Cameroon Meanwhile, the documents studied for this purpose were bills of quantities and final accounts and reports. The secondary data was obtained through administering structured questionnaires to professionals in the industry. Simple descriptive statistics and regression techniques were used for the analysis. Building projects investigated were classified according to their functional uses as residential, commercial and institutional. Average changes in costs between estimates and final cost of these projects were 15.6%, 12.4% and 13.6% respectively. Part of the analysis showed that 46% of the contributions to the change in cost are material related while 32% are labour related and problems associated with plants and equipment contributed 22% to the change in cost. Several regressional equations for predicting final construction cost were proposed, using appropriate confidence intervals to enhance effective application of the models.

INTRODUCTION

Generally in practice, the total cost of construction is an important parameter in any public projects' contract such as building project execution. It is evident, therefore, that as construction work progresses, most clients are made either to pay more for unbudgeted increase in building cost or such projects are abandoned out rightly, Solomons, D (1997), T. W. Lin (1986) & Alan, S. (1999). This may be due to the inadequacies of most of the job estimating methods not

taking into consideration the possible changes arising from the direct cost elements. Earlier studies by T. W. Lin (1986) & Alan, S. (1999) have shown that public building projects overrun their initial estimates by 10-25% or more and this generally generates contrasts in the costs of building normally prepared for on behalf of the client by professionals just before or during public tendering.

Meanwhile, the estimate is suppose to provide the basis for all economic and financial forecasting, budgeting and controls over project execution, as estimates produced professionally will make the project's contractor know his commitment from the outset and the client will have a definite statement of his intended project from conception to delivery. This state of affairs has in recent times, stimulated very strong advocacy for modeling the behavior of past projects in order to arrive at reliable estimates of project costs against budgets.

However, the direct cost of construction according to Kamang (1992) and Solomons, D (1997) is the costs of materials, labour, plants and subcontracts, while the indirect costs are the office head charges and site charges.

The objective of this study is therefore, to develop realistic costs prediction models to ascertain the final construction cost of any public project, such as, building projects within certain confidence limits. This will provide the basis for cost controls and project monitoring. It also involved the assessment of the causes of relevant changes associated with the direct cost(s) elements.

In the study, the regression method of modeling is adopted, where the relationship between the variables is determined using methods of least squares which seek to minimize the sum of the squares of the difference between the observed values and the predicted value(s) of the form:
Such as

$$\mathbf{Y = a + bX}$$

Where: Y is a Dependent variable and
X is an Independent variable.

From the above, therefore, the choice of the model is informed by the fact that, once the relationship has been established, it can be used to make a number of project's forecasts simply by inserting the value of X for which a forecast is

required. Where the clients have some reason(s) to believe that a change might have taken place, then it is necessary to collect a new set of data and new values of "a" and "b" recomputed as necessary.
Within this context, therefore, considerations include:

SOME CAUSES OF CHANGES IN DIRECT JOB COSTING

(i) Material Cost Fluctuations: Most cost fluctuations are known to have been responsible for the changes in the cost of construction in many public construction projects, Richard, M. S. Wilson (2000), & Wai F. Chua (1999). Some of the two major sources of cost fluctuation in the industry are inflation and government policies. A good example is that whenever there is an adjustment of the salary structure of the Public Service, it will also make the labour operatives in the industry to demand for the same, and this in turn, is transferred into the cost of production, thereby resulting to the high cost of construction, Richard M. S. Wilson (2000), & Wai F. Chua (1999).

(ii) Material Acquisition: Materials are specified by the designer and supplied by the contractor under terms laid down in the contract and described in the Bills of Quantities (BOQ).per specifications over projects.
Meanwhile, the cost of material(s) varies considerably depending upon the firm of suppliers and the purchasers. However, other factors such as quantity to be purchased, and annual turnover of the suppliers also determines the cost of materials (Smith 1987)

(iii) Material Wastage: That notwithstanding, during the execution of projects wastages occurs on site for a number of reasons, most of which can be presented. Some of the obvious ones as listed by (Dudley 1969) & John Piper (1998) are; misinterpretation of designs and drawings, overestimating the quantity of materials required faulty workmanship and careless handling of materials. Materials are also wasted by design requirements e.g. uneconomic cutting of timber section to achieve non-standard solutions, and elevation designs in bricks which fail to take account of the variation in brick sizes, Cook and Jepson (1979). Materials wastage is reflected in the unit price, since under the standard method for completed building, allowance for wastage can only be assessed from past experiences and the observation of wastage should be constantly noted by the estimator or experts throughout the life of the project.

