

THE CASE FOR RE-ENGINEERING CONTRACT PAYMENT MECHANISMS

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In the UK, the normal practice in the construction industry is for the contractor to be paid monthly during the execution of the works. The value of these payments is determined by agreement between the respective Quantity Surveyors of the employer and the Contractor. Advances based on measurement is a system of payment which requires detailed and time consuming management. It does not reward achievement nor does it distinguish between the inefficient and efficient contractor. Of crucial importance, it does not deliver to the customer best value for money.

The paper will review current mechanisms available to the construction industry and will demonstrate that these mechanisms fall short of facilitating best practice and ultimately client satisfaction. It will do so by highlighting issues that are affected by cash flow and of key relevance to performance and client satisfaction. It will also examine these issues from a contractor's perspective thus, underlining adverse consequences of moving away from the traditional system.

The paper concludes by a call for reengineering the payment mechanism and suggesting the criteria by which new methods can developed.

Keywords: cash flow, reengineering, payment mechanism, procurement.

INTRODUCTION

The normal practice in the construction industry is for the contractor to be paid monthly during the execution of the works. The value of these payments is determined by measuring the amount of work executed up to that point in time and multiplying these by unit prices submitted by the contractor at the tender stage. Advances based on measurement is a system of payment, which requires detailed and time consuming management. It does not reward achievement nor does it distinguish between the inefficient and efficient contractor. Of crucial importance, it does not deliver to the customer best value for money.

It is often said that cash is king and in construction contracting cash is contractors' (and subcontractors') number one concern. Over the years, contractors have come up with innovative ways of enhancing cash flow. Some of these ways have been found in more efficient management processes and information systems by which contractors minimize outstanding balances owed by clients. Some have been found through pricing policies (e.g. unbalancing and front end loading) or somewhat unfair procedures such as over-measurement and delaying payments to subcontractors and suppliers.

The extent to which cash flow influences planning of construction activities on site is however unknown and an issue that has not attracted academic and research interest yet. One possible reason for this is the current mechanism of payment itself. Construction programmes although will undoubtedly influence clients' cash flow, they

have very limited effect on contractors' net cash flow. Contractors get paid monthly for the work they manage and in turn distribute most of these payments to subcontractors and suppliers (leaving them with the balance which is usually profit minus retentions). Therefore, contractors are not seen or expected to be manipulating the construction programme to enhance cash flow since the two are not strongly related. Another reason could be the difficulty associated with attributing planning decisions and resource allocation to a single isolated factor such as cash flow. Planning is a very complex process incorporating an enormous amount of factors, some of which are difficult to quantify.

In recent years, there has been an international consensus that the construction industry worldwide needs a major reform and many of these reforms have to come from re-engineering a variety of processes. Clients are not satisfied with the industry's performance and achievements, people working in the industry are not happy and the overall profitability of the industry is low. In the UK, there has been major studies and initiatives related to this (Latham, Egan, Best Practice programmes, M4I, etc.) and subsequently the research community has reassessed and examined the ways in which the industry works, including management processes, procurement routes, supply chain issues, etc. One component that has yet to be looked at within this new culture of reassessing and re-engineering is the payment mechanism. As the following section will explain, research into cash flow has in the main concentrated on two main factors: how to forecast cash flow and how to manage cash flow, with the former receiving significantly higher attention than the latter. The author believes that a paradigm shift in cash flow research is both timely and necessary. This paper calls for a reengineering of contracts payments mechanisms. It does so by examining the limitation in the current monthly interim valuations and explores the potentials of introducing different, more innovative mechanisms. It also suggests areas where researchers can look at in working towards this goal.

PREVIOUS WORK

Standard value curves

In the early seventies, with high interest rates and more appreciation of financial management, there was a surge of interest in cash flow forecasting in both contractor's and client's organizations. Money was invested by construction clients (mainly public authorities) into research and hence more study was dedicated to client's cash flow forecasting. This was demonstrated by the development of a series of typical value S-curves by many researchers (Hardy 1970; Balkau 1975; Bromilow and Henderson 1977; Drake 1978; Hudson 1978; Singh and Woon 1984 ; Oliver 1984; Miskawi 1989 and Khosrowshahi 1991). All of these have been obtained by fitting selected functions (mostly polynomial regression) to the available data.

Although these approaches have gained general acceptance, they have not been without criticism. Bromilow and Henderson (1977) used four general building projects to develop their value S-curve. Hardy (1970) analysed a higher number of different types of projects (twenty-five) and found that there was no close correlation between the values considered even when separating them into different categories.

