THE EFFECT OF SOME TENDERING AND PAYMENT STRATEGIES ON CONTRACTORS' FINANCIAL PERFORMANCE

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This paper attempts to assess the effects of cash flow management on the overall profitability of construction companies. It describes a model that has been developed to simulate cash flow forecasting for individual projects. The model contains more than 50 variables but does not relate to a construction programme. This simple model is then modified to simulate the overall financial performance of a construction company by aggregating models of individual contracts. A series of tests evaluated the effects of changes in tendering and payment strategies on the amount of capital needed to run a contracting business.

Keywords: Cash flow, contracting, financial planning.

INTRODUCTION

Contracting is in times of economic growth a cash generating business. The amount of working capital required to run a contracting firm is low and may be negative. This is achieved by exercising tight cash flow control where contractors try their best to precipitate payments from the client and delay those to subcontractors and suppliers. Other cash flow management techniques include front end loading, preliminaries pricing, overmeasurement during early stages on site, arranging delivery of materials well in advance of them being required, (for most standard forms of contracts require the client to pay for materials and components stored on site), though the contractor may defer payment to suppliers. The effects of all these exercises is to allow contractors to gain interest on the cash they retain during construction. The interest contractors are able to acquire by manipulating cash flows can make a significant contribution to the profitability of a contracting firm.

Forecasts of cash flow can be used by management to control working capital, payments to creditors and the frequency and the speed at which claims for payment from clients (debtors) are made. The actual amount of working capital can regularly be compared with the forecast, and any significant discrepancy may indicate management problems with the performance of site personnel and managers. Although profit measurement on current contracts involves judgement and subjectivity, the actual cash flows recorded at any particular time may be compared to forecasts to produce an estimate of profitability of current contracts (Cheetham, Kaka and Humphreys 1995,1996).

In order to forecast the amount of interest the company will earn or the cost of financing a project, management needs to forecast the working capital. Working capital required for a particular project is the difference between cumulative profit and

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cumulative cash flow at any point in time. Working capital for completed contracts (i.e. contracts where final certificate has been issued and paid) is zero. Once an average level of working capital has been forecast, the interest to be earned or paid as a result can easily be calculated. Interest on the forecast cumulative profit can also be calculated, and when aggregated with the financial performances of all current contracts and other cash flow activities (e.g. dividends, tax, acquisitions, etc.), a forecast of the company's financial performance can be made. The effect of alternative patterns of payment by clients to contractors, monthly and stage payments (milestones) on cash flows for a particular contract has been demonstrated elsewhere by Cheetham, Lewis and Jones (1995).

This paper has two main objectives. Firstly to present a deterministic model developed to forecast the working capital of contracting companies using the aggregated characteristics of contracts to forecast cash flow, working capital and profit. Secondly to show the results of using the model to forecast working capital for different tender strategies and contracts' characteristics.

PAST RESEARCH ON CASH FLOW FORECASTING OF INDIVIDUAL CONTRACTS

Ideally, cash flow forecasts should be based on the construction programme and a bill of quantities (Allsop 1980). Cash flow forecasting at the tendering stage however, needs to be simple and fast, considering the short time available and the associated cost. Contractors rarely prepare a comprehensive construction plan at the tendering stage but wait until winning the contract. Previous research has acknowledged this need, and as a result various cash flow forecasting techniques have been developed (Mackay 1971; Ashley and Teicholz 1988; Kaka and Price 1991). These are now incorporated in most standard construction management text books (Harris and McCaffer 1989; Pilcher 1992). They tend to follow the same concepts and mechanisms using standard S-curves which represent the running cumulative value of contracts (e.g. those developed by: Bromilow and Henderson 1977; Singh and Woon 1984), a running cumulative cost commitment curve is produced by deducting the overall mark-up applied; these two curves are then converted (using time delays and retention) into cash in and cash out. The result is the predicted net cash flows for the contracts.