(iv) The Effects of Wage Premiums on Labour: Again, wage premium is extra money paid for overtime work, shift work, differentials and premium for

hazardous or usually arduous work Smith C. (1987) & T. W. Lin (1997). "Ordinarily, overtime is paid for work in excess of a 40 hrs-5- day week, Monday to Friday inclusive, The Cameroon Labour Code (1972).And by the resolution of the National Joint Industrial Council (1980), the employer in the Republic shall pay overtime to any employee who for no fault of his is caused to lose his break period at the rate of 125% or in alternative time-off of any fraction of an hour of 30 minutes and above, shall be recorded as one full hour for the purpose of overtime". Turner, F. (1987) has shown that as the effects of scheduled overtime begin to set in, actual total output for a 40 hour to 60 hour drops to that for a 30-hour week. Therefore, specific consequences include reduced effectiveness due to fatigue, increased absenteeism and reduced work -pace. In addition to this, possibly 57%-100% increase in labour costs. It is therefore, clear that it is not wise to save time by putting projects on scheduled overtime, Kenneth Simond (1991).

(v) Problems of Utilization of Plants and Equipment: The use of modern plants and equipment in construction projects (public or private) in the country is in most cases accompanied by break down and abandonment of plants at site even after years of project completion, Allen, L.E. (1984) & Solomons, D. (1997). They contended that "worst hit by the abandonment are the indigenous contractors who probably could purchase plant items but lack of professional expertise, technical manpower or managerial competences to put the machine(s) back to use after breakdown". The reasons for lack of proper utilization as summarized by Allen, L.E. (1984) & Solomons, D. (1997) are: The scarcity of spare parts, poor plant management and that many of the equipments are imported.

From the foregoing, the problems associated with the utilization of the plants and choice of acquisition influences the operating costs and ownership costs. The increase in these costs in turn increases the total construction costs. Since it is recognized that increase in these costs have often lead to late completion and project abandonment and at the worst without delivery. Harvey (1981), & Turner, F.(1987). Therefore, good project management and feasibility studies must vigorously pursue the efficient utilization of materials, labour, plants and equipments over project life circle.

In general, the problem of cost overrun or project abandonment, or escalation in project costs, loss of confidence in project planners, distortion of planned operations and more significantly the inability of contractors to deliver at the planned duration per contractual terms.

METHODOLOGY

The study depended on and utilized both primary and secondary data. The primary data was sourced from the bills of quantities and final accounts or reports of the projects. Information gathered include the initial contract sums, the final sums, variation in cost of project, reasons for variation, type and location of project, duration and functional use of the project. The secondary data was obtained from professionals in the construction industry (consultants, contractors and administrators of the state) by administering structured questionnaires made up of twenty two articulated questions, covering personal information of company's basis of cost estimate and project site management.
The theoretical part of the work involved the survey of relevant texts, journals and Cameroonian type projects' Contract Forms or documents. While the empirical part involved the analysis of the date obtained from Bills of quantities and final accounts or reports.

The projects used are those initiated and completed between 2011-2016, targeting the construction of capital projects in the S.W. Region for the national venue to host the 50th Anniversary Celebration of the Independence of the Republic of Cameroon. The projects were categorized according to their functional uses as; residential, commercial and institutional. Statistical software (Origin 50) was used to carry out various statistical tests to establish the relationship between initial estimates per floor area and final cost per floor area. Specifically, correlation coefficient R and degree of determination R^2 were employed for testing linearity in all cases. Analysis of variances (ANOVA) was also used to establish the variation in the contribution of each variable's element to the change in cost in all the project types. Based on the above, regression models were developed for all the categories of projects. The student's t-distribution was also used to find the confidence interval of the constants "a" and "b" for (n-2) degrees of freedom at 95% confidence limit to the degree of accuracy.