Oliver (1984) analysed projects collected from three construction companies. He concluded that, although the number of projects analysed was statistically small, construction projects are individually unique and follow such diverse routes that value curves based on historical data are not capable of providing the accuracy required for

individual project control. Drake (1978) collected projects from regional health authorities and further classified them into different cost categories. He fitted an S-curve into each of these categories. Unfortunately, no figures were published of the number of projects analysed or of the level of accuracy of the fitted functions.

Singh and Woon (1984) fitted envelopes of S-curves for high rise commercial, industrial and residential buildings. The envelopes contained half of the values considered in each category. Although they did not quote the number of projects analysed, the graphs plotted through the scatter points show that the sample was small and the values outside the envelopes were not relatively close.

The failure of the aforementioned nomothetic models (Models which aggregates groups of projects in order to develop a single standard curve) to produce typical value curves pointed the way to the introduction of an idiographic approach. The basic principle of this methodology is that value curves are generally unique and should be modelled separately (i.e. a curve should be fitted for each project) .

Kenley and Wilson (1986) applied the idiographic methodology and used the logit transformation to fit data. They analysed seventy-two commercial and industrial building projects in two groups of data. They also developed a value S-curve for each individual project and an average one for each of the two groups. The error obtained from the two average curves was much higher than that of the individual fits. This meant that the systematic error involved in the group regression was high and the individual curves took a unique shape. They concluded by saying that it was their belief that group models are both functionally as well as conceptually in error.

A more recent study attempted to investigate the feasibility of developing accurate standard S-curves for projects that have been classified using a more detailed criteria (Evans and Kaka 1998). The monthly cost records of 20 food retail developments were collected from one company (ASDA). Analysis of these developments revealed that these projects were very similar in design and contract conditions (thus satisfying the detailed classification argument). The same procedure (to that used by Kenley and Wilson (1986)) was used in developing the standard S-curve and measuring its accuracy. Results showed that a standard S-curve could not be fitted accurately even when further classifying the projects into groups of sizes.

A study which has recently been completed (Petros 1995) investigated the effect of having different works plans on the cost flow curve of one project. An actual industrial building was used as a case study and four different planners were asked to schedule the construction activities associated with the project. The four suggested plans were then analysed and used to estimate the cost flow curves. Results demonstrated the significant variability of the possible S-curves on the one project.

Client cash flow

Several models for clients to use were developed using these value curves. Balkau (1975) derived the Bromilow and Henderson S-curve in an empirical formula to allow prediction of the cumulative cash flows. This formula was first used in a capital works programming model (Balkau 1975) and in a life cycle costing model and later updated.

Contractor cash flow

Considerable effort is required to compile a contractor's cash flow plan and forecast the field cost-flow for an individual project. The conventional process of preparation

entails the calculation of production quantities for each time interval according to progress schedules and multiplying them by the estimated unit costs. Clients' valuations are derived from the field cost by adding the relevant markups. The need for cash flow forecasts equally applies to current contracts in addition to those to be tendered for. Cash flow forecasts are often essential at the bidding stage in order to estimate the financing of the project and its possible influence on the overall liquidity of the company. However, contractors do not usually plan detailed schedules before contracts are awarded because of the cost involved and the short time available. Therefore, contractors require a simpler and faster to use technique which would enable them to forecast cash flow with reasonable accuracy. Research into contractors' net cash flow forecasting took advantage of the available value curves. Several models were developed on computers, which required the input of value curves (Allsop 1980, Kaka and Price 1991, etc.). Commercial packages adopted the same approach, some of which had a library of typical S-curves to allow the user to select an S-curve that closely represented the projects under consideration (Cash flow, Cash flow Manager, etc.).

The accuracy of cash flow forecasts generated from standard value curves depends on whether the adopted S-curve accurately represents the project to be constructed. 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.

Standard cost commitment models

Kaka and Price (1993) identified four factors as contributing to the failure of previous research to develop standard value curves, the extent of which is unknown and possibly differs from one factor to another. The four factors are listed below.

1. Construction projects are unique and the progress of work varies from one project to another.
2. In previous work the choice of project groupings was poor.
3. Unbalancing (front end loading) and over-measure distort the shape of the value curve. This can be shown by comparing the bills of quantities of several tenders for the same contract.
4. Errors in estimating affect the shape of the value curve, and lead contractors to submit different tenders for the same project.