Studies on the accuracy of cash flow models based on standardised ideal value curves have produced conflicting results. The development of such curves for different project types is questionable. Kenley (1986) studied the variability of net cash flow profiles by collecting the cash-in and cash-out data from twenty-six commercial and industrial projects. Comparisons between the results indicated that there was a wide degree of variation between the individual project profiles. Mackay's (1971) sensitivity analysis of net cash flow profiles to different value curves assumes that either net cash flow curves conform to predictable patterns (which is known not to be the case -see Nazem 1968) or they are sensitive to the selection of systematic delays. The sensitivity of the net cash flow profile to the selection of systematic delays, was studied by the principal author through a series of visits to construction companies (Kaka and Price 1994). These visits confirmed that time delays are usually controlled by contractual conditions and their variability tends, under normal circumstances, to be fairly limited. It was thus, concluded that there is a strong justification for building an improved model which can be adjusted to represent a wide range of variable profiles.

THE CASH FLOW FORECASTING MODEL FOR INDIVIDUAL PROJECTS

The variables incorporated within the model and these relationships are illustrated in Figures 1 and 2. Figure 1 presents a description of the means of producing the contractor's monthly payments to suppliers and subcontractors. Figure 2 illustrates the processes associated with the contractor's claim for payment from the client. The cash flow is calculated monthly. This requires that the starting date of construction, duration of the contract (in days) and the dates of interim valuations are known.

The different types of cost (labour, plant and site overheads; materials; labour only and labour and materials subcontractors; and nominated subcontractors) are all considered. They each have different time lags (vis. time differences between costs committed and cash paid out). This necessitates the use of individual cost commitment curves for each individual cost headings, rather that one curve for the total cost. The cost commitment curve is derived from the individual cost headings' curves. These were developed using the logit transformation model Ashton (1972). Two constants (a and b) are required to produce the shape of the S-curve for each individual cost heading. Research by Kenley and Wilson (1986); Kaka and Price (1993) has evaluated these constants for different types of projects. However, these previous studies were used to derive overall cost commitment S-curves rather than those relating to individual cost headings. Thus there remains a need to investigate the prospect of developing S-curves for individual cost headings. This is not investigated by this paper. The present paper focuses on calculating the cash flow of individual projects using various given shapes of the S-curves.

Contractors usually retain a percentage of the money due to subcontractors before making payments and are usually allowed a cash discount (from suppliers and nominated subcontractors) if payments are made within a specified period. The model incorporates the effects of these. Thus a project net cash flow model was developed which incorporated over 50 variables.

THE COMPANY CASH FLOW FORECASTING MODEL

Forecasting future years' cash flows and working capital requirements involves incorporating forecasts of current contracts with guesses of the future financial characteristics of unknown contracts yet to be gained. To achieve this, contractors budgets are often produced by extrapolating past company financial performance rather than by summing the financial characteristics of individual contracts. This has inevitably results in inaccurate company budgets.

The Corporate Financial Model for Construction Contractors (CFMCC) developed earlier by Kaka (1994) attempted to use the simulation principle to forecast companies' cash flow by randomly generating and integrating individual contracts. For a given company, the model predicts the monthly cash flow and working capital in terms of ranges. Although, this is very useful in terms of appraising the cash levels needed to finance the business, the range of output produced makes the assessment of strategies unclear.

To this end, a deterministic model which takes into account variations in pricing strategies and payment conditions, retentions and discounts, to forecast companies cash flows and working capital requirements has been developed from the viewpoint of a main contractor receiving payment from the client.