FINDINGS AND DISCUSSIONS ON SOME CAUSES OF CHANGES

From the data of the study the actual causes associated with the change in cost was determined. For residential projects, material price fluctuation and wastages were found to be the most prevalent cause, which is 55%; followed by labour related factor (fluctuation, ineffective use of labour and effects of wage premiums) which contribute about 30% to the change. Meanwhile, plant(s) and equipment break down contributes 15%. And for commercial projects, problems associated with materials cost contribute 52% to the change in cost, and followed by labour, which is 29%, and plant related problems 19%. While, for institutional projects, the percentages of the causes of changes are material related 54%, labour related 25%, and plant and equipment related problems 21%. Details of illustrations are as presented below:

Fig 1: Percentage contribution to Changes in Costs of projects

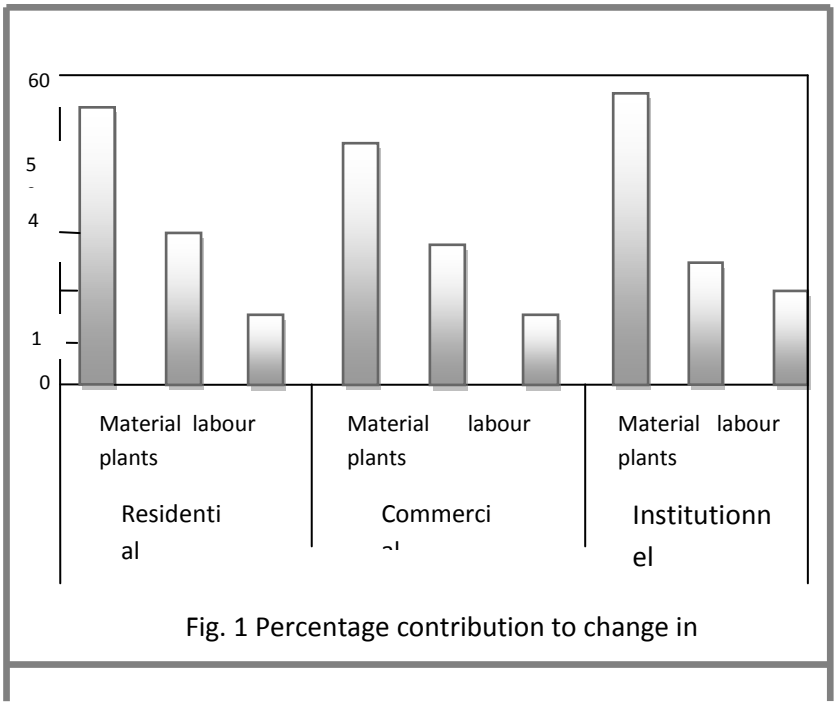


Fig. 1 Percentage contribution to change in

Source: Field Survey, (2016)

From the findings, almost all projects were completed at costs far higher than earlier estimates made for them. This is as a result of changes arising from direct cost elements.

Paired t-test Results

The paired t-test results as presented showed a significant difference (at 5% level significance) between initial estimates per floor area and final project cost per floor area for different categories of buildings considered. The results are as summarised in Table1 below:

Table 1: Paried t-test Results

Projects	Mean Diff.	DF	t-value	p-value
Residential	16.31	22	5.612	<0.0001
Commercial	28.74	13	3.849	<0.0001
Institutional	19.51	31	3.306	<0.0001
All projects	20.32	69	6.202	<0.0001

Source: Field Survey, (2016)

Going by the results as presented, and in all comparisons, p-values less than 0.0001 means that there is 0% change of initial estimate per floor area being higher than the final cost per floor area; this therefore, shows that such projects overrun their initial estimates. And the average percentage change in cost between estimates and final cost for different categories of projects as obtained are; 15.6% for residential, 12.4% for commercial, and 13.6% for institutional projects. Again, the t-values of 5.612, 3.849, 3.306 and 6.202 are greater than the corresponding critical t-value (from statistical table) of 1.717, 1.697, and 1.607 respectively at (n-2) degrees of freedom and 0.05 level of significance, using the two tailed test, indicating the significant difference between the initial estimates per floor area and the final costs per floor area as per the study.