They argued that, for the same project and the same schedule of work, two contractors are likely to produce two different value curves. This is due to estimating errors and unbalancing implemented by different contractors. These two factors have no effect on the actual commitment curve of a project. Cost commitment curve is the cumulative monthly cost committed by the contractor. Therefore, it was proposed that the development of standard cost commitment S-curves for different groups of contracts might yield more accurate results. This was tested and as a result seven groups of projects were collected and modelled. Results confirmed the hypothesis that cost curves can be modelled more accurately than value curves.

A PARADIGM SHIFT?

The above section is by no means a comprehensive review of all cash flow research as there has been a significant amount of work in the past three decades. Cash flow as a research topic at present is seen as being somewhat mature and out of fashion. Yet, cash flow remains one of contractors top priorities and any factor affecting cash flow would be looked at with a great deal of seriousness. To this end, it is apparent that the current payment mechanism is not making use of this important factor and literally wiping off any link between project performance and clients' satisfaction on one hand and contractors' cash flow on the other.

In the UK, Sir Michael Latham's report entitled "Constructing the Team" contained some radical proposals regarding contracts and current practice of monthly valuations. It was suggested that negotiated payments based upon stages (milestones) would be a fairer system of valuation and payment. Other proposals include; the abolition of retentions, the abolition of "pay when paid" practices and the amendments to the New Engineering Contract (a requirement that clients pay project monies into a trust fund and the revision of payment schedules which at present prevent subcontractors from obtaining their money until three months after finishing work). One of the main intentions of the report is that the government will include most proposals in a new bill (The Construction Contract Bill) before parliament.

The UK government has echoed the above in their application of the Government Public Procurement form of Contract (GC WKS1 Edition 3) which recommends two alternative payment mechanism: stage payment chart and milestone payments. The MOD's policy (for example) is to deploy payments as a factor in incentivizing satisfactory and timely completion. This policy is endorsed by the Treasury and is claimed to have achieved significant benefits. The objective behind milestones is not to affect profitability or cash flow adversely but rather to facilitate management of the project. The aim is to define milestones which, if achieved, secure payments which cover the contractor's likely outflow of cash at any point in the programme when a milestone becomes due.

Since the publication of Sir Michael Latham's proposals contractors have, in a series of articles, voiced their concern regarding these proposals (e.g. Building 22 July 1994). All contractors look at cash flow and how they can obtain interest on cash. If trading arrangements change and reduce the cash flow, contractors claim that they will have to reappraise their margins. This may jeopardize one of the main intentions of the recommendations for stage payments application (to reduce cost). In addition, the definition and interpretation of milestones may cause disputes as to when a pre-defined stage is complete and due for payment. The effect of these disputes on cash flow would be more significant than in the traditional method of payment. Stage payments may thus, increase the risk associated with the cash flow of contractors.

In the US, a new type of contract is emerging and the Department of Energy is already adopting it for its own projects. Performance-Based contracts or sometimes referred to as Performance-Based Incentives are gaining momentum in the US and to a lesser extent in Europe. The concept of these contracts is to align targets and clients' satisfaction with payments. Clients and contractors agree on specific objectives to be followed by formulae on how payments are to be dispatched in a manner that will encourage the achievement of the pre-set objectives.

The UK Trust and Money model is a radical and new model developed by the Movement for Innovation initiative and will soon be applied to a number of projects. Its concept is very similar to that of the DOE in the US, but it goes further to suggest radical ways for setting up a virtual company consisting of different members of the supply team being seconded from their own companies. Both of the above models are yet to be implemented fully to understand and appreciate their extent of benefit. In fact, there are still no validated guidelines or formulae on how to go about aligning objectives with payments. Also, these models do segregate between cost of construction and professional fees as performance targets are related to fees rather than cost. Payments for construction cost are still being dealt with by interim valuations.

The traditional payment mechanism was designed when the architect was essentially the project manager, contractors were asked to tender only after a complete set of drawings were available and projects ended at commissioning. Today, the construction industry is completely different comprising so many delivery systems. The fact that the current payment mechanism has survived throughout all these developments (and indeed is still being applied in different delivery systems) may prove to be the strongest argument in favour of the mechanism. Undoubtedly, there are some advantages to the system particularly that related to its application. Although it is cumbersome and bureaucratic, it is easy to define and implement across most if not all sectors of the industry.

It seems apparent from the above that a thorough study of payment mechanism is both timely and necessary. Research in cash flow has so far concentrated on how to forecast and manage cash flow given the current set of rules and conditions. It will now shift to look at how the rules can be changed and modified to suit the new environment and clients expectation. This will not only bring cash flow research back into fashion, but it will bring cash flow itself to the forefront of construction management.

