Innovative and emerging financing models in construction

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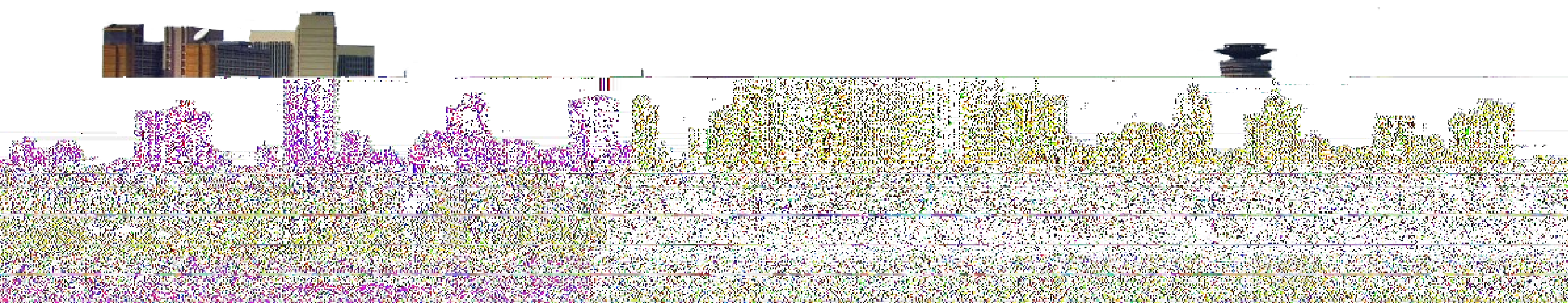

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Abstract

Anticipating business failure is not a thing that most businesses care to consider, even though it is a reality in the construction industry. The two main characteristics of a construction industry that distinguishes it from other industries include sensitivity of different factors within the market to the overall economy and the low level of working capital required for operations. Previously, dealing with the problem of business failure could rely on changing and synchronizing contract regulations and this could not be adequate. It is important to do Planning and controlling contracting activities with present regulations and the industry environment . Cash flow forecasting has its importance well emphasized in most financial models though they do not produce reliable information for dealing with business failure. To be able to conduct cash flow forecasts frequently, the method to be used should be simple, fast and reliable. However, large construction firms have their output that responds less to the economic fluctuations. Their small amount of working capital is balanced by other construction businesses that require much capital. With this advantage, they have failed to have a large share of the construction market as compared to the large number of small firms that are also unstable. The output of any large construction contracting firm is the integration of many factors that strategic and financial planners face difficulty in interpreting and evaluating. This is the major reason why strategic planning and financial modeling have not been adequately researched by the construction industry. A detailed kind of cash flow forecasting needs the preparation of a construction schedule and cost..

This has not been accepted generally because of the cumbersome task involved and the need for the contract's schedule at the tendering stage. Current financial related practices including financial planning and forecasting are captured in the CFMCC. A survey undertaken construction firms showed that these practices are exercised inadequately without the use of a financial model. CFMCC was developed to assist all construction firms formulate and evaluate strategies for business success. It assists managers in their strategic and financial planning. The model puts into practice a simulation of strategies and the overall economic environments and generates a comprehensive financial report that can help contractors to control performance. Construction output is generated by the CFMCC through integration of individual contracts. The model comprises of a single net cash flow forecasting module, which fulfills other explicit applications for all the contracting firms. The model also employs development of standard cost commitments versus time curves which could be useful in project cost control, and the development of relationships between value of projects and duration, which can be used as standards for clients and contractors.

Introduction

Each year the construction industry experiences a large number of bankruptcies. It is capital intensive to support a relatively high turnover in relation to capital employed. This enables contractors to operate with very low profit margins, whilst maintaining the standard return on investment. This may place a contractor in a vulnerable position due to its financial resources becoming stretched. The large number of new construction firms starting each year means that many people become part of the industry without having sufficient experience to ensure success. Consequently, there are a large number of business failures as free entry also implies free exit, hence the high level of risk and uncertainty in the industry. This industry is also fragmented, very sensitive to economic cycles and highly competitive. Attempts to identify and solve the problem of business failure in the construction industry have always been in conflict. The construction process has attracted a lot of attention regarding cash flow which is considerably affected by retention held against the contractor. Therefore, there have been suggestions to modify contract regulations in general and reduce retention rates in particular. Current levels of investment in working capital required of a contractor are a lower proportion of turnover than in other industries. This leads to high business failures as a result of many firms entering the industry. In the absence of effective modifications, the contractor is left with the prospect of planning the business properly to overcome the existing problems. Lack of cash flow forecasting is often put forward as the main cause for the failure of construction.