Table 2: Regression Analysis Results

Projects	R	R^2	p-value	SD	Std Error Intercept	Std Error Coefficient
Residential	0.99	0.98	<0.0001	13.46	4.67	0.03
Commercial	0.86	0.74	<0.0001	26.90	16.91	0.14
Institutional	0.95	0.89	<0.0001	31.48	9.16	0.07
All projects	0.95	0.91	<0.0001	26.76	5.55	0.04

Source: Field Survey, (2016)

According to the presentations above, and from the table, the regression coefficient R of 0.99, 0.86, 0.95 show a high positive linear relationship between

initial estimates per floor area and final project cost per floor area of all categories of building projects considered. And the P-values <0.0001 shows 0% chance that there is no difference between initial estimates per floor area and final cost per floor area by the survey.

The Regressional Models

Going by the models, and having established that there is a linear relationship between initial estimates per floor area and final cost per floor area, the linear regression models were considered and developed to predict that the likely final cost of various categories of projects… were as follows:

Y = 10.32 + 1.05 X Presented for Residential.
Y = 50.54 + 0.80 X Presented for Commercial.
Y = 3.46 + 1.16 X Presented for Institutional.
Y = 12.09 + 1.08 Presented All Projects.
Where Y = Final cost and X = Initial estimate.

Fig 2: Regression plot for residential projects.

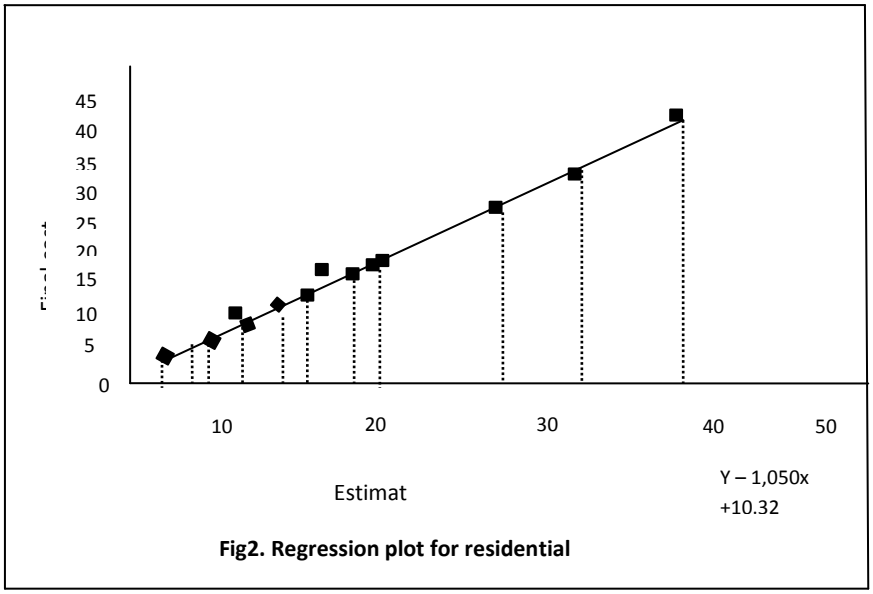
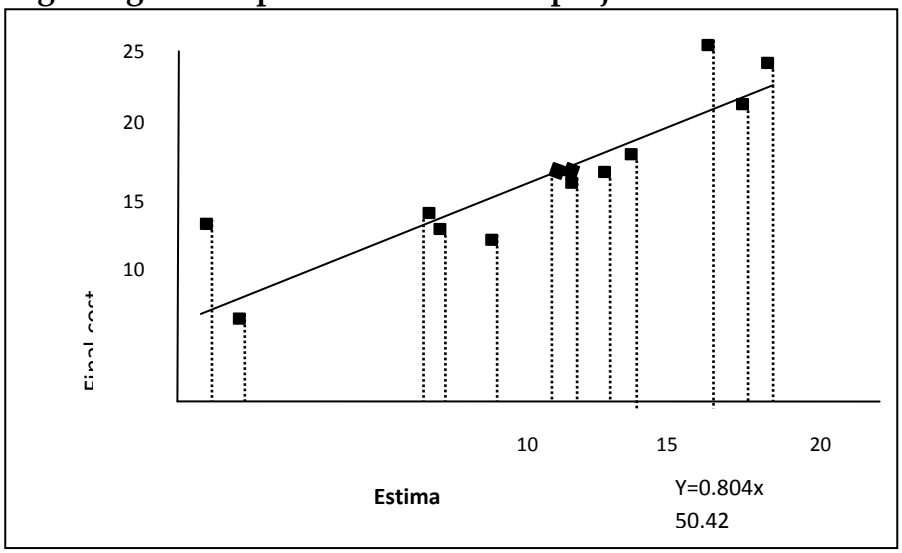