LIMITATIONS OF THE CURRENT MECHANISM

The pros and cons of the current payment mechanism are yet to be identified, as there have been no critical review and analysis of payment mechanisms. Perhaps, a separate study should be conducted by a task group to pin point explicitly the advantages and disadvantages of the system. This task group should be international and comprise academics and practitioners from the various members of the supply chain including clients' representatives. Knowledge about the problems associated with the current system has to be elicited from practitioners from across the supply chain. Limitations of the system would be identified by introducing alternatives and what if scenarios.

More implicitly, there are some problems and limitations that come out even without a critical examination, some of which have already been mentioned earlier. In fact, the main problem with the system is what it doesn't do rather than in what it does. It limits the role of cash flow, a factor that is seen to be of extreme importance, as a performance enabler. So it's a matter of lost opportunity rather than a fault in the system. This makes the task of critically investigating the system much more difficult as limitations can only be identified if alternative systems are in place or at least provided.

There are some problems and faults in the current system that can be readily identified. The system does not facilitate nor encourage the monitoring of interim

progress on site. Contractors can get away with falling behind schedule at any point in time during progress if they can rectify the situation later on. This will often result in fire fighting and short cuts, which will lead to problems with quality issues which in turn may lead to disputes and increased cost. Currently, there is no mechanism of enforcing a project programme and schedule. A payment mechanism that is based on stages (milestones) for example would align contractors' interim progress with their own financial reward. It will also encourage the contractor to complete stages and components, something that could be of significant value to clients who want and need to make use of these components quickly (e.g. a floor that needs to be fitted out with IT facilities or become operational while work progresses on other parts of the building).

As mentioned before, the influence of this mechanism on how contractors programme their work is yet to be determined. However, one could imply that as measured work is literally construction materials and products that has been installed in the building, it would not be in the contractor's interest to accumulate a lot of value of preparation work. Some forms of contracts allow for payments to be made for materials being on site. The effect of this on contractor's decisions and plans is again unknown.

The system can also be argued to be unfair in a number of fronts. Clients usually retain a percentage of each monthly valuation, only to be paid back to the contractor after the maintenance period has elapsed. With current competition and economic situation, this often equates to the contractor's profit being taken out of the project. Subcontractors are usually paid after contractors receive payments from the client. The low profit margins associated with the construction industry leads contractors to rely on cash flow as a mechanism for generating profit (an exercise referred to as "cash farming" (Kenely 1999)). Subcontractors often end up as the victims of such exercises as contractors whenever possible delay payments.

Finally, it is worth while pointing out that cash flow is not currently considered as a factor in selecting the winning tender. In a recent study by Kaka and Dawood (2000), it was found that different construction programmes might result in significantly different cash flow profiles. Although the effect of that on contractors' profitability may be negligible, its effect on clients' cost (difference in interest payments on used capital) is significant. The current payment mechanism does not encourage the contractor to satisfy the client on this front.

CONCLUSIONS

This paper calls for the re-engineering of payment mechanisms. It gives a brief review of past work in cash flow research, a research area that is currently being perceived as somewhat mature and old fashioned. Yet, cash flow itself is still one of practitioners main concerns. The majority of cash flow research has so far concentrated on either how to forecast research or how to manage it, given a set of rules and conditions. These rules and conditions have been there for a long time and yet no serious critical review or assessment has been conducted.

The construction industry internationally has and is still going through a major reform in its processes and structure. Clients are dissatisfied with the industry's services and as a result client satisfaction is seen as a major drive for these reforms and initiatives. The current payment mechanism offers no advantage at all to the client. It does not reward excellence nor does it use cash flow as a potential performance enabler. The mechanism is also very old and has not been designed to

cater for the “new” procurement routes being developed. A critical review of the mechanism is both necessary and timely.

The paper outlines some of the apparent problems and limitations associated with the mechanism with particular emphasis on limitations. It recommends that the critical review should come in the form of an industry led task force that includes clients, the supply team and academics. The study should not be limited to the identification of problems in the current system but to explore how cash flow can be used as a performance enabler.

A research project has just been started at Heriot-Watt University. The objective of the research is to evaluate the extent to which contractors would manipulate the construction programme to suit their cash flow requirements. The traditional payment mechanism is one of a series of mechanisms to be examined. The research will invent and develop alternative payment mechanisms and assess their influence by developing what if (hypothetical) scenarios with practitioners. It is hoped that the result of the research would enhance knowledge about this issue and would hopefully lead to the re-engineering of payment mechanisms.

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