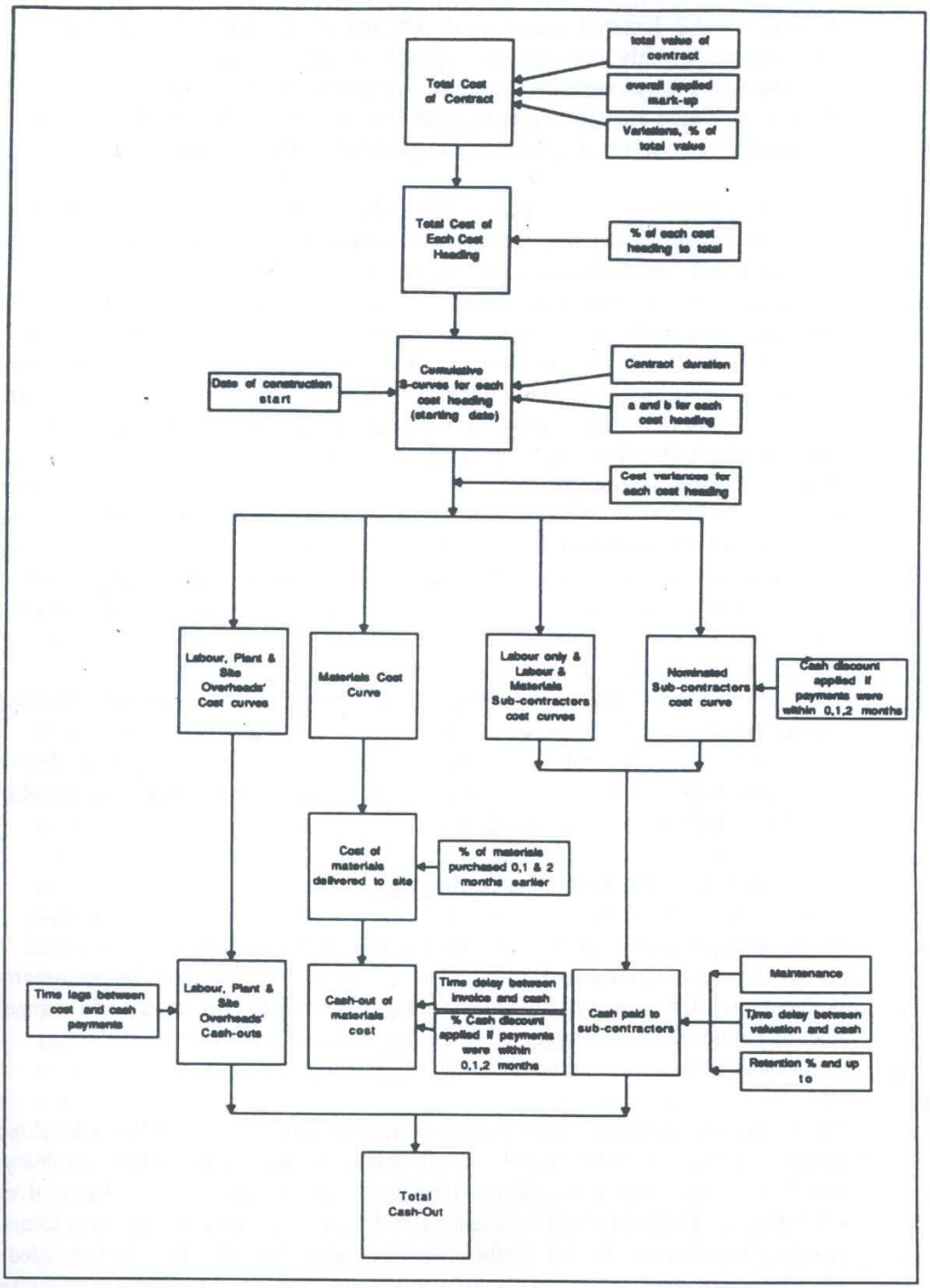

Figure 1 The Mechanism for Producing Cumulative Monthly Cash Out

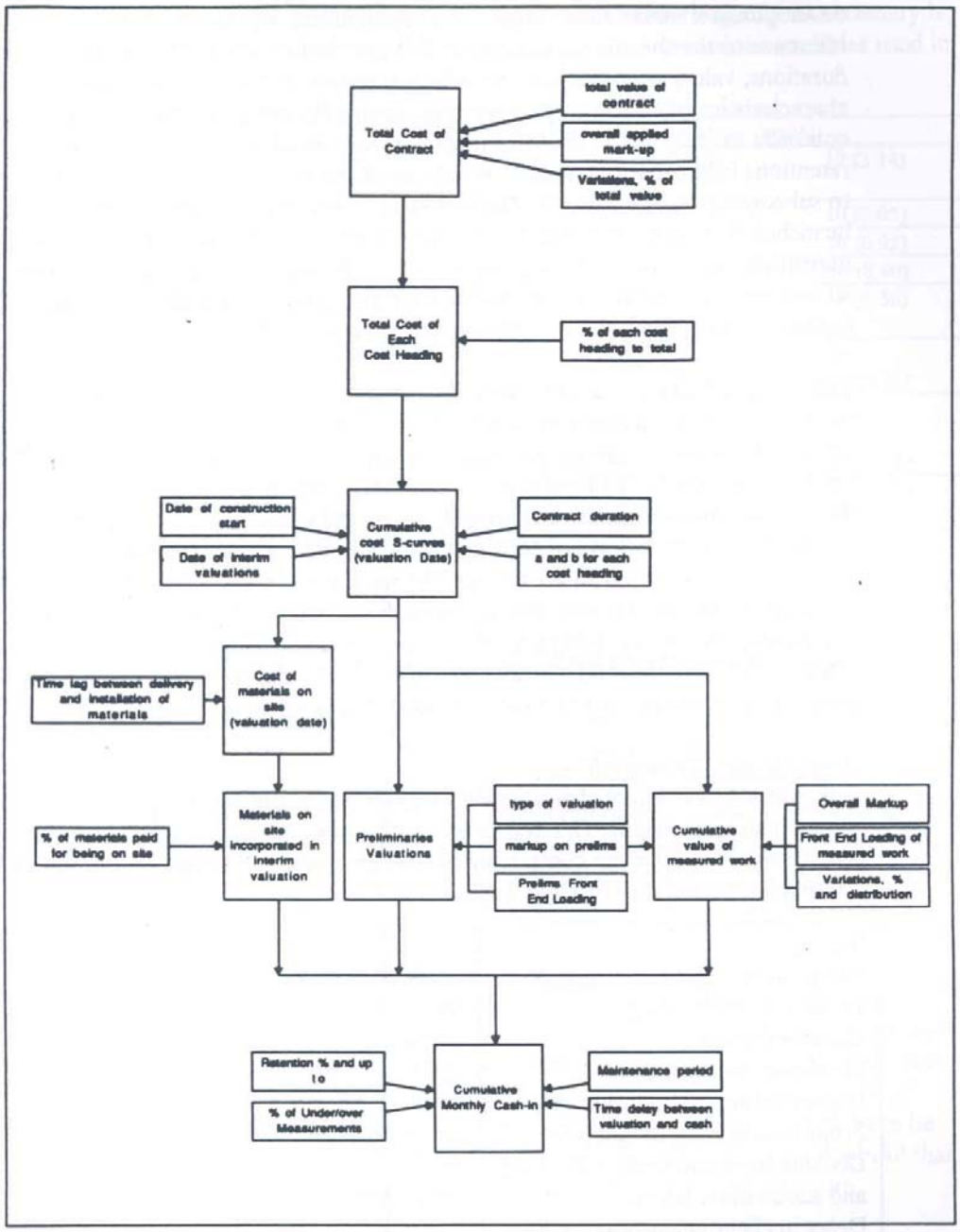

Figure 2 The Mechanism for Producing Cumulative Monthly Cash In

It is based on the Cash Flow Forecasting Module for Individual Projects (CFFMIP) but as it is in an early stage of development it makes many simplifying assumptions. The model does not make reference to the specific characteristics of individual contracts (e.g. starting dates, durations, value, etc.) that are currently in progress, but assumes average characteristics of all contracts in progress during the period of the forecast. Only contracts running within the forecast period are considered. The effects of release of retentions held against contracts completed earlier and of consequent payments made to subcontractors are ignored. The overheads costs of running the firm are assumed to be included in contract preliminaries and in work item unit rates. It makes the unrealistic assumption (but from a contractors management view point desirable) that all contracts are of equal value and have similar curves for the different cost and price headings used. Furthermore, contracts are assumed to start at regular intervals.