Fig2. Regression plot for residential

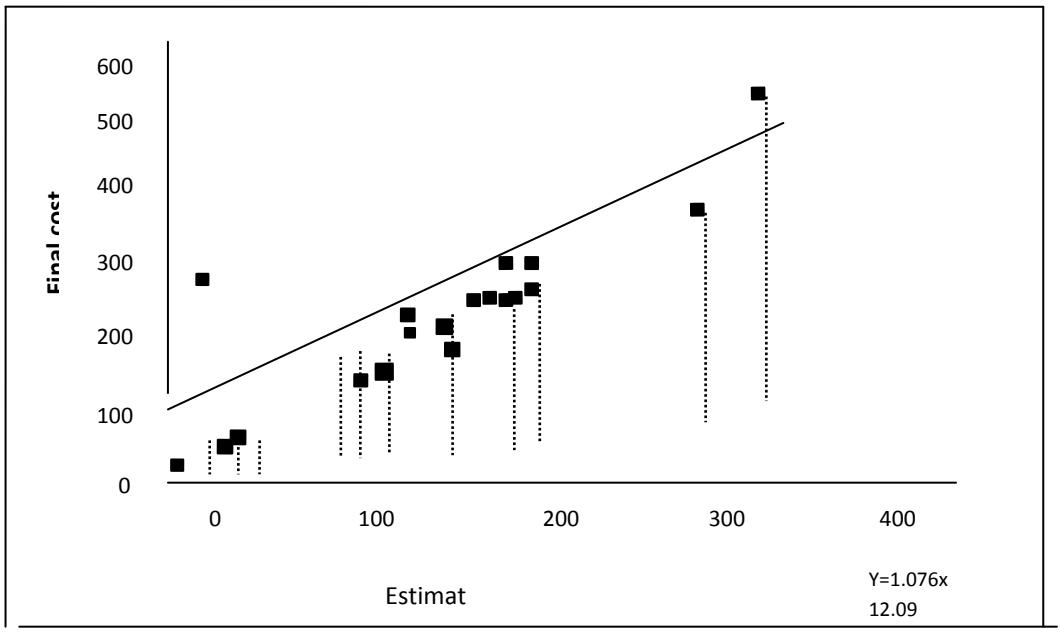
Source: Field Survey, (2016)

Fig3: Regression plot for commercial projects



Source: Field Survey, (2016)

Fig 4: Regression plot for Institutional projects.



Source: Field Survey, (2016)

Going by the presentations from the study therefore, the standard errors for the coefficient "b" given in the table were used to develop the confident interval for the true of the regression coefficient ($C.I_b$)

Where $C.I_b = b + t_{crit}\ (SE_b)$.

And in the same manner, the standard error for Y intercept "a" (given in the table) are used to develop the confidence interval:

Where $C.I_a = b + t_{crit}\ (SE_a)$.