To be able to conduct cash flow forecasts on a frequent basis, the method used has to be simple, fast and reliable. Many models have been developed to forecast contractors’ cash flow for individual contracts. However, the reliability of these is questionable. Detailed cash flow forecasting requires the preparation of a construction schedule and cost. This has not received general acceptance due to the cumbersome task involved and the need for contract's schedule at the tendering stage. Others attempt to model the profile of the single net cash flow in order to be used as standard for forecasting. Single net cash flow profiles are unique and variable, thus standard value curves were modeled in the CFMCC and used instead. This background has pointed to the fact that there is sufficient cause for research into the investigation and development of a possible solution to these problems. The CFMCC is a solution to this case.

Text/theory/methods/results

Mail questionnaire was used to collect information due to its reliability. Fifty letters were sent to construction companies head offices so as to ask if they could participate in the survey. Fifteen companies accepted to participate, twenty five declined for reasons of confidentiality or work load. The remaining ten did not respond at all. The CFMCC simulates cash flow and other financial output for the selected strategies, hence developing simultaneously financial plans and budgets. These can then be used as a yardstick to control actual performance. To evaluate the reliability and effectiveness of the CFMCC, the debugging facility was performed, movements in cash flows and movements in current values were compared, input variables were modified and the behavior of the output to these modifications inspected, and then manual calculations were performed to check the reasonableness of the output. The model was run again with variations in input data and the behavior of the output was validated with contractors. A modified copy of the model was then developed by changing random functions into fixed values as this enabled small variations to be traced. The monthly actual cost commitments with other required information were provided and the feasibility of using standard cost commitment curves was evaluated. After debugging the CFMCC, tests were performed to ensure the validity of the model. The CFMCC was applied to a hypothetical company for strategic decision making and financial budgeting.

The case study was then used to validate the stochastic nature of the model. The construction model was run five times and variation in output was evaluated. The same test was undertaken on a smaller hypothetical company so as to evaluate the effect of the number of contracts executed on the stochastic nature. To evaluate the error incurred when using budgeting techniques, the projection concept of current budgets was simulated using a model that is commonly used. The model was run and the outcome was compared with that when using the CFMCC properly. Contractors were invited to comment on the mechanisms of the CFMCC, the analysis in particular and the model in general. The inputs to the CFMCC are a combination of strategic plans and decisions, together with information representing the environment and measures of actual performance. The output from the model is a comprehensive financial report representing the behavior of the company to the simulated strategies. The evaluation of the CFMCC confirmed its reliability and effectiveness. Current procedures in budgeting were shown to be unreliable and may, at any one time, produce significant errors. For the final budget, the model may be run stochastically in order to produce envelops for financial control. The feasibility of forecasting current contracts separately was evaluated. Results showed that the improvement of accuracy achieved does not justify the tedious task involved. Contractors participating in the CFMCC admitted the effectiveness of the model in terms of accuracy, in addition to the educational value for its users.

Charts/tables

Formulas

The value curve is calculated from the adjusted cost commitment curve generated by the CFMCC and it contributes to the turnover of the contractor. In the case of fixed price contracts, the cost curve is adjusted for the expected inflation rate and hence converted to the value curve. The remaining cost schedule is multiplied by an adjusted mark-up rate. The adjusted rate is: **Adj.M=**

$$Adj.M = \frac{M(C-Pr)}{C}$$

Where M is the entered markup rate, C is the total cost of contract; and Pr. is the premium cost. The model assumes that the contractor holds retention of subcontractors at the same rate it is held on him. Hence, the effective retention rate is calculated as follows:

$$eff.\ ret = ret.\left(1-\frac{SC}{V}\right)$$

Where: **ret**. is the contractual retention rate, **S** the percentage of sub-contract cost to total cost, **C** is total cost; and **V** is total value of contract.