The model calculates the total values of contracts to be started each month by dividing the total value of contracts to be started during the period extending from the month in which the first set of current contracts starts till the end of the of the forecast period by the forecast period. The total values of monthly starts is then used in conjunction with the average characteristics of contracts (i.e. the 50 variables used to run the CFFMIP) to calculate the cash flows of contracts to be started in each of month to be considered. The total cumulative profit is calculated by multiplying the average percentage of mark-up by the cumulative running cost of the corresponding contracts. Finally, the cumulative cash flow is subtracted from the cumulative profit to yield working capital. Thus output from the model enables the effect of changes to various strategies on working capital required to finance the current projects to be calculated.

ANALYSIS AND DISCUSSION

A typical set of contract characteristics was initially assumed based on previous research and judgement. This was used to calculate a typical working capital requirement for the given contracting business modelled. The data entry used and consequent outputs are listed in Table 1.

Variable	
Duration of contract (months)	9
Profit sought (mark-up)	5%
Client retention	2.5%
Measurement accuracy	-3%
Defect liability period (months)	6
Front End loading of unit price	0
Division between employed labour and subcontract labour	6% 16%
Delay in client payment (month)	1
Working capital requirement (as % turnover)	2.61%

Table 1 Working Capital Required for Initial Financial Situation

The working capital forecast is 2.61% of the annual turnover. A sensitivity analysis was subsequently performed in which each of the variables was changed separately. Table 2 summarises the values used and the results achieved. The working capital

necessary is recorded in brackets immediately following the values for the various variables used in the model.

Variable	(% of turnover needed as working capital)			
Duration of contract (months)	6 (2.09)	8 (2.44)	10 (2.79)	12 (3.14)
Profit sought (%mark-up)	0 (2.13)	3 (2.43)	7 (2.79)	10 (3.05)
Client retention %	0 (1.18)	2 (2.33)	5 (4.05)	10 (6.92)
Measurement accuracy %	5 (-4.00)	0 (0.13)	-5 (4.27)	-10 (8.40)
Defect liability period (months)	0 (1.14)	3 (1.88)	12 (4.09)	18 (5.56)
F.E. loading (% increase) (% of value)	5 30 (2.28)	20 75 (-0.91)	5 50 (2.06)	10 75 (0.85)
Division between own Labour and subcontract labour	10 12 (3.07)	15 7 (3.65)	3 19 (2.27)	0 22 (1.92)
Delay in client payment (weeks)	5 (3.33)	6 (7.23)	7 (9.92)	8 (10.95)
Delay in payment to suppliers and subcontractors (weeks)	5 (5.10)	6 (2.43	7 (1.1)	8 (-2.4)

Table 2 Working Capital Requirement for Changed Financial Situation

It can be noted first that an increase in average duration of contracts has a adverse affect on working capital. Contractors who complete their contracts in 6 months require 2.09% of turnover as working capital while those who complete their contracts in 12 months require 3.14%. The effect of client retentions is marked. An increase of retention from 2.5% to 5% would result in an increase in working capital requirements from 2.61% to 4.05% of annual turnover. Undermeasurement and overmeasurment during interim certification often occur. The effect of this is considerable; working capital may vary from 8.4% to -4% as a result of a change from 10% undermeasurment to 5% overmeasurement respectively. Front end loading, which is the tender strategy for improving cash flow, is shown to have less influence than over or undermeasurement. The percentage increase in front end loading is shown in the table above the percentage of the value of the contract at to which that increase is applied. When the contractor adds 5% to the first 30% of the value of the work, 2.28% of turnover is required as working capital. A negative working capital (-0.91%) can be achieved by increasing the initial 75% of the value of work by 20%. It is doubtful that a client would enter into a contract based on such a distorted pricing structure.