Table 3: Confidence Interval for the Regression Constants

Projects	Intercept "a"		Regression constant "b"	
	From	To	From	To
Residential	2.30	18.34	0.99	1.04
Commercial	20.50	80.40	0.43	1.04
Institutional	-12.09	19.00	1.04	1.29
All projects	3.17	21.00	1.01	1.14

Source: Field Survey, (2016)

Table 4: Analysis of Variance (ANOVA)

Variation	**Sums of square**	**Df**	**δ^2**	**F**	**$F_{0.95}$**
Total	4900	8	-	-	-
B/W Means	686	2	343	0.28	5.14
B/W blocks	2384.4	2	1192.2	0.94	5.14
Within Samples	2515.6	2	1257.8	-	-

Source: Field Survey (2016)

According the results presented, the interpretations show that from the analysis of variance (Table 4), low value of F implies low variance between sample treatments. Since 0.28<5.14 and 0.9<5.14, this shows that there is no significant difference between the contribution of the various cost(s) elements to the change between initial estimates and final cost per floor area as per the survey.

CONCLUSION AND RECOMMENDATION

The paper critically examined the factors responsible for the increase in project construction cost that arise from the direct cost elements (material, labour and plant). The Paired t-test shows that there is a significant difference between the initial estimate per floor area and final cost per floor area for all categories of

projects at 5% level of significance. However, the Regression analysis has also confirmed that there is a high positive correlation between initial and final cost per floor area of public building projects in Buea & Limbe, S.W. Region of Cameroon. This shows that the likely final project cost can be predicted from the initial estimates within 95% confidence limits using the regression models.

The findings of this study will be useful to clients especially government which is the largest financiers of construction projects in the country. Whenever there is cost overrun with no proper provision for it, the results are delays in payments and subsequent abandonment of the projects. The models could very well provide useful basis for estimating contingencies with respect to project (public or private) costs.

REFERENCES

Allen, L.E (1984), Introduction to Linear Regression and Correlation, Second Edition, W. H, Freeman and Co., New York.

Cook, B. and Jepson, W.B. (1979) Cost and Financial Control of Construction Firms. BSP Professionals, London.

Dudley, J. (1969) Creative Cost Control. McGraw Hill book Co. London

Harvey J. (1981) The Economies of Real Properties. Macmillan Press Ltd London

Kamang E. J (1992) Effective Project Management in the Construction Industry. Builders' Magazine, vol.7, No.4, pp 14 August 1992. Journal of the Nigeria Institutes of Building, Lagos.

Kenneth Simond (1991). The Accounting Assessment of Competitive Position; European Journal of Marketing, vol 20, MCB, University Press Ltd.

Richard, A. O. (2000) Management Implication of Cost Trends of Construction in Nigeria (1989 – 1999). The quantity surveyor, March 2000 pp 30-34 Journal of the Nigeria institute of quantity surveyors, Lagos.

Richard, M.S Wilson and Wai F. Chua (1999). Managerial Accounting: Methods and Meaning, Chapman and Hall, London, U.K

Sandlands Report (1975), Report of the Inflation Accounting Committee, HMSO, CMND 6225, September

Seigal, A. F and Morgan C. (1996) Introductory Statistics Analysis, John Wiley & Sons California.

Smith, C. (1987), Estimating for Civil Engineering Works. Whilefriars Press Ltd, London.

Solomon's, D,(1997). The Accounting Review, October 1997.

SSAP7 (1974), Accounting for Changes in the Purchasing Power of Money, U.K.: ASC. March

SSAP16 (1980),Current Cost Accounting, UK: ASC March.

Turner, F. (1987) Quantity Surveying Practice and Administration. George Godwin, London.

Wainwright, W. H. (1975); Practical Builders Estimating, Hutchinson & Co. Ltd, London.

Wittington, R.C. (1983), Inflation Accounting as cited in Afful, G.G. (1903), Accounting Report in an Inflationary Period.

Reference to this paper should be made as follows: Fumenya, F. A. (2017), Assessing the Causes and Consequences of Costing Public Projects' Contracts in Cameroon: Case of Public Buildings' Projects in Buea & Limbe, South West Region. *Intl J. of Management Studies, Business & Entrepreneurship Research*, Vol. 2, No. 4, 2017, Pp 200-211