The actual cost flow module developed adopted the logit model. The linear equation is found by a logit transformation of both the Independent and dependent variables:

$$Logit = \ln \frac{Z\ .}{1-C}$$

Where Z is the variable to be transformed and Logit is the transformation.

The logistic equation for cost flows can be expressed as

$$Ln\ \frac{C}{1-C} = a+bX$$

Where C is the actual cost (dependent variable) in a particular time (t) (the dependent variable).

$$X = \ln \frac{t}{1-t}$$

C, the actual cost can also be expressed as:

$$\frac{e^a\left(\frac{t}{1-t}\right)^b}{\left[1+e^a\left(\frac{t}{1-t}\right)^b\right]}.$$

Or

$$C = \frac{F}{1+F}. \quad \text{Where } F = e^a\left(\frac{t}{1-t}\right)^b$$

The logit actual cost flow model given above uses scales from 0.0 to 1.0 where the ratio 1.0 is equivalent to 100 percent. As percentage scales are to be used with convention, the equations should be expressed as follows:

$$\ln \frac{C}{1-C} = a + b\left(\ln \frac{t}{100-t}\right)$$

or

$$C = \frac{100F}{1+F} \quad \text{Where} \quad F = e^a\left(\frac{t}{100-t}\right)^b$$

The practical application of the logit transformation actual cost flow model implies that construction project cost flow curves approximate the s-curve yielded by the above.

Therefore, a transformation of the data should approximate to a line described by the following equation and with parameters a and b.

Y=a+bX Where $Y=\ln\frac{C}{100-C}$ and $X=\ln\frac{t}{100-t}$

In order to transform data from a particular project, X and Y must be calculated for each value of t and C respectively. Deriving the constants a and b is then simply a matter of linear regression of the transformed data, where

$b=\frac{(X-X)(Y-Y)}{(X-X)^2}$ and **a=Y-bX**

In order to draw comparisons between this model and other models, it was necessary to measure the accuracy of the fit. The measure chosen, put forward as a risk index and given the acronym SD, is the standard deviation about the estimate of Y. SDY adopts the common measure of dispersion.

$SDY=(Y-YE)^2/N$ Where Y is the actual value at any accounting period, YE is the estimated (or fitted) value N is the number of observation (accounting periods).This measure can also be used to compare the forecasted net cash flow with the actual one. When Y and YE are either positive or negative the formula holds, but when one is positive and the other negative then they would have to be added. This measure permits models to be compared. The model with the lowest SDY value has the best fit and is therefore the most desirable. The case study was used to run the model five times with the same input data. The cumulative closing values at the end of the first year at twelve months interval were used to measure the variability of these runs. The following equation was used to measure variability:

$$Var(i)\%=abs\left[\frac{x_i-avg(x_i)}{Avg(x_i)}\right]100$$

Discussion/Conclusion/Recommendations

The testing and implementation of the CFMCC on a case study has shown that it is possible to apply this idea in contracting organizations with sufficient accuracy. Financial plans and budgets should be prepared simultaneously with corporate plans using the CFMCC. Large size contractors can rely on individual runs for strategic evaluation. The variability of the model output with respect to the stochastic nature is shown to be relatively limited. It is up to the contractor whether to run the model stochastically at the final budgeting stage. The accuracy of standard value curves developed from properly classified contracts is more encouraging. The CFMCC relates contracting activities with the level of plant investments using hire charges. This method was tested on the case study and confirmed to be simple and reliable. The input variables for strategic and financial planning were identified in this research. Contractors should use these variables for analyzing strengths and weaknesses, analyzing the market, setting objectives and targets, and controlling performance. The CFMCC was developed using a spread sheet called LOTUS 123 that is commonly known for its applications in financial accounting and control. LOTUS 123 has proved to be an efficient tool for modeling and simulation of complicated contracting activities. After getting used to the inhibited functions, commands and macros, the development of the model was not difficult. Although some limitations were found during the programming stage, the author recommends the software for non-financial simulations.

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