The choice between employing own labour or subcontractors also influences cash flow. Own labour needs to be paid weekly, while subcontractors' payments are paid after the contractor collects payments from the client. The model assumes that 22% of the value of total cost of projects is incurred in labour cost. This may be split between directly employed labour and subcontract labour. When 10% of the labour cost is incurred by directly employing labour (consequently 12% is subcontract labour) a working capital requirement of 3.07% occurs. In the management contracting situation, when all 22% labour cost is employed by trade contractors paid monthly in arrears the percentage of turnover required is reduced to 1.92%.

Various strategies may be adopted for the advance purchase and delivery to site of materials and various scenarios were considered.

Variable	(% of turnover needed as working capital) .			
% materials purchased early (month)	2 1 0	30 40 30 (2.75)	0 60 40 (2.65)	0 30 70 (2.56)	0 0 100 (2.47)
when no advance payments are made by the client for materials on site		(3.66)	(2.94)	(2.87)	(2.47)

Table 3 Working Capital Required for Changed Material Delivery Strategies

The timing of material purchase may also effect cash flow. Table 3 shows that the effects are not large. When 30% of materials are purchased 2 months in advance, 40% purchased 1 month in advance and 30% immediately before use, a working capital requirement of 2.75% arose. Even when all materials were delivered immediately before use the working capital did not decline significantly for the materials are paid for once delivered to site. When no payments are made by clients for advanced delivery of materials, contractors working capital requirements increase slightly (3.66% on the first scenario assumed).

Payments' delays by clients have most effect on working capital. A two month delay of client's payment from the date of valuation would result in the contractor having a working capital of 10.95% of turnover. On the other hand a delay of two months in payments to subcontractor and suppliers would result in -2.24 working capital ratio.

Many of the practices described are contentious, some clients may decline to pay for materials delivered to site prematurely and the question of reasonable stocks may be subject to dispute. Clients may be reluctant to accept tenders with obvious front end loading of rates for in the event of contractor default the payments made by clients may well exceed the market value of work completed. The Latham report (1994) seeks to create trust among the parties by advocating a new contract which equitably allocates risks. There is undoubtedly a need to redress the unfair practices of some main contractors who delay payment to smaller specialist subcontractors and impose contract terms widely regarded as unfair.

CONCLUSIONS

A deterministic model has been developed to assess contractors working capital requirements. The model makes many simplifying and possibly unrealistic assumptions about the different contracts' characteristics and tender strategies adopted to win the work load when calculating cash flows and the levels of working capital. The model in its current state of development does not assess the fluctuations in working capital requirements that may occur due to different mixes of contracts, irregular start dates or variations in relative proportions of the major cost inputs. Nevertheless, the sensitivity analysis that has been performed helps to determine the effect of variations in strategies and contract conditions on contractors cash flows.

It has been demonstrated that for the typical case contractors could operate their contracting business with working capital of 2.61% of the annual turnover. In the UK, it is not unique to find contractors operating with negative working capital (e.g. -2.2%

in one of the large companies). The analysis has shown that negative working capital can be achieved by front end loading, overmeasure and delays of payments to subcontractors and suppliers. The analysis demonstrated that by various tender strategies, contractors may reduce their working capital from approximately 10% to

-5%. In monetary term, and assuming interest rate of 10% and annual turnover of 100m, the difference in interest between the above two is 1.5m. In the current economic climate this may well determine whether the company makes a profit or loss.

The results obtained are consistent with those that might be expected by intuition but the magnitude of the consequences of alternative strategies and occurrences could not be intuitively quantified.

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